Jane's

MAJOR WARSHIPS

1997

Edited by David Miller

Volume Two

First Edition

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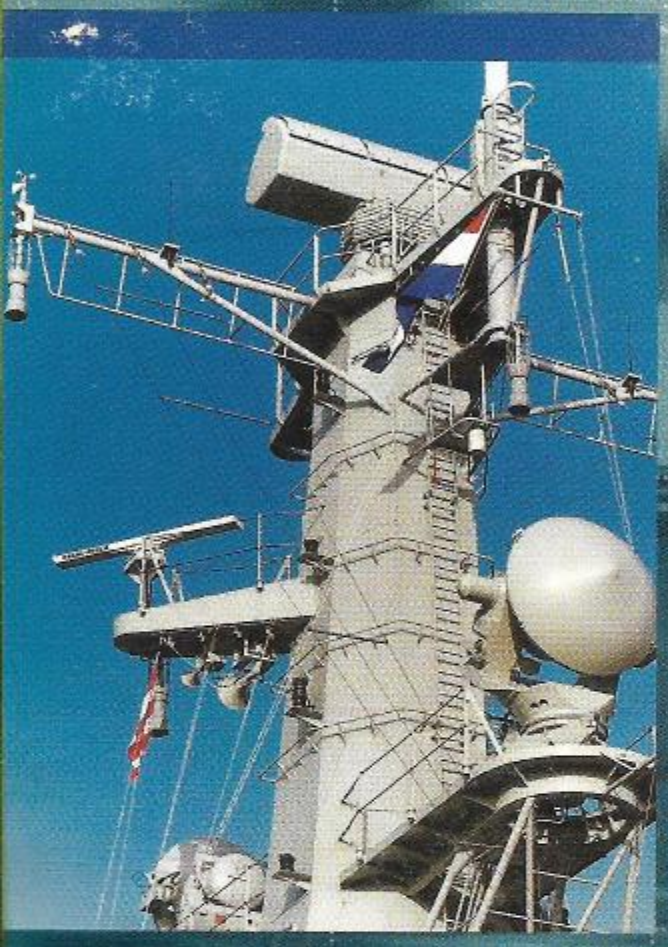

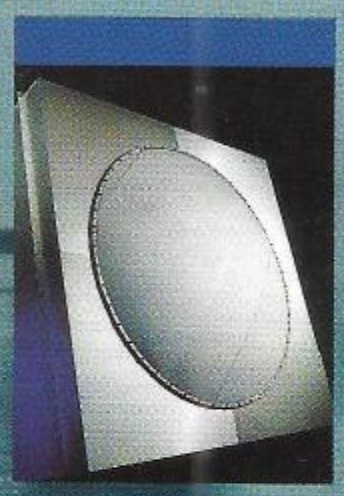

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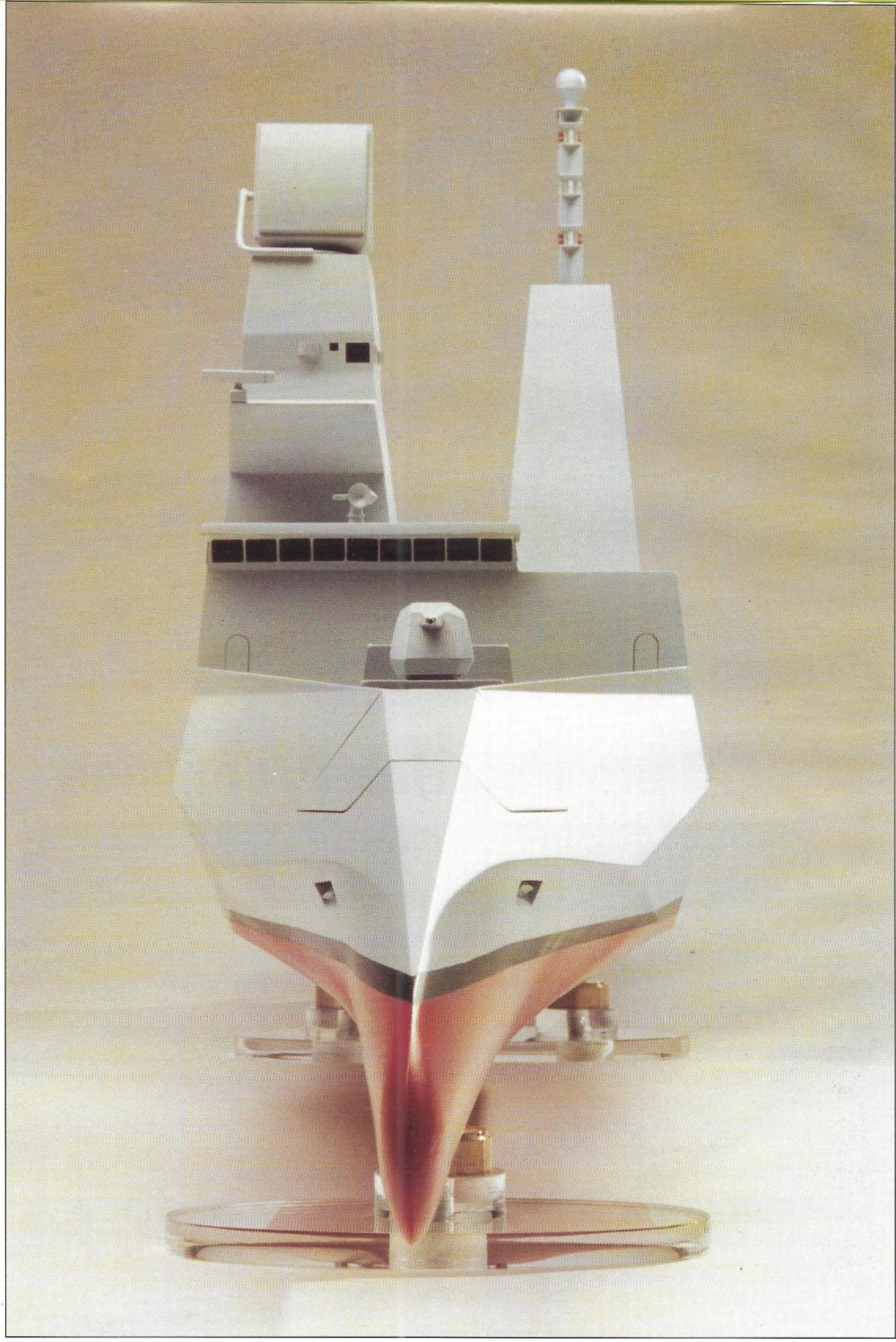

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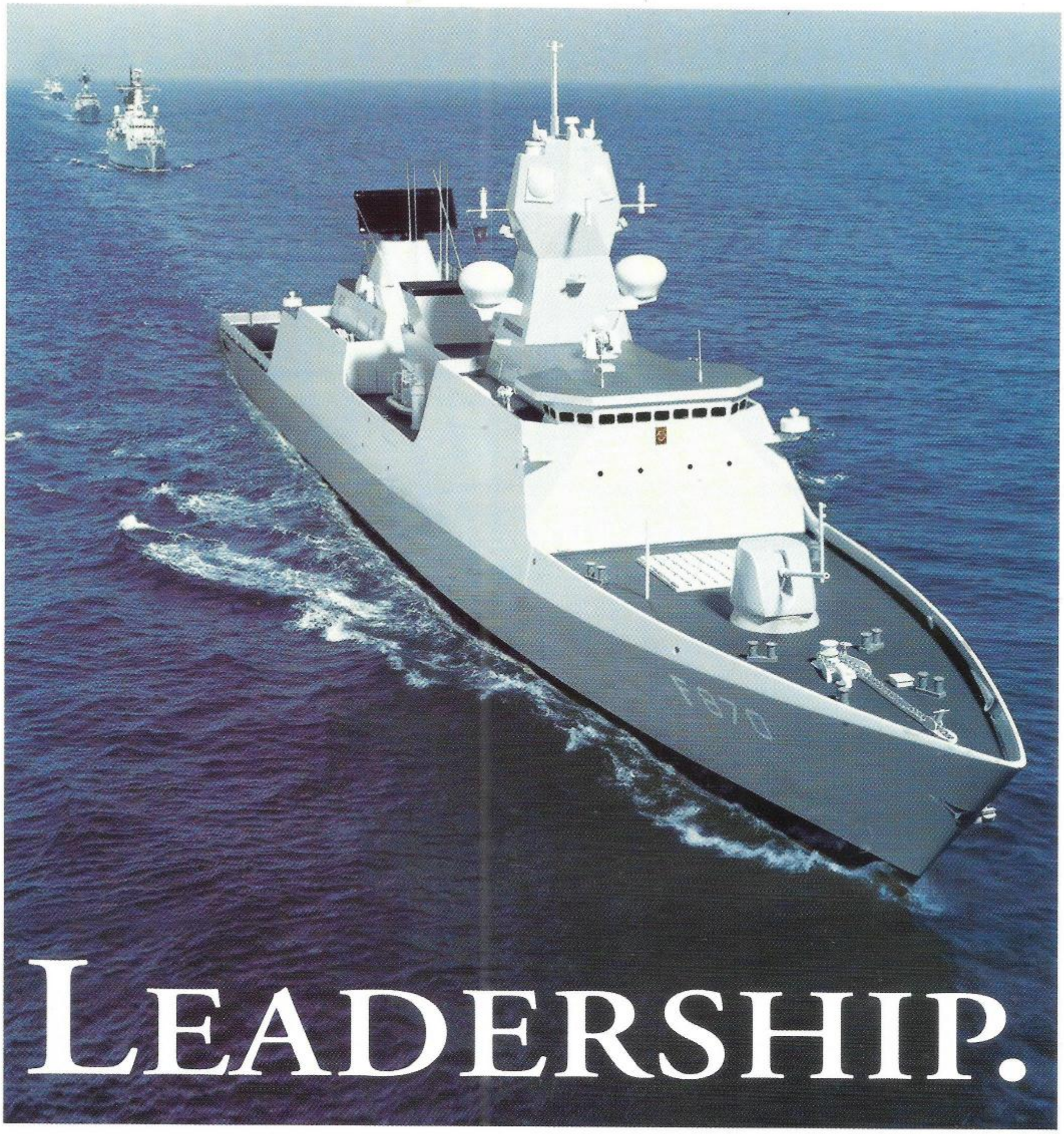

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Introduction

The aim of *Jane's Major Warships* is to present the reader with all the information currently available on all major naval combatants. The book includes all but the very smallest combat craft and excludes patrol craft, auxiliaries, logistic vessels, harbour craft, training ships, coastguard vessels, army vessels and small boats, although some of these may follow in later volumes. In general terms, the cut-off point between major ships which have been included and minor ships to be excluded has been taken as 500 tonnes full load displacement, although a degree of flexibility has had to be applied, particularly in fast attack craft.

Jane's Major Warships is divided into two volumes covering:

Volume I
- Introduction
- Aircraft carriers
- Shipboard aircraft
- Ballistic missile submarines
- Nuclear-powered attack submarines
- Diesel-electric-powered attack submarines
- Cruisers
- Destroyers
- Index (to Volume I only)

Volume II
- Frigates
- Corvettes
- Fast attack craft
- Amphibious warfare ships
- Mine countermeasures vessels
- Index (to Volume II only)

Each entry is designed to give the reader all the information required on the ship concerned, without having to cross-refer to other parts of the book. The only exception is aircraft, where a certain amount of information is included in the ship entry, with full details given in the 'Shipboard Aircraft' section.

This means that short descriptions and specifications of weapons and electronic equipment are repeated in different entries, an approach which has been adopted in order that the reader only needs to make a 'one-stop' consultation of the book to find everything that is required. However, it should be noted that each weapon or electronic entry is tailored to give information specific to the ship concerned.

If even more detailed information or background on a weapons system or electronic equipment is needed then the reader should refer to the relevant *Jane's* yearbook, such as *Jane's Naval Weapons Systems, Jane's Underwater Warfare Systems* or *Jane's Radar and Electronic Warfare Systems.*

A certain amount of historical information is given in some class entries. This is considered essential to place the class in its contemporary context, and to show how the surviving ships have developed from their original to their current states.

TABLE I. NAVAL RANKS BASED ON SIZE OF SHIP

US/UK rank[1]	France[2]	Germany	Italy	Spain[3]
Captain	*Capitaine de Vaisseau*	*Kapitän zur See*	*Capitano di Vascello*	*Capitan de Navio*
Commander	*Capitaine de Frégate*	*Fregatten-Kapitän*	*Capitano di Fregata*	*Capitan de Fregata*
Lieutenant-Commander	*Capitaine de Corvette*	*Korvetten-Kapitän*	*Capitano di Corvetta*	*Capitan de Corbeta*

Notes:
(1) Also followed by most Commonwealth navies (except for Singapore), and a number of other navies, including Japan and South Korea.
(2) Also followed by most former French colonial territories.
(3) Followed by many South American navies.

Warship Designations

One of the difficulties in categorising warships is that there is no international agreement on the definitions of the various types of ship. Thus, in Western navies the description of warships follows a pattern that is fundamentally traditional, classifying warships into groups such as cruisers, destroyers, frigates and corvettes. These descriptions give a very general idea of the size, role and capability of the ship, so that, in the most general terms, a frigate is larger and more capable than a corvette, while a destroyer is larger and more capable still. The only known source of such warship designations is Standardised NATO Agreement Number 11 of 1966 (STANAG 11/66) which, of course, has no authority outside the Alliance, but as there is no known comparable document, it forms a useful basis for designations.

STANAG 11/66 is summarised at Appendix 1 to this Introduction and it will be seen that it attempts to classify every type of naval vessel or craft to be found in any navy. Experience suggests that it tends to be amended to suit national changes rather than to set standards with which nations will comply. It is, nevertheless, the only standardisation document in this area.

It should be noted also that warships are sometimes categorised for motives other than the purely naval. There have been occasions, for example, where navies have deemed it necessary to mislead potential enemies (or friendly politicians) into thinking that a proposed warship is smaller and less significant than it really is. Thus, in the past, cruiser-sized ships have been described as destroyers, and frigates as corvettes. Conversely, navies have sometimes wished a potentially hostile power to over- rather than underestimate their capabilities and so they have placed a warship in a category greater than is properly the case, for example, by describing a ship which most navies would classify as a corvette, a 'frigate'.

An additional factor is that many navies enshrine the relative size of ships in the middle-grade officers' ranks titles, as shown in Table 1, where a four-ring captain is a 'captain of ship' (in the sense of a traditional sailing 'ship-of-the-line') while a commander is a 'captain of frigate' and a lieutenant-commander is a 'captain of corvette.'

A further complication arises where ships are rebuilt to fit a different role from that for which they were originally designed. Sometimes the ships are redesignated to match this change; when the British Royal Navy rebuilt a large number of Second World War destroyers in the 1950s as convoy anti-submarine escorts, for example, it changed their designation to 'frigate.' Other navies, however, do not do this, and ex-US Navy 'Gearing' and 'Sumner' class ships have remained designated 'destroyers' throughout their lives, regardless of their changes in role.

A cruiser is defined by STANAG 11/66 as a vessel of '150 m (492 ft) and over', with subdivisions of CA (a cruiser with 150 mm (6 in) guns or larger and carrying no missiles) or CG (cruiser having guided missiles as a main armament). Despite this, the US Navy's 'Kidd' class ships are designated destroyers, even though they are 171 m (561 ft) in length, displace 9,574 tonnes and have an armament as heavy as that of cruisers, such as the 'California' and 'Bainbridge' classes. Similarly, the 'Ticonderoga' and 'Spruance' classes share a common hull and propulsion system, but the former are designated cruisers and the latter destroyers.

According to STANAG 11/66, destroyers have a length bracket of 95 to 140 m (312 to 459 ft), whereas the frigate length bracket is somewhat greater at 75 to 150 m (246 to 492 ft). The difference between the two lies in the role, where destroyers are optimised for '. . . operations with strike, ASW, and amphibious forces, and to perform screening and convoy duties' while frigates are '. . . fitted primarily to fulfil an ASW role: generally has lighter surface armament than DD.' The surface armament stipulation seems to have been overtaken by modern technology, where most destroyers and all but the smallest frigates are armed with one 76 mm gun and eight Harpoon SSM launchers.

The Russian system is shown in Table II. This system is also a mixture of functional designations (large anti-submarine ship,

TABLE II. RUSSIAN WARSHIP DESIGNATIONS[1]

Russian designation	Russian abbreviation	English translation	Examples	Western designation
Raketnyy Kreyser	RKR	Missile cruiser	Kirov Slava	Battle cruiser Missile cruiser[2]
Kreyser	KR	Cruiser	Sverdlov	Cruiser
Bol'shoy Protivolodochnyy Korabl'	BPK	Large anti-submarine ship	Kara Udaloy	Cruiser Destroyer
Eskadrennyy Minonosets	EM	Destroyer	Sovremenny	Destroyer
Storozhevoy Korabl'	SKR	Patrol ship	Krivak Koni	Frigate
Malyy Raketnyy	MRK	Small missile ship	Tarantul Nanuchka	Corvette
Raketnyy Kater	RKA	Missile cutter	Osa	Fast attack craft[3]

Notes:
(1) This is only a small selection, and concerns the major warship types only.
(2) The 'Kirov' class is much larger than the 'Slava' class but in the Russian Navy both share the designation RKR. In the West, however, the Kirov is generally designated a battle cruiser (BC), a designation previously used in the first half of the twentieth century to denote a ship of battleship size and with a battleship's armament, but which sacrificed armour for speed. (BC does not appear in STANAG 11/66)
(3) Fast attack craft (FAC) is not a NATO designation, but is widely accepted.

patrol ship) and of traditional designations such as *kreyser* (cruiser) and *eskadrennyy minonosets* (destroyer).

Entries
Some further explanations of the layout and contents of the entries is in Appendix 2.

Parts of a ship
For the convenience of non-specialist readers, diagrams are given in Appendix 3 which illustrate the naval terminology used in this book.

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Contributions
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APPENDIX 1

The NATO Standard Ship Designator System (Extract)

Serial	Letter designator	STANAG 11/66[1] Reporting title	Description[1]	Editors' comments
1.	BB	Battleship, general	General designator for battleship. Largest possible type of surface combatant designed for surface action. Showing a reasonable compromise between speed, protection and armament.	1. Last applied to US 'Iowa' class. 2. Note there is NO category of 'battle-cruiser'
3.	CA	Cruiser, gun	A cruiser with guns (15 cm (6 in)) or larger as its main armament and which has no missiles	
4.	CC	Cruiser, general	General designator for all cruiser-type ships of 140 m (459 ft) or more	
5.	CG	Cruiser, guided missile	A ship of cruiser size, having a guided missile system as main armament	Peruvian *Almirante Grau* is one of few remaining examples
6.	CH	Cruiser, helicopter	A cruiser equipped with a major flight deck with a primary mission of operating and maintaining helicopters.	Peruvian *Aguirre* is one of few remaining examples
7.	CV	Aircraft carrier	1. General designator for aircraft carriers 2. Designator for multirole aircraft carriers	
8.	CVH	Aircraft carrier, VSTOL/ helicopter	A carrier not fitted with arrest gear/catapult, operating VSTOL and/or helicopters, which is not an amphibious or mine warfare vessel.	
9.	CVS	Aircraft carrier, ASW	Carrier capable of operating VSTOL and/or helicopters in sustained ASW operations and escort duties	For example, British 'Invincible' class as originally built
10.	DD	Destroyer, general	General designator for destroyer-type ships. Major surface combatant in range of about 95-140 m (312-459 ft). General mission is to conduct operations with strike, ASW, amphibious forces and to perform screening and convoy duties. May have helicopters not especially fitted for ASW.	Suffix 'G' is frequently added to indicate primary missile armament.
11.	DE	Destroyer, escort	A destroyer-sized ship optimised for escort duties	Has not been applied to a new class for many years
12.	FF	Frigate/corvette, general	General description for a frigate. A surface combatant in size range of about 75-150 m (246-492 ft). Fitted primarily to fulfil an ASW role: generally has lighter surface armament than DD	Suffix 'G' is frequently added to indicate primary missile armament
13.	FS	Corvette	Small escort in size range 60-100 m (197-328 ft)	For example, Italian 'Minerva' class
14.	LCAC	Landing craft, air-cushion	A high-speed (40 kts) assault landing craft capable of travelling over land or water from over-the-horizon distances (12-200 n miles) using air-cushion/gas-turbine propulsion	
15.	LCC	Amphibious command ship	Command ship for amphibious task force and landing operations. May carry a limited number of troops and supplies for the headquarters element of the landing force	For example, US Navy 'Blue Ridge' class
16.	LCM	Landing craft, mechanised	Landing craft in the range 15-25 m (49-82 ft), capable of carrying one tank or 50-200 troops. Must have landing ramp	
17.	LCP	Landing craft personnel	Landing craft suitable only for personnel. Size range 7.5 to 30 m (24.6-98 ft) overall. May be fast and/or ramped.	
18.	LCU	Landing craft, utility	All-purpose landing craft. Size range 25-55 m (82-180 ft). Capable of handling 2-3 tanks or 300-450 troops. Must have landing ramp or other landing facilities. Full load displacement of 120-500 tonnes.	
19.	LCVP	Landing craft, vehicle, personnel	Similar in size to LCP but capable of carrying light vehicle in place of troops. Must have bow ramp	
20.	LCW	Landing craft, swimmer support	High-speed craft utilised primarily for underwater demolition and/or special warfare operations	
21.	LFS	Amphibious fire support ship	Landing ship converted for use in amphibious assaults (sic). Armament is usually rocket launchers, but may also have bombardment guns; may or may not carry amphibious troops	

Serial	Letter designator	STANAG 11/66[1] Reporting title	Description[1]	Editors' comments
22.	LHA	Amphibious general assault ship	A large general purpose amphibious assault ship which embarks and lands elements of an assault force in both organic helicopters and organic landing craft. Capable of carrying about 1,800 assault troops. Must have internal stowage and ramp and flooded well capability for vehicles or craft.	
23.	LHD	Amphibious assault ship, multipurpose	A large multipurpose amphibious ship that embarks and lands elements of a landing force in assaults by helicopter, landing craft and amphibious vehicles. Also can conduct sea control and power projection missions with VSTOL aircraft and ASW helicopters	
24.	LKA	Amphibious cargo ship	Ship which carries supplies for amphibious assaults and can land same in its own organic landing craft	
25.	LL	Amphibious vessel, general	General designator for amphibious vessels	Is never used
26.	LPA	Amphibious transport, personnel	Ship capable of carrying 1,300-1,500 troops and landing them in its own landing craft	
27.	LPD	Amphibious transport, dock	A ship which carries about 1,000 troops. Capable of carrying up to nine LCM; primarily a troop ship and armoured car carrier, with considerable internal berthing space. Must have permanent helicopter platform	
28.	LPH	Amphibious assault ship	A large helicopter carrier with the mission of transporting and landing about 1,800 assault troops with its own aircraft. Employment of organic landing craft not a principal function	
29.	LSD	Landing ship, dock	Primarily a tank and vehicle carrier, but capable of transporting 150-400 assault troops and launching them embarked in organic landing craft without off-loading in the landing area. Need not have a helicopter platform.	
30.	LSL	Landing ship, logistics	A landing ship capable of carrying initial, second echelon and follow-on equipment, vehicles and troops. Normally ramped. Not part of initial assault force.	
31.	LSM	Landing ship, medium	Ship in size range 45-85 m (148-279 ft). Capable of beaching to land troops and/or tanks. Must have bow doors and/or landing ramp	
32.	LST	Landing ship, tank	Ship in size range 85-160 m (279-525 ft) to transport troops, vehicles and tanks for amphibious assault. Must have bow doors and/or landing ramp	See Note 2.
33.	LSV	Landing ship, vehicle	Ship in size range 45-60 m (148-197 ft) overall, intended primarily to carry vehicles. Must have bow doors and/or landing ramp. Not capable of beaching.	
34.	MM	Mine warfare vessels, general	General designator for mine warfare vessels	
35.	MCCS	MCM command and support ship	An armed combatant fitted for the command and support of MCM vessels and their equipment	
36.	MCD	MCM vessel, diving	A mine countermeasures vessel specially equipped to carry out and support diving operations	
37.	MCJ	MCM vessel, hovercraft	Specially equipped for MCM operations	
38.	MCMV	Mine countermeasures vessel, general	General designator for mine countermeasures vessels	
39.	MCS	MCM support ship	An armed combatant fitted for the control and support of MCM vessels in combat situations. Has limited facilities for repair of MCM vessels and their equipment	
40.	MH	Minehunter, general	Ship fitted with specific equipment to hunt mines	
41.	MHA	Minehunter, auxiliary	Any seagoing ship not designed as a minehunter but converted to such use	
42.	MHC	Minehunter, coastal	Very low-magnetic signature ship in size range 25-60 m (82-197 ft) with an enhanced minehunting capability. Must be equipped with unusually sensitive gear for the detection of sea mines. May or may not carry sweep gear as well. May carry frogmen for mine clearance.	
43.	MHSC	Minehunter/sweeper, coastal	A mine warfare craft capable of hunting and sweeping mines in coastal waters	
44.	MHSO	Minehunter/sweeper, ocean	A mine warfare craft capable of hunting and sweeping mines in the open ocean	

Serial	Letter designator	STANAG 11/66[1] Reporting title	Description[1]	Editors' comments
45.	MHI	Minehunter inshore	Same basic function as MHC but designed to operate in more shallow waters and estuaries	
46.	MHO	Minehunter ocean	Same basic function as MHC but operates primarily in open seas	
47.	ML	Minelayer, general	Any ship with a primary mission of laying mines	
48.	MLA	Minelayer auxiliary	Any fishing or merchant ship having both capability and mission to lay mines	
49.	MLC	Minelayer coastal	Minelayer in the size range 50-85 m (164-279 ft) overall	
50.	MLI	Minelayer inshore	Minelayer in the size range 25-50 m (82-164 ft)	
51.	MLO	Minelayer ocean	Large ship over 85 m (279 ft) used primarily for minelaying	
52.	MLR	Minelayer river	Small minelayer 15 m (49 ft) or less, suitable only for operations in rivers or protected roadsteads	
53.	MLS	Minelayer, support ship	A large armed ship (over 90 m) capable of extensive minelaying, but not capable of speeds up to 30 kts. Has facilities for command and control of mine warfare ships and boats in combat environment. Has limited support capability.	
54.	MS	Minesweeper, general	Ship designed to sweep mines	
55.	MSA	Minesweeper, auxiliary	Any seagoing ship not designed as a minesweeper but converted to such use.	
56.	MSC	Minesweeper, coastal	Non-magnetic minesweeper between 40-60 m (131-197 ft)	
57.	MSCD	Minesweeper coastal with drone(s)	Coastal minesweeper capable of deploying and/or controlling unmanned remote-controlled or towed vehicle(s) capable of clearing mines	
58.	MSF	Minesweeper, fleet	Minesweeper in size range 46 m (151 ft) or more which cannot be regarded as non-magnetic	
59.	MSI	Minesweeper, inshore	Minesweeper between 20-40 m (65.6-131 ft). Intended and equipped for inshore minesweeping	
60.	MSO	Minesweeper, ocean	Non-magnetic minesweeper 45 m (148 ft) or more	
61.	MSR	Minesweeper, river	Shallow water minesweeper in the size range 12.5-25 m (41-82 ft), which has been armoured to provide protection for crew in close combat situations. Within the USN a converted LCM-6 known as MSM	
62.	PP	Patrol vessel, general	General designator for patrol vessels	
63.	PB	Patrol boat, general	Coastal patrol unit intended for a basically coastguard function. Should include any coastal patrol ship under 45 m (148 ft) which cannot qualify as a PG in armament. May be unarmed	
64.	PBF	Patrol boat, fast	Unit qualifying as a PB but capable of at least 35 kts	
65.	PBR	Patrol boat, river/ roadstead	Light armed unit generally suitable by design only for operations in sheltered waters, such as rivers and roadsteads	
66.	PBS	Patrol boat, fire support	High-speed (35 kts) craft not over 30 m (98 ft) in length, fitted and employed primarily to provide close in fire support. The primary weapons are multiple rocket launchers, but can have guns, as well	
67.	PC	Patrol subchaser, general	Ship in size range 35-55 m (115-180.5 ft) designed and fitted primarily for ASW role	
68.	PCE	Patrol boat, escort	Ship in size range 55-75 m (180.5-246 ft) designed and fitted primarily for ASW role and coastal duty. Improved seakeeping, vice mere large size. Distinguishes PCE from PC and ships lacking this should be typed PC.	
69.	PCF	Patrol subchaser, fast	Same basic function as PC, but capable of speeds of at least 35 kts	
70.	PG	Patrol ship, general	Patrol, blockade and surveillance ship in range 45-85 m (148-279 ft) overall. Designed to operate in other than open ocean areas. Has special mission of attacking hostile ships. Must have at least 76 mm main armament.	
71.	PGF	Patrol ship, fast	Same as PG, but with speed of at least 35 kts	
72.	PGS	Patrol ship, ASW	ASW patrol ship in range 45-85 m (148-279 ft). Fitted with medium-range sonar and ASW weapons	

Serial	Letter designator	STANAG 11/66[1] Reporting title	Description[1]	Editors' comments
73.	PHM	Patrol combatant, guided missile	A high-speed patrol combatant (hydrofoil) with SSM capability, which can operate offensively against surface combatants and conduct surveillance screening and special operations.	
74.	PT	Patrol/torpedo boat	High-speed (35 kts) anti-surface ship torpedo-equipped unit 20-30 m (65.6-98 ft)	
75.	SS	Submarine, general	General designator for submarines	
76.	SSA	Submarine, auxiliary	Submarine used mainly in a non-combatant role which has at least a residual combat capability	
77.	SSB	Submarine, ballistic missile	Submarine armed with ballistic missiles normally deployed on strategic missions	
78.	SSBN	Submarine, ballistic missile, nuclear	Primary strategic nuclear submarine armed with ballistic missiles	
79.	SSC	Submarine, coastal	Submarine designed primarily for operations in coastal and shallow water	
80.	SSG	Submarine, attack, surface missile	A submarine fitted with underwater or surface-to-surface missiles	
81.	SSGN	Submarine, attack, surface missile, nuclear	A nuclear submarine fitted with underwater or surface-to-surface missiles	
82.	SSK	Submarine, patrol	A non-nuclear, long-range patrol submarine. May have primary anti-surface or anti-submarine role	
83.	SSN	Submarine, attack, nuclear	A nuclear-propelled attack submarine that has both anti-submarine and anti-surface capability	

Notes:
(1) These are taken verbatim from the STANAG 11/1966 Edition 4 (Amendment 6).
(2) It should be noted that although the designation 'LST' still exists, the designation 'LCT' (landing-craft, tank) is not in the STANAG.

Suffixes
The following suffixes can be added to qualify most of the preceding groups:

A A unit equipped with force surface-to-surface (SSM) or underwater-to-surface (USM) guided missiles. (Notes 1,3,4)
B [The suffix 'B' is NOT used]
C A ship equipped with a critical angle towed array system (CATAS)
D A ship equipped with a depressed towed array system (DTAS)
E A unit for experimental purposes
F A ship other than a CV type equipped with fixed-wing aircraft
G A unit equipped with force surface-to-air guided missiles (SAM). (Notes 1,3,4)
H A ship equipped with helicopter(s)
I [The suffix 'I' is NOT used]
J A unit that is either an air-cushion or surface-effect design
K A ship equipped with hydrofoils
L A unit minelaying capability (Note 5)
M A ship equipped with more than one force missile system; that is, SAM + SAM, SAM + SUM. (Notes 1,3,4)
N A ship or submarine using nuclear propulsion (Note 2)
O, P } [Suffixes 'O' and 'P' are NOT used]
Q A unit configured for, or employed on, a Command, Control and Communications mission
R A unit equipped primarily to carry out radar picket duties
S A unit with minesweeping/minehunting capability (Note 5)
T A unit used primarily for training with a reduced operational capability
U A unit equipped with surface-to-underwater (SUM) or underwater-to-underwater (UUM) missile-delivered force weapon. (Notes 1,3,4)
V A ship equipped with variable depth sonar (VDS)
W A ship without organic helicopter(s) but equipped with a flight deck and limited helicopter facilities
X, Y } [Suffixes 'X' and 'Y' are NOT used]
Z A non-self-propelled ship or craft

Notes:
(1) Suffixes may be combined as required but suffix 'M' should not be used with suffixes 'A,' 'G,' or 'U'.
(2) Suffix 'N', when used, is normally the last character.
(3) A force weapon contributes to the overall force offensive and/or defensive posture.
(4) The suffix 'G' for US Navy ships indicates a ship equipped with surface-to-air guided missiles (SAM) and does not exclude other systems (SSM and/or SUM). The US Navy does not use suffixes 'A', 'M' or 'U' to indicate missile systems.
(5) To be used for vessels whose primary purpose is not mine warfare.

APPENDIX 2

Entries

Classes

(a) Ships are grouped together by classes under the country where the design originated, and within such classes by alphabetical order of countries.
(b) Where necessary, an introduction or 'overview' is given, which is designed to give the reader the overall picture, to show how the class originated and how it was dispersed, either by building to foreign orders, or by foreign sales at the end of the ships' careers in the original navies.

Building programme. The current status of the class is divided into:
(a) 'Built' The total number constructed
(b) 'Building' The total number on firm order and under construction
(c) 'Active' The total in service on 1 January 1997
(d) 'Projected' The total on firm order
(e) Where there is a degree of uncertainty a question mark is appended.

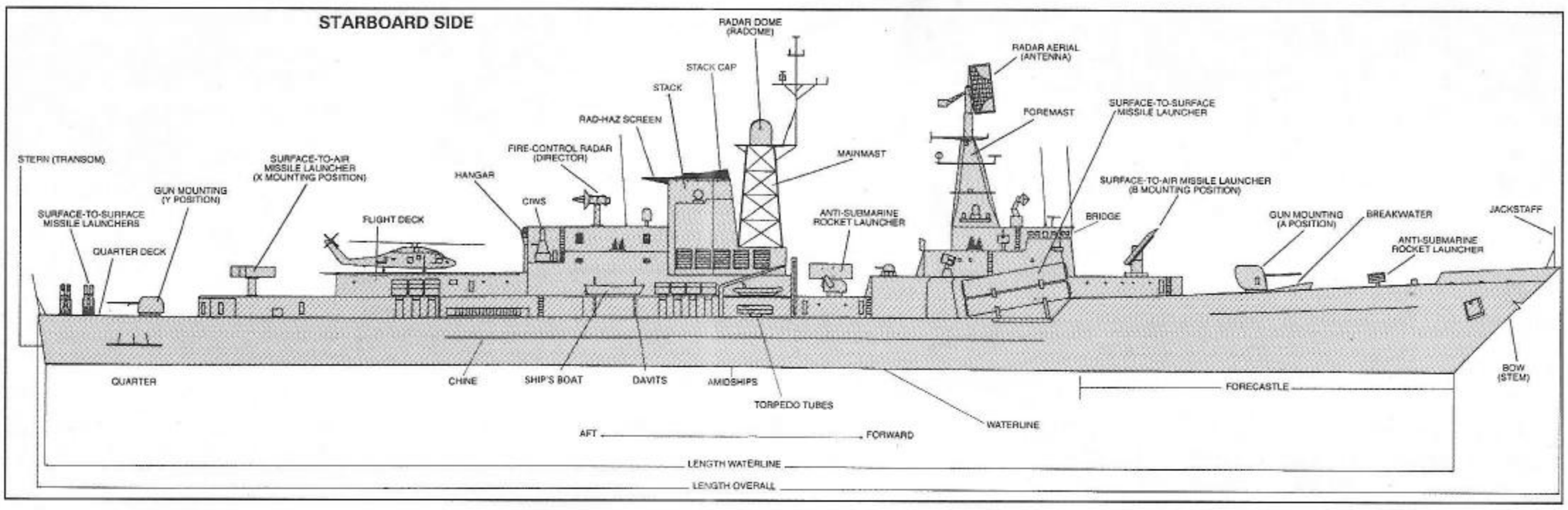
Displacement. This is given as
(a) Light: without fuel, water or ammunition
(b) Standard: as defined by Washington Naval Conference 1922 — fully manned and stored but without fuel or reserve feed-water
(c) Full load: fully laden with all stores, ammunition, fuel and water

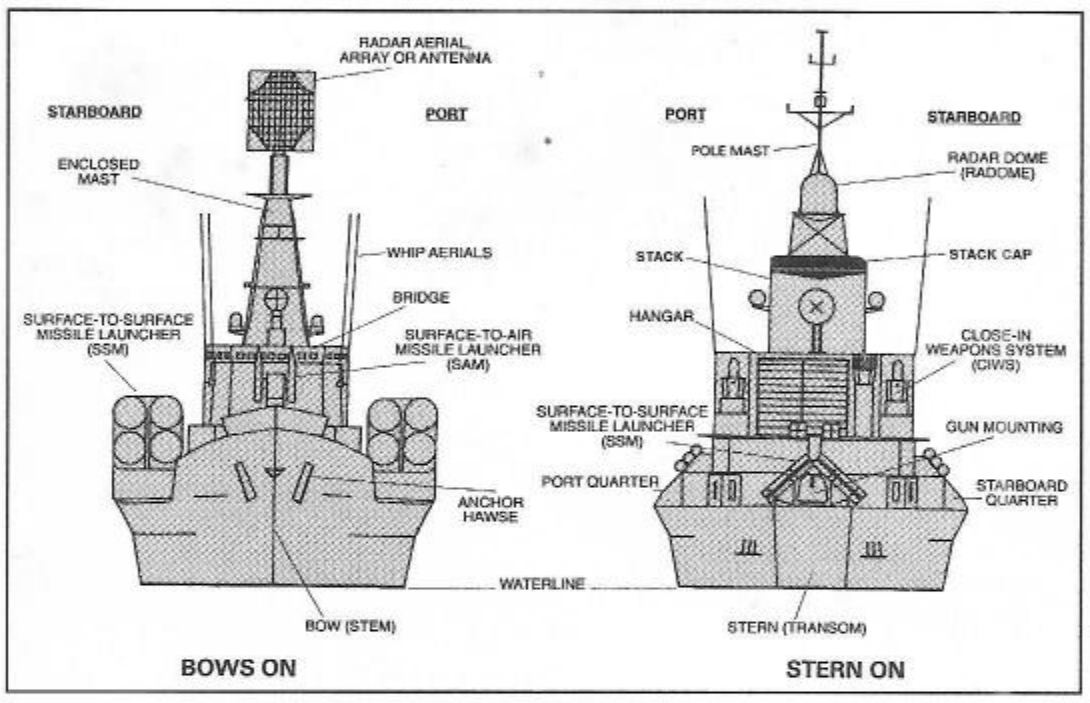
Dimensions

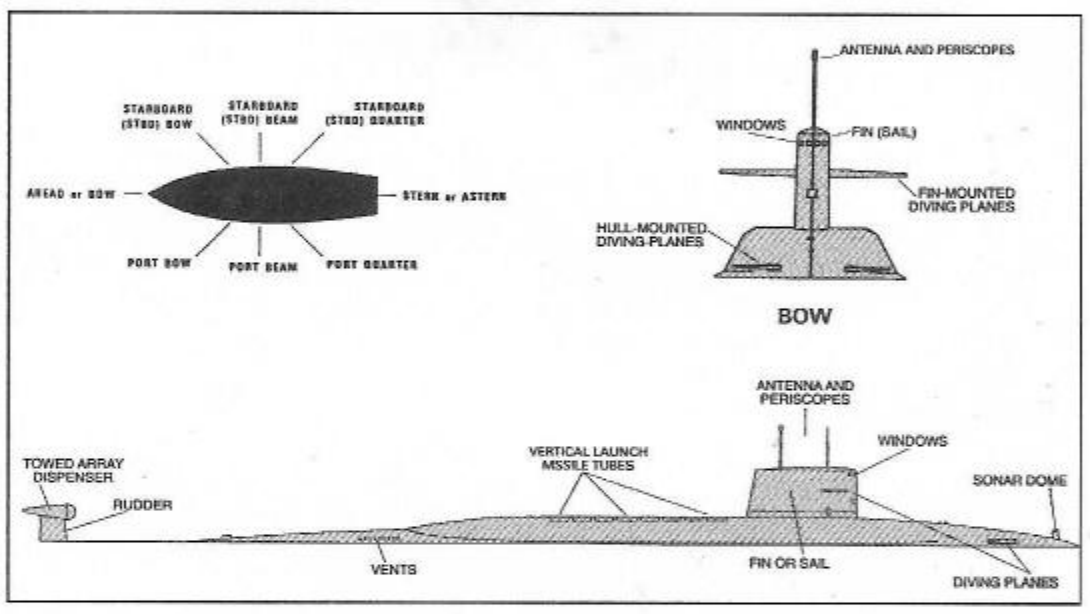
(a) Length. This is length overall, unless specified by:
i: '(oa)' length overall between extremities
ii: '(wl)' length of waterline at standard load
(b) Beam. Maximum width of the hull, but excluding sponsons.
(c) Draught. Draught at standard load at deepest point

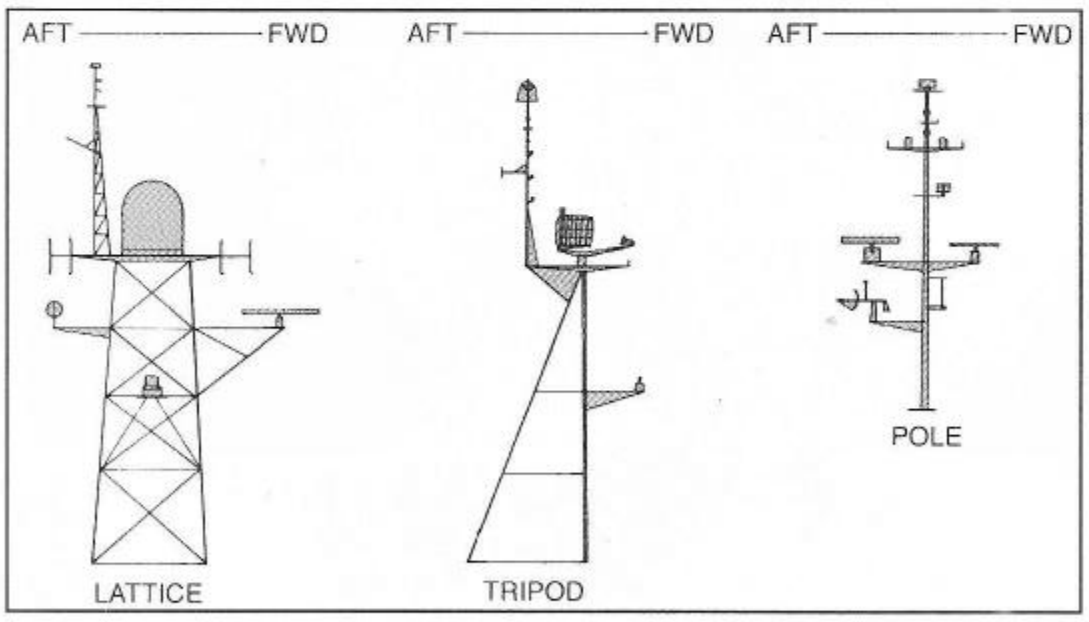
HMS *Norfolk* (H M Steele)

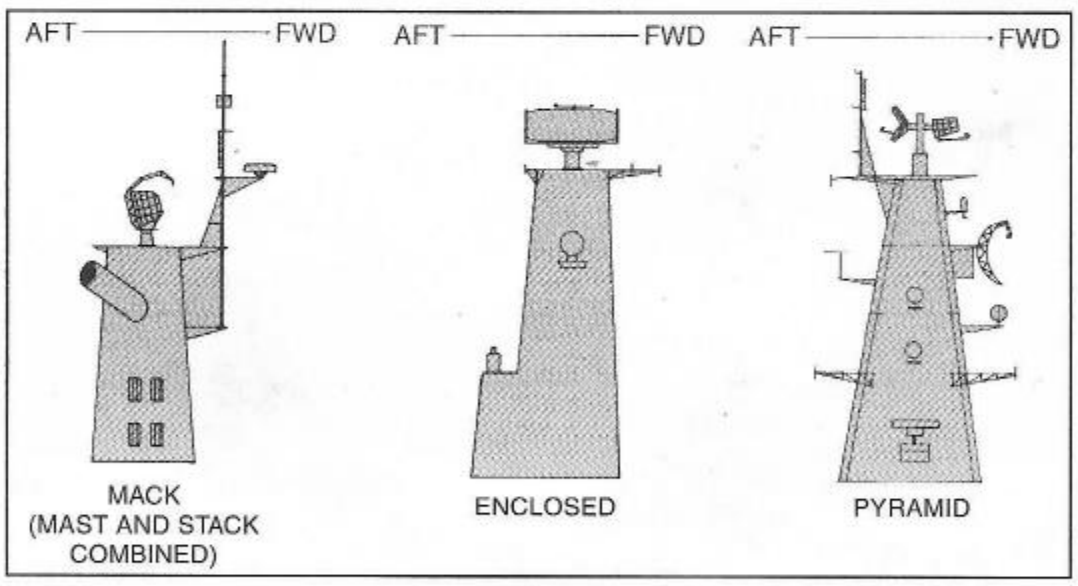
APPENDIX 3











Above are composite diagrams of warships, submarines and masts, which are annotated for the benefit of non-specialist readers

Glossary

AAW Anti-air warfare
ACDS Advanced combat direction system
ACV Air cushion vehicle
AEW Airborne early warning
AIP Air independent propulsion
ANV Advanced naval vehicle
ARM Anti-radiation missile
A/S, ASW Anti-submarine (warfare)
ASuW Anti-Surface Warfare
ASM Air-to-surface missile
AUV Autonomous undersea vehicle
BPDMS Base point defence missile system
Cal Calibre — the internal diameter of a gun barrel; also used for measuring length of the barrel, for example, a 152 mm gun 50 calibres long (152 mm/50) would be 7.6 m (25 ft) long
cep Circular Error Probable — a measure of the accuracy of missiles, bombs and artillery shells, being the diameter of a circle within which 50 per cent of the missiles/projectiles would land
CIWS Close in weapon system
COD Carrier onboard delivery
CODAG, CODOG Descriptions of mixed propulsion systems: CODLAG = combined diesel-electric and gas turbine
COGAG = combined gas turbine and gas turbine
COGOG = combined gas turbine or gas turbine
COSAG = combined steam and gas turbine
CONAS = combined nuclear and steam
cp Controllable pitch (propellers)
DC Depth charge
DCT Depth charge thrower
DP Dual-purpose; a gun which can be used against both surface and aircraft targets
Displacement Basically the weight of water displaced by a ship's hull when floating: (a) Light: without fuel, water or ammunition
(b) Standard: as defined by Washington Naval Conference 1922 — fully manned and stored but without fuel or reserve feed-water
(c) Full load: fully laden with all stores, ammunition, fuel and water
DSRV Deep submergence recovery vessel
dwt Deadweight tonnage
ECM Electronic countermeasures, for example, jamming
ECCM Electronic counter-countermeasures
EEZ Exclusive economic zone
EHF Extreme high frequency (30-300 GHz)
ELF Extreme low frequency (0-3 kHz)
ELINT Electronic intelligence, for example, recording radar, radio, and so on
ESM Electronic support measures, for example, intercept
EW Electronic warfare
FAC Fast attack craft
FLIR Forward looking infra-red radar
FRAM Fleet rehabilitation and modernisation programme (a US Navy programme in the 1960s)
GFCS Gun fire-control system
GMLS Guided missile launch system (US)
GPS Geographical positioning system
grt Gross registered tonnage
GWS Guided weapon system
HF High frequency (3-30 MHz)
HMG Heavy machine gun
Horsepower (hp) Power developed or applied: or (hp(m))
(a) bhp: brake horsepower = power available at the crankshaft
(b) shp: shaft horsepower = power delivered to the propeller shaft
(c) ihp: indicated horsepower = power produced by expansion of gases in the cylinders of reciprocating steam engines
(d) 1 kW = 1.341 hp = 1.360 metric hp. 1 hp = 0.746 kW = 1.014 metric hp. 1 metric hp = 0.735 kW = 0.968 hp
(e) Sustained horsepower may be different for similar engines in different conditions
IFF Identification friend/foe
kT Kiloton; measure of the power of a nuclear explosion, where 1 kT is equivalent to the effect of 1,000 tons of TNT
kW Kilowatt
LAMPS Light airborne multipurpose system (US)
Length The length of a ship, which can be expressed in various ways:
(a) oa: overall = length between extremities
(b) pp: between perpendiculars = between fore side of the stem and after side of the rudderpost
(c) wl: waterline = between extremities on the waterline
LF Low frequency (30-300 kHz)
LMCR Liquid metal cooled reactor
LRMP Long-range maritime patrol
MAD Magnetic Anomaly Detector — a system used by aircraft to detect submarines by identifying the movement of a steel body through the earth's magnetic field
MAP US Military Assistance Programme
MCMV Mine Countermeasures Vessel
MDF Maritime defence force
Measurement *see* Tonnage
MF Medium frequency (300 kHz-3 MHz)
MFCS Missile fire-control system
MG Machine gun
MIRV Multiple, independently targetable re-entry vehicle
MRV Multiple re-entry vehicle
MSA Maritime Safety Agency (Japanese)
MSC Military Sealift Command (US)
MW Megawatt
NBC Nuclear, biological and chemical (warfare)
net Net registered tonnage
n miles Nautical miles
NTDS Naval tactical direction system (US)
NTU New Threat Upgrade (US)
oa Overall length; that is, the length between the two extremities of the hull
OTC Officer in Tactical Command
PDMS Point defence missile system (US)
PUFFS Passive underwater fire-control system (US)
PWR Pressurised water reactor
RAM Radar absorbent material
RAS Replenishment at sea
RBU Anti-submarine rocket launcher (Russian)
RIB Rigid inflatable boat
Ro-ro Roll-on/roll-off
ROV Remote operated vehicle
rpm Revolutions per minute of engines, propellers, radar aerials and so on
SAM Surface-to-air missile
SAR Search and rescue
Satcom Satellite communications
SDV Swimmer delivery vehicle
SES Surface effect ship
SHF Super high frequency (3-30 GHz)
SINS Ship's inertial navigation system
SLBM Submarine-launched ballistic missile
SLCM Ship-launched cruise missile
SLEP Service Life Extension Program
SRBOC Super rapid blooming offboard countermeasure
SSBN Submarine, ballistic missile, nuclear-powered (that is, nuclear-powered, strategic missile submarine)
SSDE/SSE Submerged signal and decoy ejector
SSK diesel electric-powered submarine
SSM Surface-to-surface missile
SSN attack submarine, nuclear powered
STIR Surveillance Target Indicator Radar
SUBROC/ASROC Rocket-assisted torpedo, part of whose range is in the air (US)
SURTASS Surface Towed Array Surveillance System (US)
SUWN-1 Surface-to-underwater missile launcher (Russian)
SWATH Small waterplane area twin hull
TACAN TACtical Air Navigation beacon
TACTASS TACtical Towed Acoustic Sensor System (US)
TAS Target Acquisition System
TASS Towed Array Surveillance System
Tonnage Measurement tonnes, computed on capacity of a ship's hull rather than its 'displacement' (see above):
(a) Gross: the internal volume of all spaces within the hull and all permanently enclosed spaces above decks that are available for cargo, stores and accommodation. The result in cubic feet divided by 100 = gross tonnage
(b) Net: gross minus all those spaces used for machinery, accommodation and so on ('non-earning' spaces)
(c) Deadweight (dwt): the amount of cargo, bunkers, stores and so on that a ship can carry at her load draught
Tonnes Metric ton = 1,000 kg = 0.98 tons
UHF Ultra-high frequency (300 MHz-3 GHz)
UUV Unmanned undersea vehicle
VDS Variable depth sonar which is lowered to best listening depth. Known as 'dunking' sonar in helicopters
Vertrep Vertical replenishment; that is, resupply at sea using helicopters
VHF Very High frequency (30-300 kHz)
VLF Very low frequency (3-30 kHz)
VLS Vertical launch system
VSTOL Vertical or short take-off/landing
VTOL Vertical take off/landing
WIG Wing-in-ground effect
wl Waterline length

COUNTRY NAMES

Throughout this work, where it is necessary to list countries, this is done using the UN and NATO convention of alphabetical order according to the initial letter of the country name, using the anglicised spelling. The order in such a listing does not, therefore, imply any suggestion of relative size or importance, or of comparative merit.

In the case of Russia and the Soviet Union the following convention has been applied:

In any references of a purely geographical nature the name 'Russia' is used and, as far as possible, names of regions and towns are given in their modern (1997) form. Thus, for example, the name 'St Petersburg' is used even when the event referred to may have taken place in the Soviet era.

In references to the country and the navy, the terms Soviet Union and Soviet Navy are used where the events referred to happened before 1990. For events after that date the terms Russia and Russian Navy are used.

ELECTROMAGNETIC SPECTRUM

Some confusion has been caused over the past few years by the use of two different systems to describe radio frequencies and wavelengths. One particular problem has been the use of frequency band letters by the EW fraternity and the waveband letters by the radar fraternity. To avoid this, *Jane's Major Warships* follows the lead given by *Jane's Radar and Electronic Warfare Systems* in using the NATO frequency band designation as standard throughout (ie, Column (1) below). In order that readers can evaluate wavelength against frequency the wavelength letters are given in Column (3).

RADAR BANDS

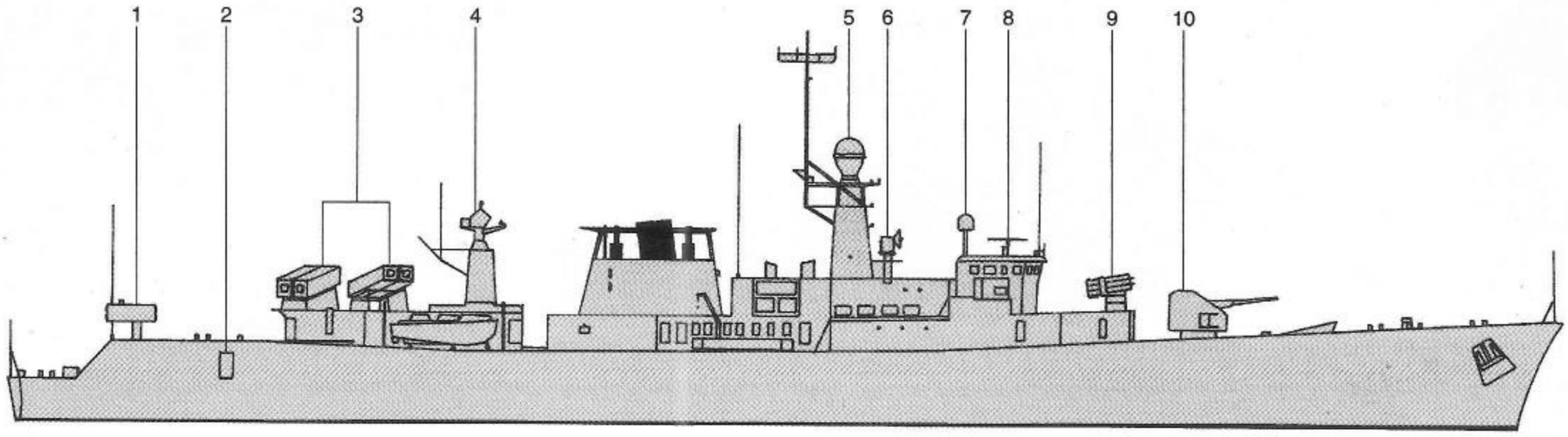
Frequency band	Frequency	Wavelength band	Wavelength
(1)	(2)	(3)	(4)
A	100-300 MHz	VHF	300-100 cm
B	300-500 MHz	UHF	100-60 cm
C	0.5-1 GHz	UHF	60-30 cm
D	1-2 GHz	L	15-30 cm
E	2-3 GHz	S	10-15 cm
F	3-4 GHz	S	7.5-10 cm
G	4-6 GHz	C	5-7.5 cm
H	6-8 GHz	X	3.75-5 cm
I	8-10 GHz	X	3-3.75 cm
J	10-20 GHz	X-Ku	1.5-3 cm
K	20-40 GHz	K-Ka	7.5 mm-1.5 cm
L	40-60 GHz	V	5-7.5 mm
M	60-100 GHz	W	3-5 mm

COMMUNICATIONS BANDS

Frequency	Band	Frequency
ELF	Extra Low Frequency	0-3 kHz
VLF	Very Low Frequency	3-30 kHz
LF	Low Frequency	30-300 kHz
MF	Medium Frequency	300 kHz-3 MHz
HF	High Frequency	3-30 MHz
VHF	Very High Frequency	30-300 MHz
UHF	Ultra High Frequency	300 MHz-3 GHz
SHF	Super High Frequency	3-30 GHz
EHF	Extremely High Frequency	30-300 GHz

FRIGATES (FF)

WIELINGEN



Wielingen (Ian Sturton)
1 *Eight Sea Sparrow SAMs in Mk 29 launcher* **2** *Launch tube (covered) for ECAN L5 Mod 4 533 mm (21 in) torpedoes* **3** *Four MM 38 Exocet anti-ship missiles* **4** *DA-05 air/surface search radar* **5** *WM-25 fire-control radar* **6** *DMAb optical director* **7** *Satcom* **8** *TM 1645/9X navigation radar* **9** *375 mm six-barrelled ASW mortar* **10** *Single 100 mm (3.9 in)/55 Mod 68 gun*

GENERAL SPECIFICATIONS

Operator: Belgium
Type: E-71

Class: WIELINGEN

Built: 4
Active: 3

Displacement:
light: 1,940 t
full load: 2,430 t

Dimensions
Length: 106.4 m (349 ft)
Beam: 12.3 m (40.3 ft)
Draught: 5.6 m (18.4 ft)

Speed:
max: 26 kts
cruise (one diesel): 15 kts
cruise (two diesels): 20 kts
Range: 4,500 n miles at 18 kts; 6,000 n miles at 15 kts

Complement: 159 (13 officers)

SHIPS

WIELINGEN (F 910)
Builder Boelwerf, Temse, Belgium
Laid down 5 Mar 1974
Launched 30 Mar 1976
Commissioned 20 Jan 1978

WESTDIEP (F 911)
Builder Cockerill, Hoboken, Belgium
Laid down 2 Sep 1974
Launched 8 Dec 1975
Commissioned 20 Jan 1978

WANDELAAR (F 912)
Builder Boelwerf, Temse, Belgium
Laid down 28 Mar 1975
Launched 21 Jun 1977
Commissioned 27 Oct 1978

Wandelaar (F 912) (Belgian Navy)

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Raytheon Sea Sparrow point-defence missile system

There is a single Mk 29 octuple launcher for the Sea Sparrow system, which is located aft. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg blast fragmentation warhead and a dual-purpose proximity-impact fuze. The RIM-7M missiles originally carried have been replaced by RIM-7P, which has improved electronics and a computer with significantly increased capacity. There are no reloads.

Specifications
RIM-7P
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Aircraft Company Missile Systems Group (second missile source).
Naval Weapons Center, Crane, USA (warhead).

ANTI-SHIP MISSILES (ASM)

Exocet MM 38 medium-range anti-ship missile

Four Aerospatiale MM 38 Exocets are mounted on the roof of the after deckhouse, in individual ITS *(Installation de Tir Standard)* launcher-containers, within which they are suspended from a launch rail in the ceiling. The launcher-containers point outwards and are

Westdiep *(F 911). The cap on the muzzle of the 533 mm (21 in) torpedo tube can just be seen on the ship's side below the Sea Sparrow launcher* (B Sullivan)

raised at an angle of 12° to the horizontal. Targets are acquired by the ship's search radar and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence. This involves turning on the thermal battery, releasing the mechanical safety locks, igniting the booster, and, finally, breaking the umbilical cord; the total process takes some 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change of course during its flight.

The attack consists of three phases:

Cruise phase. The cruise phase starts as the missile clears the container and the missile, powered by the sustainer motor, flies towards the general location of the target at a height of about 100 m which is low enough to reduce the chance of detection but adequate for target acquisition. This phase can be as long as 11.9 n miles (22 km) and ends when the seeker acquires the target. This seeker is a Dassault Electronique ADAC (Auto Directeur Anti-Clutter) active monopulse radar, working in the I-band (8-10 GHz), which has a typical range of 13 n miles (24 km) against FACs.

Approach phase. On detecting the target the missile descends to 9-15 m (30-50 ft) in the approach phase.

Terminal phase. During this final phase the missile descends to 8 m (26 ft) (2-5 m (6.6-16 ft) in a calm sea) for a sea-skimming run in to the target.

A salvo may be fired in 12-20 seconds.

Specifications

MM 38
Length: 5.21 m (17.1 ft)
Diameter: 35 cm (13.8 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s
Booster: SNPE Epervier boost motor, burn time of 2.4 s
Warhead: Luchaire 165 kg (364 lb) fragmentation warhead
Fuzes: Delayed impact fuze and autopilot-controlled proximity fuze

Manufacturer/Contractor

Aerospatiale Tactical Missiles, Chatillon Cedex, France.

TORPEDOES

There are two 533 mm (21 in) torpedo launchers, one on each beam, located in the ship's side, aft. Ten ECAN L5 torpedoes are carried.

ECAN L5 Mod 4 533 mm (21 in) torpedoes

L5 is a lightweight ASW torpedo, which can be used for direct or indirect attacks. The weapon is of conventional design with a light alloy body, four fins and twin contrarotating propellers, and a blunt nose made of a laminated material. The torpedo is electrically propelled using silver/zinc batteries. They have passive/active seekers which have various operating modes including direct attack or programmed search.

Specifications

Mod 4
Length: 4.4 m (14.43 ft)
Diameter: 533.4 mm (21 in)
Weight: 935 kg (2,061 lb)
Speed: 35 kts
Range: 5 n miles (9.54 km)
Depth: 555 m (1,820 ft)
Warhead: 150 kg (331 lb)

Manufacturers/Contractors

DCN International (prime).
ECAN, Saint Tropez, France.

GUNS

100 mm/55 Modèle 1968

There is one single 100 mm/55 Modèle 1968-II CADAM dual-purpose mounting located on the foredeck ('A' position). This is normally operated in the fully automatic remote mode with an unmanned turret, although there is a fall-back manual mode, which requires two men in each turret. The turrets have been taken from an old ship and upgraded to CADAM (CADence AMéliorée) standard with improved recoil and feed systems, raising the firing rate from 60 rds/min to 78 rds/min. The magazine in the 'Wielingen' class carries 600 rounds.

Specifications

Calibre: 100 mm
Length of barrel: 55 calibres
Muzzle velocity: 870 m/s (2,854 ft/s)
Traverse: 360° at 40°/s
Elevation: −15 to +80° at 25°/s
Mounting weight: 21 t
Crew: 2 (optional) and 2 loaders

Westdiep *(F 911). The main armament is the single Creusot-Loire 100 mm gun on the foredeck and between that and the bridge is the six-tube Modèle 1964 375 mm ASW mortar, also from Creusot-Loire. Above the bridge is the well-known Signaal 'egg', in this case housing the WM 25 fire-control radar antennas* (Belgian Navy)

Range:
anti-surface: 9.15 n miles (17 km)
anti-air: 8,000 m (26,000 ft)
Rate of fire: 78 rds/min
Ammunition: 13.5 kg (multipurpose projectile); 9.7 kg (charge)

Manufacturers/Contractors
Direction des Constructions Navales (DCN) (prime).
Mécanique Creusot-Loire, Marine Products (mountings).
DCN Ruelle (gun).
CSEE, Défense (servo equipment).

ANTI-SUBMARINE MORTARS

Creusot-Loire Modèle 1964 375 mm ASW rocket system
There is a single, six-tube Model 1964 ASW rocket launcher on the forecastle. This weapon was developed in France, but uses Bofors 375 mm rockets. The system consists of a rocket launcher, a handling system, the ship sonar and a fire-control system. Reload time is three minutes, each tube being loaded separately. The rate of fire is one round a second and rockets may be fired singly or in salvos. There are two types of rocket, both with Hexotonal filling. The Type E (Erika) rocket has Stidar time and impact fuzes, while the Type N (Nelli) uses the Zambo proximity and impact fuzes.

Rockets

	Type E	Type N
Weight	250 kg (551 lb)	230 kg (507 lb)
Muzzle velocity	130 m/s (427 ft/s)	205 m/s (673 ft/s)
Explosive weight	107 kg (236 lb)	80 kg (176 lb)
Range	0.35/0.87 n miles (0.65/1.63 km)	0.85/2.11 n miles (1.58/3.62 km)
Final sinking speed	10.7 m/s (35 ft/s)	9.2 m/s (30 ft/s)

Manufacturer/Contractor
Creusot-Loire, France.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Thomson-CSF DR 2000 radar threat warner
The Thomson-CSF DR 2000U ESM system detects pulse and continuous wave (CW) signals, and when coupled with the Dalia analyser is used as a basic ESM suite, under the company designation TMV 434. There are six DF antennas and one omnidirectional antenna on a telescopic mast, and a processing control/display console in the EW centre. It provides a virtual 100 per cent probability of detection over the complete 360° of azimuth and gives instantaneous audio and video alerts.

Manufacturer/Contractor
Thomson-CSF, RCM, Elancourt, France.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher
There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 4 km (2.2 n miles)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

AN/SLQ-25 Nixie noisemaker
One AN/SLQ-25 Nixie (Phase 1), a solid-state, modular design electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom or in a partially or totally enclosed location on the main deck. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm long (3.10 ft), 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SEWACO IV data handling and weapon control system
Sewaco IV is an automated data handling and weapon control system, which was specifically designed for the 'Wielingen' class frigates to form the link between the ship's sensors and its weapons. The main functions of Sewaco are: sonar display and control; contact evaluation; classification; contact motion analysis; tactical plot and general plot functions; weapon control; and simulation and test.

Sewaco consists of seven identical Display and Computer Consoles (DaCCs) with a built-in SMR-MU computer. The large amount of data from the sonars is handled by two extra SMR-MUs, also housed in the CCU. Sensors comprise a Signaal DA-05 air and surface warning, and target indication radar, Signaal WM25 combined search and tracking radars, a Raytheon TM 1645/9X navigation radar (also used for helicopter control, if required), IFF, Thomson-CSF DR2000 ESM suite, datalink, optical director, and sonar. The weapon control and combat information equipment consists of the WM25FCS for missiles, gun and ASW rockets.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

Set	DA 05	WM 25	TM 1645/9X
Company	Signaal	Signaal	Raytheon
Role	Air/surface search/target indication	Fire control (SSM/127 mm gun)	Navigation
Band	E/F	I/J	I/J
Range	137 km (75 n miles) for 2 m² target	25 n miles (46 km)	—
Beam	1.5 × 8°	1.5 × 4/7° (search) 2.4° (track)	4 × 25°
Peak power	1,200 kW	200 kW	4 kW
Gain	32.2 dB	33.5 dB	—
Pulsewidth	1.3/2.6 µs	0.22/4.5 µs	0.08/0.25/0.5 µs
PRF	1,000/500 pps	3,600/1,800 pps	2,250/1,500/750 rpm
Scan rate	10-20 rpm	60 rpm	24 rpm

COMMUNICATIONS AND DATALINKS

Datalink: Link 11
Satcom.
IFF: Mk XII.

WEAPONS CONTROL

Two CSEE DMAb optical directors.

SONARS

AN/SQS-505A sonar
The Canadian Westinghouse AN/SQS-505 sonar is a hull-mounted 7 kHz, search and attack sonar. It is a deep water, omnidirectional, surveillance system, but is

Wielingen *(F 910), name ship of a class of three. These were the first large warships to be designed and built in Belgium and have proved to be most successful. Note Satcom dome on bridge roof* (H & L van Ginderen Collection)

also able to operate in a directional mode that can maintain search ability while tracking defined targets. Three selectable frequencies are available so that several ships can survey an area in close proximity without cross-talk. In high sea states leading to excessive roll and pitch of the ship, the AN/SQS-505A utilises transmit beam stabilisation, which delays transmission until near optimum roll and submergence conditions prevail, thereby minimising chances of the target being missed altogether.

Specifications

Coverage: 360° (azimuth)
Range: 183-3,000 m (200-3,200 yd)
Doppler range: ±40 kts (7.2 kHz)
Displays: Range (A Scan); Bearing (B Scan)
Doppler Frequencies: 6.4, 7.2 and 8.0 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT
Power level: High and low (10 dB reduction)

Manufacturer/Contractor

Westinghouse Canada Inc, Burlington, Ontario, Canada.

PROPULSION

Specifications

System: Combined diesel-or-gas turbine (CODOG)
Engines: One Rolls-Royce Olympus TM3B gas turbine; 19 MW (25,440 hp) sustained; two Cockerill CO-240 V 12 diesels; 4.4 MW (6,000 hp(m))

Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

The Belgian Navy acquired eight ex-RN 'Algerine' class warships for use as fleet minesweepers and ASW escorts in 1949-53. These were due to be withdrawn from service by 1969 and the Belgian naval staff formulated a requirement for a replacement which would provide 'in close co-operation with Allied naval forces, protection of the Allied and national merchant shipping in the North Sea, the English Channel and its Western Approaches'. The units were to possess a full ASW capability and to be equipped with limited anti-air and anti-surface weapons.

Three principles were laid down. First, that only those features essential to the escort mission and self-protection were to be provided. Second, to mount only weapons and sensors which had been standardised (or, at least trialled) by other NATO navies. Third, that the ships must be built in Belgian yards.

The programme was approved on 23 June 1971, design studies were completed in July 1973 and the order was placed in October 1973. Two ships were built by Boel at Temse and two by Cockerill at Hoboken, and the first ship from each yard was commissioned in January 1978, followed by the second from each yard in October 1978.

DESIGN

This is a compact and well-armed class of frigate with as good a combination of anti-air, anti-surface and ASW capabilities as could be expected in a hull of this size. The only serious deficiency is the lack of an ASW helicopter.

The ships are fully air conditioned and are fitted with Vosper roll dampers.

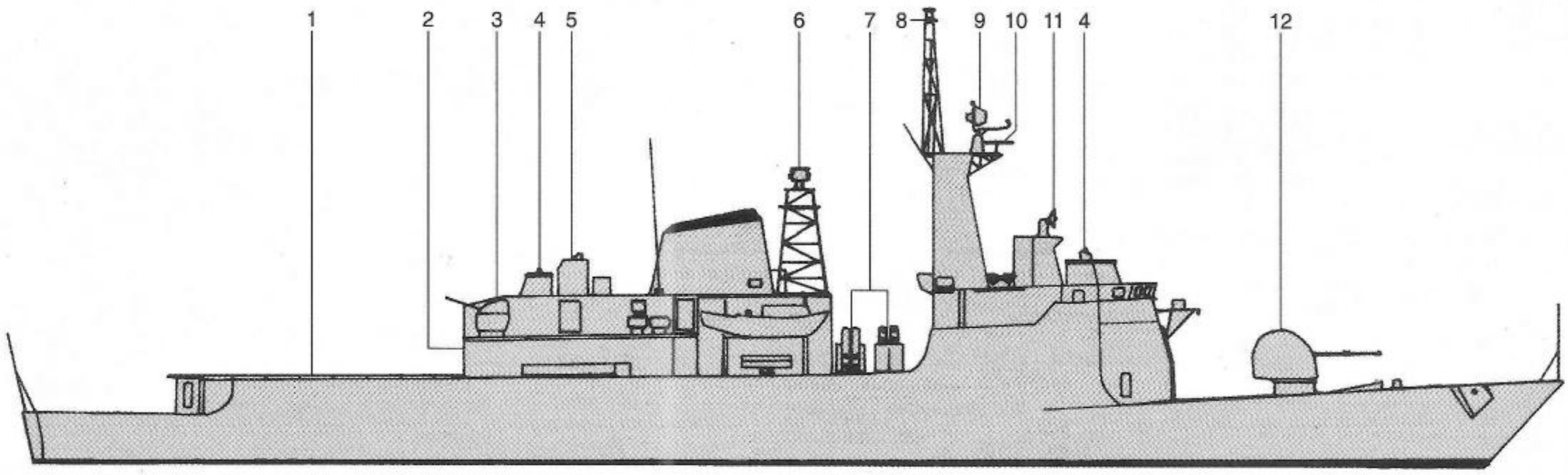
MODERNISATION

In the 1980s the need for a CIWS was recognised and there was a plan to fit whatever system the Netherlands Navy decided upon. The Dutch selected the Goalkeeper, but the Belgian plans were abandoned in 1993. The Sea Sparrow missiles were, however, upgraded from 7M to the 7P model. Current plans are for the existing search and fire-control radars and the ESM system to be upgraded when funds are available. The fitting of an electro-optic scanner is also under consideration. Updates to the sonar, IFF and communications systems are also planned in due course.

DEPLOYMENT

The ships are based at Zeebrugge. *Westdiep* (F 911) and *Westhinder* (F 913) deployed to the Adriatic in 1993 as part of the UN embargo forces. *Westhinder* (F 913) subsequently hit rocks off the Norwegian coast in mid-1993 and was then deleted and offered for sale, although no purchaser has yet been found. Two of the three remaining ships are to be kept in an operational status.

INHAUMA



Inhauma (Ian Sturton)
1 *Flight deck (for UH-12 Esquilo (AS 350 Ecureuil)* **2** *Hangar* **3** *Bofors 40 mm/70 enclosed mount* **4** *OFDLSE optical director* **5** *Saab EOS-400 fire director* **6** *IPqM SDR-7 jammer* **7** *Aerospatiale MM 40 Exocet anti-ship launchers* **8** *IPqM SLQ-1/Racal-Decca Cygnus B1 ESM (radar intercept)* **9** *Plessey AWS-4 surface search radar* **10** *Kelvin Hughes Type 1007 navigation radar* **11** *Selenia Orion RTN-10X fire-control radar (for 114 mm gun)* **12** *Vickers 114 mm (4.5 in)/55 Mk 8 gun*

GENERAL SPECIFICATIONS

Operator: Brazil

Class: INHAUMA

Active: 4
Building: 1
Proposed: 1

Displacement:
standard: V 30 to V 33 — 1,600 t; V 34 — 1,785 t
full load: V 30 to V 33 — 1,970 t; V 34 — 2,350 t

Dimensions
Length: V 30 to V 33 — 95.8 m (314.2 ft); V 34 — 100 m (328 ft)

Beam: 11.4 m (37.4 ft)
Draught: 3.7 m (12.1 ft)(hull): 5.3 m (17.4 ft) (sonar)

Speed: 27 kts
Range: 4,000 n miles at 15 kts

Complement: 122 (15 officers)

SHIPS

INHAUMA (V 30)
Builder Arsenal de Marinha, Rio de Janeiro, Brazil
Laid down 23 Sep 1983
Launched 13 Dec 1986
Commissioned 12 Dec 1989

JACEGUAY (V 31)
Builder Arsenal de Marinha, Rio de Janeiro, Brazil
Laid down 15 Oct 1984
Launched 8 Jun 1987
Commissioned 2 Apr 1991

JULIO DE NORONHA (V 32)
Builder Verolme, Angra dos Reis, Brazil
Laid down 8 Dec 1986
Launched 15 Dec 1989
Commissioned 27 Oct 1992

FRONTIN (V 33)
Builder Verolme, Angra dos Reis, Brazil
Laid down 14 May 1987
Launched 6 Feb 1992
Commissioned 11 Mar 1994

BARROSO (V 34)
Builder Arsenal de Marinha, Rio de Janeiro, Brazil
Laid down 16 Dec 1994
Launched Aug 1998
Commissioned Sep 2000

Julio de Noronha *(V 32). This class was designed in Brazil, with assistance from Marine Technik, a German design consultancy. The gun is the British Vickers 114 mm (4.5 in)/55 Mk 8, with its Selenia Orion RTN-10X director on the bridge roof (Robert Pabst)*

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 40 medium-range anti-ship missile

Two pairs of Exocet launchers are mounted immediately abaft the foremast, firing across the ship.

Specifications

	MM 40 Block 1	MM 40 Block 2
Length	5.78 m	5.80 m
Diameter	35 cm	35 cm
Wing span	1.13 m	1.13 m
Weight	855 kg	870 kg
Speed	Mach 0.9	Mach 0.9
Range	2-38 n miles (4-70 km)	2-40.5 n miles (4-75 km)
Warhead	165 kg HE frag	155 kg HE frag
Fuze	Delay impact/ proximity	Impact/proximity
Guidance	Inertial and active radar	Inertial and active radar

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited in the waist.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications

Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

Vickers 114 mm (4.5 in)/55 Mk 8 multipurpose gun

The 'Inhauma' class mounts a single 114 mm (4.5 in)/55 calibre Mk 8 gun in 'A' position. This weapon provides quick-reaction short-range air defence, engages surface targets including fast attack craft, and provides gunfire support to ground forces. The weapon system consists of the gun mounting, the ammunition feed system, the remote power control system, and the captain-of-turret panel.

The barrel is 6.22 m (20.4 ft) long, is fitted with a muzzle brake and fume extractor, and has a life of 3,300 rounds EFC. The mounting is completely enclosed in a glass fibre shield which protects it against the environment, blast and shrapnel. The loading system is hydraulically operated, with an autoloader which is manually fed by two loaders and has a capacity of six rounds. The hoist transfers them in two stages to the turret from where they are raised by a pivoting loading arm to the breech where they are inserted by a power rammer. After the shell is fired the case is extracted automatically and ejected through a chute in the front of the mounting.

Specifications

Calibre: 114 mm
Length of barrel: 55 calibres
Traverse: 340° at 40°/s
Elevation: −10 to +55° at 40°/s
Muzzle velocity: 868.7 m/s (2,850 ft/s)
Weight of projectile: 21 kg (46.3 lb)
Rate of fire: 25 rds/min
Range:
anti-surface: 11.9 n miles (22 km)
anti-air: 6,000 m (20,000 ft)
Crew: 4 (gun captain (CIC), loading supervisor, 2 loaders)

Manufacturer/Contractor

Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

Bofors 40 mm L/70

Two single Bofors 40 mm AA guns are mounted on a platform at the after end of the hangar. They have glass-reinforced plastic (GRP) shields.

Specifications

Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000-1,025 m/s (3,281-3,363 ft/s)
Range:
anti-surface: 6.75 n miles (12.5 km)
anti-air (nominal): 6,900 m (22,638 ft)
Rate of fire: 300 rds/min (practical)
Ammunition: 2.21 kg (4.9 lb)

ELECTRONIC WARFARE SYSTEMS

DECOYS

Plessey Shield Tactical Decoy System

There are two launchers, each with six parallel barrels, for the Plessey Shield system, sited on either beam, just forward of the mast. Shield is a microprocessor-controlled, fully automatic missile decoy system, which is designed to provide effective protection for various sizes of ship, including fast attack craft, corvettes, frigates and destroyers. On detecting a threat, Shield selects the most appropriate response from up to six million scenarios held in its EPROM memory, using data obtained from onboard sensors such as radar and ESM and then automatically deploys the pattern of decoys that will give the highest probability of success. GEC-Marconi chaff rockets are fitted with a variable fuze which allows the chaff to be dispersed at optimum positions along the trajectory. To counter threats with a dual-mode capability, both chaff and infra-red decoys can be deployed automatically. Shield offers four protection modes — confusion; distraction; seduction/ breaklock; and seduction dump — and uses two types of decoy — chaff and infra-red — which may be used on their own, or in combination with each other.

Manufacturer/Contractor

Plessey, UK.

Cutlass B1 ESM system

Cutlass B1 is designed for operation in very dense signal environments, receiving signals in the 1 to 18 GHz frequency range, measuring their parameters, comparing these with those in the radar library which contains the parameters of 2,000 radars, and displaying the information — all within one second. The EW operator is presented with a tabular display for threat identity and threat evaluation, and a tactical display giving a pictorial representation of the RF environment. Selected digital outputs can be sent to other local systems, and hard copy printout of the intercepted radar is also available. The tabular display can indicate 150 intercepts, in the order of priority. Cutlass is wide open in both bearing and frequency: that is, it does not employ sweep techniques, giving a very high-intercept probability (nearly 100 per cent). Cutlass B1 uses the Cutlass processor and an Instantaneous Frequency Measurement (IFM) receiver. It has a 32-element array antenna to provide bearing measurement by phase analysis techniques. This antenna also provides RF for the IFM. In both systems the processor is provided with fast and accurate information on incoming pulses.

Specifications

Frequency coverage: 2-18 GHz
Accuracy: 2° RMS in bearing
Coverage: 360° azimuth; +40 to −10° elevation
Pulse density capability: 500,000/s
Radar store capability: 2,000 modes

Manufacturer/Contractor

Racal Radar Defence Systems Ltd, Chessington, Surrey, UK.

Racal Cygnus B1 jammer

The Cygnus radar jammer operates in the I or J-bands and was designed for integration with Cutlass ESM equipment. Cygnus uses both responsive noise and deception jamming to provide an effective jamming capability against all types of radar including early warning, target acquisition and missile guidance. It has a narrow beamwidth giving high effective radiated power (300 kW) and is kept on target by a built-in, interferometer type, passive tracking system in both azimuth and elevation. The tracking system may also be used to relay accurate position data to systems of other ships. RF received by the tracking antennas is also used as the basis of transmitted RF and modulation and power management is under the control of a processor which also controls the tracking procedure. Types of modulation sequence available include range gate pull off and false target generation.

Manufacturer/Contractor

Racal Radar Defence Systems Ltd, Chessington, Surrey, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

CAAIS 450 tactical picture compilation system

CAAIS (Computer Assisted Action Information System) was developed for the UK RN (Outfit DBA) and is a tactical picture compilation system designed for air, surface and underwater warfare. The system automatically tracks air and surface targets, processes sonar and EW inputs, operates a digital datalink, designates targets, controls torpedoes and produces vectored attack orders for ASW helicopters.

The version used in the 'Inhauma' class, CAAIS 450, is a distributed processing system using the FM1600E computer operating at 650 Kips and with a memory of 1.2 million words. Programming is in Coral 66 software language. Each console has its own computer, core, Dragon display drive (using Ferranti F100L microprocessors)

and input/output devices. There are two types of display system; two-operator (Racal-Decca ED 1600 console) and single-operator (Racal-Decca ED 1200).

CAAIS 450 accepts ESM and Datalink YB input and is linked directly to ship sonar systems. It is also capable of surface-to-air, surface-to-surface and anti-submarine weapon and ECM system designation. It has a total track capacity of 120, of which 100 may be automatic.

Manufacturer/Contractor
Ferranti Naval Systems, UK.

WSA 421
The WSA 421 (WSA = Weapon System Automation) fire-control system has a mainframe architecture based upon a single Ferranti computer and a Selenia (now Alenia) RTN-10X tracker radar with targets designated through the CAAIS. The system includes a control console with four operators and a target acquisition unit, with a PPI display and an A/R scope. The RTN-10X radar is an I-band conical scan radar with a maximum range of 20 km. It features a slatted parabolic reflector and feed with integral trunnion box, the antenna coverage being −30 to +90°. The antenna includes a GEC-Marconi closed-circuit television camera. It has a 200 kW peak-power, frequency changeable, high-power magnetron transmitter.

The WSA 421 has a federated architecture based upon the 24-bit Ferranti FM1600E computer, which has an operating speed of 650 Kops (thousand operations per second) and a memory of 1.2 million words, with one computer housed in each console. The system uses Coral 66 language software.

In addition to the consoles and the tracker radar, the system includes a television camera, a visual sight and an Nd:YAG laser rangefinder. The visual sight is usually the TDS to which the Ferranti Type 901 laser rangefinder may be added. The laser has a wavelength of 1.064 µm, a pulse length of 25 µs and a PRF of 10 pps. Optional extras include range-only radar, surface-to-air missile direction and an ASW capability through rocket and torpedo control.

The basic WSA 421 fire-control system is designed to control two guns of differing calibres against two targets. It may also be used to control a surface-to-air missile. The system consists of a two-man fire-control console, an interface cabinet and an interface with the CAAIS 450 tactical data handling system. The fire-control console consists of a target acquisition unit and a gun controller's unit. The former has a PPI which may also be used to display either a B-scope for air search or an expanded B-scope for surface tracking and ranging.

The gun control unit has a 17.78 cm (7 in) alphanumeric data display with supporting keyboard, a closed-circuit television monitor, a joystick two gun control units, a magnetic tape unit for loading program and recording, and a system status monitor.

Manufacturer/Contractor
Ferranti International Plc, Defence Systems Integration.

Link YB
The Brazilian Navy purchased Link YB, which was developed in the UK by Ferranti as a digital link suitable for sale to non-NATO countries for naval and aircraft use. Different users have versions tailored to their own needs; Link YB, for example, is exclusive to the Brazilian Navy. Link Y, generally, uses a standard message format of two 24-bit words and a transmission speed of 300-1,200 bits/s.

RADARS

Set	AWS-4	Type 1007	RTN-10X
Company	Plessey	Kelvin Hughes	Selenia
Role	Air search	Navigation	Fire control
Band	D/E	I/J	I/J
Beam	1.9 × 30°	1.0 × 18°	—
Peak Power	—	25 kW	200 kW
Gain	—	31 dB	—
Pulsewidth	1.0/0.3 µs	.08/0.3/0.8 µs	1.5 µs
PRF	680/1,360 pps	1,600/800/400 pps	450-550 pps
Scan rate	10/20 rpm	26 rpm	—
Typical ranges	55 n miles (105 km)		Missiles: 10.75 n miles (20 km) Aircraft: 21.5 n miles (40 km)

WEAPONS CONTROL

CelsiusTech EOS-400 electro-optical fire-control system
The EOS-400 TV tracker/laser rangefinder fire director system is used to provide an accurate target position. It consists of a television tracker for automatic tracking in conjunction with a laser rangefinder, both units being mounted on a common training and elevating stabilised platform. The control/display unit is usually located in the operations room, while the only other major item, the electronics cabinet, can be sited in any convenient position in the ship.

The control/display unit contains a TV monitor and a joystick for sensor platform operation, a mode selector, and target data displays. The electronics cabinet houses the video tracking electronics and other control electronics. The video output is connected to the platform and the video input to the control/display unit. The system can track either surface or airborne targets among several in close formation, even when radar tracking is not possible. Inputs from other systems include those from the surveillance radar, and reference data from the ship's compass. The system calculates ballistics for several guns and gives gun-laying data.

Specifications
Tracking parameters
Training: Unlimited
Elevation: −30 to +85°

Platform
Angular speeds, azimuth and elevation: 150°/s
Angular accelerations: Azimuth 2 rad/s²; elevation 3 rad/s²
Angular transducers: Multispeed synchros
Stabilisation: Rate gyros in 2 axes
Tracking: Digital correlation
Contrast selection: Automatic black/white
Lock on area: Whole field

Daylight camera
Scanning standard: 625 lines
Camera tube: Si-vidicon

Laser rangefinder
Wavelength: 1.06 µm
Repetition rate: 10 Hz
Beamwidth: 1.5 mrad

Manufacturer/Contractor
CelsiusTech, Sweden.

SONAR

STN Atlas ASO 84-2 (DSQS-21C) hull-mounted sonar
The DSQS-21 sonar was originally designed by (the then) KAE for the German Navy's Type 122 frigate. The ASO 80 series were the subsequent export models, the specific model for the 'Inhauma' class being the ASO-84-2. Computer-aided detection techniques are used for classification and tracking and the information is presented on colour CRT displays to permit Doppler coding and the discrimination of data on the integrated displays. The transducer array is 1 m (3.28 ft) in diameter and consists of 32 staves.

Manufacturer/Contractor
STN Atlas Elektronik GmbH, Bremen, Germany.

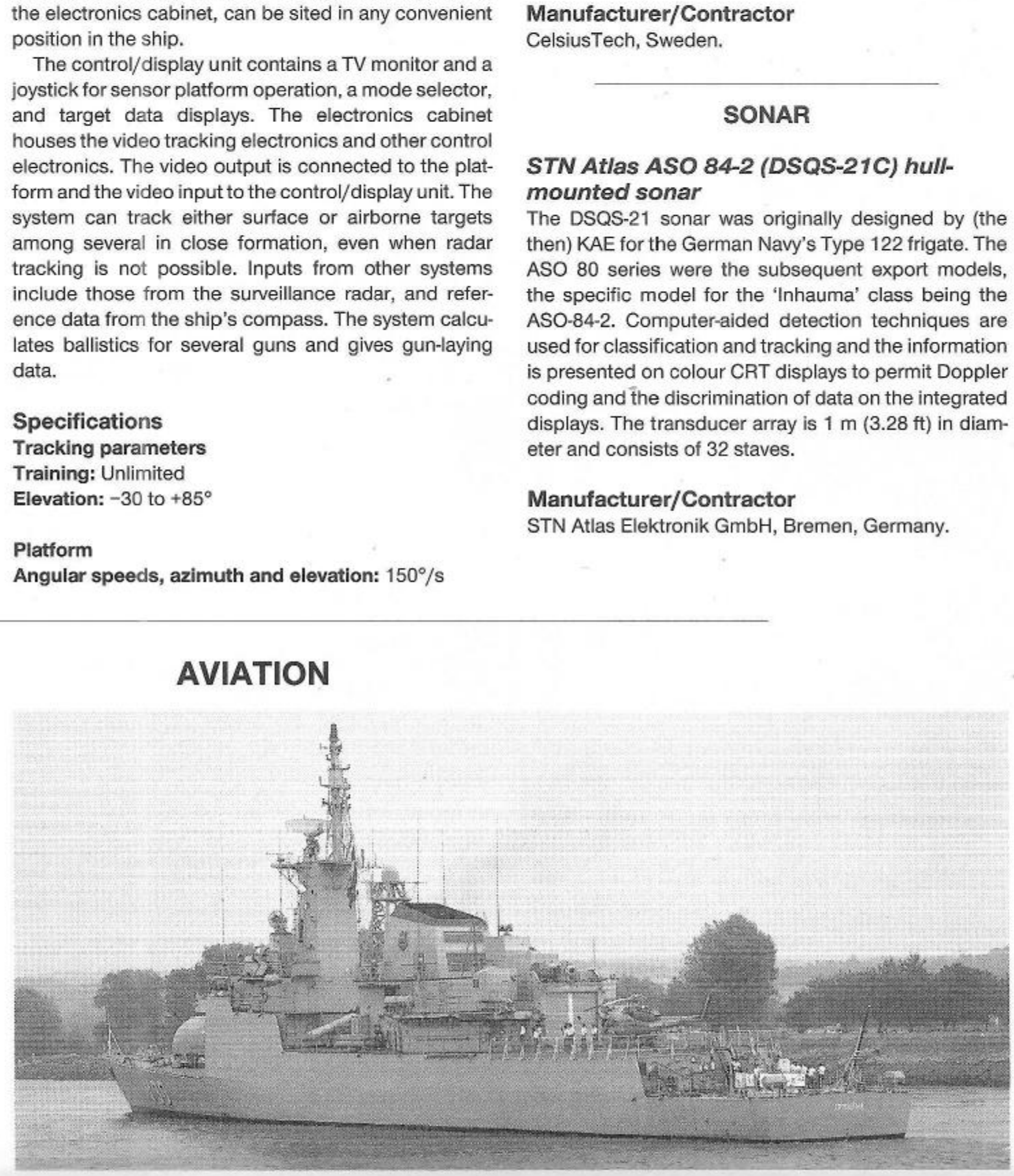
AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 18 × 11 m (60 × 37 ft)

HELICOPTERS

UH-12 Eurocopter AS 350 Ecureuil
One Eurocopter AS 350 Ecureuil five/six-seat light general purpose helicopters.



Inhaúma *(V 30) name ship of a class of six. The ship embarks an Aerospatiale UH-13 (AS 355F2 Ecureuil 2) seen here on the flight deck. Note the two Exocet launchers and triple 324 mm torpedo tubes abreast the stack* (Jane's/H M Steele)

Specifications

Main rotor diameter: 10.69 m (35.07 ft)
Length, rotors turning: 12.94 m (42.45 ft)
Length, fuselage: 10.93 m (35.86 ft)
Height overall: 3.14 m (10.3 ft)
Main rotor disc area: 89.75 m² (966.1 sq ft)
Weight, empty: 1,146 kg (2,526 lb)
Weight, max take-off: 2,100 kg (4,630 lb)
Weight, max take-off: 2,100 kg (4,630 lb)
Max speed, (never exceed): 155 kts (287 km/h)
Max cruise: 126 kts (234 km/h)
Max rate of climb: 456 m (1,500 ft)/min
Service ceiling: 4800 m (15,750 ft)
Range, no reserve at economic cruise: 394 n miles (730 km)
Weapons: 20 mm Giat M621 gun, or FN Herstal TMP twin 7.62 mm machine gun pods, or Thomson Brandt 68.12 launchers for 68 mm rockets (12), Forges de Zeebrugge launchers for 7–2.75 in rockets (7), or ESCO HeliTOW anti-tank missile system

Manufacturer/Contractor

Eurocopter, Paris, France

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 General Electric LM-2500 gas turbine; 20.52 MW (27,500 hp) sustained; 2 MTU 16V 396 TB94 diesels; 4.26 MW (5,800 hp(m)) sustained
Shafts: 2
Propellers: 2 KaMeWa cp

FURTHER INFORMATION

PROGRAMME

The construction contract was signed on 1 October 1981, with the first pair ordered on 15 February 1982 followed by the second pair on 9 January 1986. In mid-1986 the government gave approval, in principle, for the construction of a total of 16 ships but this has been reduced to an additional two and an order for the fifth ship, *Barroso,* stretched by 4.2 m (13.8 ft) was placed in 1994, with a sixth ship likely to be ordered in 1996.

DESIGN

The original Inhauma design was prepared by the Brazilian Naval Design Office with advice from the German private design company, Marine Technik and it is worth noting that there is a slight similarity to the FS 1500 corvette, which was designed and built in Germany for Colombia ('Padilla' class) and Malaysia ('Kasturi' class).

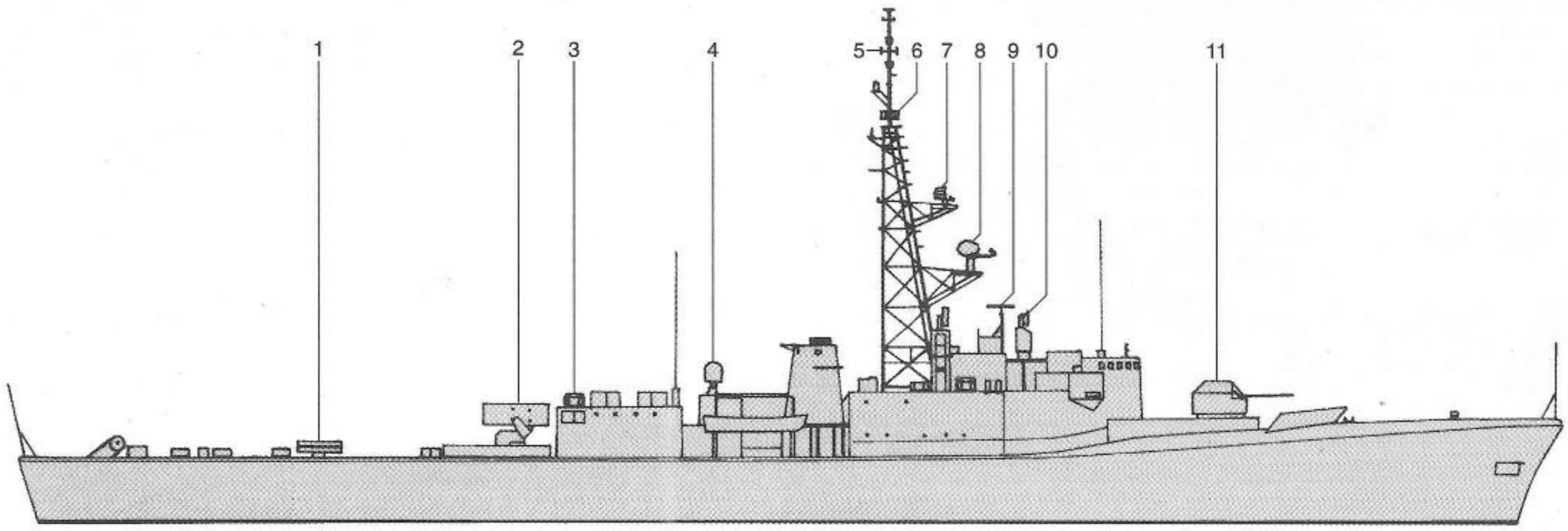
Barroso, now under construction, is to have more powerful diesel engines, Brazilian electronic equipment, a larger flight deck, greater freeboard at the bow and an improved combat data system. It will also incorporate new stealth features.

MODERNISATION

The EW equipment aboard the first four ships may be in the course of replacement by domestically designed and manufactured equipment. Possible models include the IPqM SDR-7 and the Elebra SLQ-1 jammer.

Jaceguay *(V 31). The last two ships in the class are to have increased freeboard in the bows and new 'stealth' features* (Robert Pabst)

IMPROVED RESTIGOUCHE



Gatineau (Ian Sturton)
1 *Triple Mk 32 324 mm torpedo tubes* **2** *ASROC Mk 112 eight-cell launchers* **3** *Loral Hycor Mk 36 six-tube chaff/IR launcher* **4** *Satcom* **5** *UHF ship-ship link* **6** *CANEWS ESM system* **7** *Raytheon SPS 10 surface search radar* **8** *CelsiusTech Sea Giraffe HC 150 air search radar* **9** *Sperry 127E navigation radar* **10** *Bell SPG 48 fire-control director* **11** *VSEL twin 76 mm (3 in)/70 Mk 6*

GENERAL SPECIFICATIONS

Operator: Canada

Class: IMPROVED RESTIGOUCHE

Built: 7
Active: 2

Displacement:
standard: 2,390 t
full load: 2,900 t

Dimensions
Length: 113.1 m (371 ft)
Beam: 12.8 m (42 ft)
Draught: 4.3 m (14.1 ft)

Speed: 28 kts
Range: 4,750 n miles at 14 kts

Complement: 214 (13 officers)

SHIPS

GATINEAU (236)

Builder	Davie Shipbuilding, Lauzon, Quebec, Canada
Laid down	30 Apr 1953
Launched	3 Jun 1957
Commissioned	17 Feb 1959

TERRA NOVA (259)

Builder	Victoria Machinery Depot Co, Victoria, British Columbia, Canada
Laid down	14 Nov 1952
Launched	21 Jun 1955
Commissioned	6 Jun 1959

Terra Nova *(259)* (Canadian Armed Forces)

WEAPONS SYSTEMS

ANTI-SHIP MISSILES

Mk 16 launcher group

The Improved 'Restigouche' class is fitted with a Mk 16 Launcher Group located aft, with a single Mk 112 launcher, which consists of four pairs of launch tubes, each pair elevating independently. Maximum launch rate is 3 missiles per minute.

Honeywell RUR-5A ASROC

ASROC consists of a Mk 46 torpedo with strap-on aerodynamic surfaces and a rocket motor to enable it to fly to within range of its submarine target. Attached to the rear end of the torpedo is a short airframe assembly of clam-like construction, held together by a steel band, with a Naval Propulsion Plant solid propellant booster and four trapezoidal aerodynamic surfaces to provide stability in flight. The torpedo has a dome-shaped frangible plastic nose cap to protect the transducer as it enters the water. Payload is an Alliant Mk 46 Mod 5 torpedo, which has a seeker designed specifically to detect most types of target including submarines with anechoically coated hulls and has an estimated acquisition range of 460 m (1,509 ft).

When a submarine target is detected it is tracked and the attack console's fire-control computer predicts the target's position. The launcher is turned in the appropriate direction and elevated to an angle appropriate to the range. The fire-control computer then orders the launch and the booster burns for a programmed time of between 1 and 4 seconds, by which time the missile will have reached a height of between 60 and 305 m (197 and 1,000 ft), although the aerodynamically stable airframe enables it to coast up to 600 m (1,969 ft). On reaching the programmed position, an explosive bolt cuts the steel band holding the airframe assembly sections together and, as they separate, the parachute deploys to retard the torpedo's fall, water entry taking place some 14 to 50 seconds after launch. As the torpedo enters the water the frangible nose cap breaks off and the torpedo begins its search for the target using a predetermined pattern.

Specifications

ASROC missile
Length: 4.6 m (15.1 ft)
Diameter: 32.5 cm (12.8 in)
Span: 84.5 cm (33.3 in)

Weight: 435 kg (959 lb)
Range: 0.86-5.39 n miles (1.6-10 km)
Speed: Mach 0.9

Mk 46 Mod 5 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Manufacturer/Contractor
Loral Defense Systems, Akron, Ohio, USA.

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited on the quarterdeck.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

Gatineau *(236) one of the two remaining 'Improved Restigouche' class frigates. The weapon on the foredeck is the Vickers 76 mm/70 Mk 6 with the two barrels in a common elevating mass and an electrically driven loading system* (Jane's/H M Steele)

GUNS

Vickers 76 mm (3 in)/70 Mk 6
The Improved 'Restigouche' class is one of the very few still to retain the Vickers 76.2 mm (3 in) Mk 6 twin mounting, with one mounting in 'A' position on the foredeck. The mounting consists of two guns in a common elevating mass which receive ammunition from an electrically driven system.

Specifications
Mounting Mk 6
Weight: 45 t
Traverse: 360°
Elevation: 0 to +89°
Crew: 20

3 in gun
Calibre: 76.2 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,036 m/s (3,399 ft/s)
Rate of fire: 90 rds/min
Weight of round: 23.13 kg (51 lb)
Range: 9.2 n miles (17 km) (anti-ship)
Mounting weight: 38 t
Mounting traverse: 360°
Mounting elevation: to +90°

Manufacturer/Contractor
Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

AN/SLQ-501 (CANEWS I) radar warning system
CANEWS is a real-time radar detection and analysis system, covering the frequency band 0.5-18 GHz in five bands, each with its own receiver. It has four major subsystems: an IFM-based (instantaneous frequency measurement) antenna and receiver subsystem; a data transfer unit incorporating a high-speed digital processor; twin processors for real-time analysis, supervision and interfacing with the ship's command and control system; and a display console. A library holds data on numerous radar modes and signatures, and analysis of the detected RF signals identifies the radar type and platform, as well as providing an indication of the confidence level. Many of the functions are automatic to reduce operator workload, but AN/SLQ-501 also provides facilities for manual control if required, with one operator only required to control the complete ESM system.

Manufacturer/Contractor
Lockheed Canada Inc, Kanata, Ontario, Canada ((CANEWS II) prime).

ELECTRONIC COUNTERMEASURES (ECM)

AN/ULQ-6
AN/ULQ-6 is a deception jammer which was originally developed to deal with the threat posed by Soviet missiles such as SS-N-2.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher
There are four Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

ADLIPS tactical data handling system
ADLIPS (Automatic Datalink Plotting System) is a modular system which collects and processes 'own ship' sensor data, together with transmitting, receiving, filtering and displaying target track data, from ships and aircraft through Link 11 and Link 14 data communications networks to compile a composite tactical display rapidly. It exchanges target track, weapon assignment and status data with 'own ship's weapon systems. All members of the operations room team have access to the complete tactical picture through a remote plasma display.

ADLIPS is a mainframe system using a 16-bit AN/UYK-20 general purpose computer with 96 k memory, CMS-2 program language and 750 nanosecond cycle time. The program loading, training and analysis facilities are provided by an AN/USQ-26 cartridge magnetic tape system with 9.6 Mbyte storage capacity. An HF Link 11 radio transceiver provides for communications over this link while an AN/USQ-76 modem allows operation in either picket or net controlled modes. The radio has independent transmitter and receiver sections digitally tuned in 100 Hz steps. For Link 14 a CV-2757/SGC interface converts the low-level signals from the computer to the high-level signals required by the cryptographic equipment and the inverse conversion.

The main presentation is on two Situation Information Displays (SID), each of which has a 51 cm (20 in) diameter CRT for presenting raw radar video, IFF data and computer-generated graphics to produce a picture

of the tactical situation. Each system, which has a capacity of up to 140 tracks, also has a hard copy plotter.

Manufacturer/Contractor
Litton Systems Canada Ltd.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11; Link 14

Satcom: Satcom is installed; model unknown

Tacan: URN 25.

WEAPONS CONTROL

Mk 69 Gun Fire Control System (GFCS)

The Mk 69 GFCS is the fire-control system for the 76 mm (3 in) guns. The director, with its associated AN/SPG-515 radar is located on the bridge roof.

SONARS

AN/SQS-505 hull-mounted and VDS search and attack sonar

Gatineau (236) only. The Canadian Westinghouse AN/SQS-505 sonar is a combined hull-mounted and VDS 7 kHz, search and attack sonar. It is a deep water, omnidirectional, surveillance system, but is also able to operate in a directional mode that can maintain search ability while tracking defined targets. Three selectable frequencies are available so that several ships can survey an area in close proximity without cross-talk. In high sea states leading to excessive roll and pitch of the ship, the AN/SQS-505 utilises transmit beam stabilisation, which delays transmission until near optimum roll and submergence conditions prevail, thereby minimising chances of the target being missed altogether.

Specifications
Coverage: 360° (azimuth)
Range: 183-3,000 m (200-3,200 yd)
Doppler range: ±40 kts (7.2 kHz)
Displays: Range (A Scan); Bearing (B Scan)
Doppler frequencies: 6.4, 7.2 and 8.0 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT
Power level: High and low (10 dB reduction)

Manufacturer/Contractor
Westinghouse Canada Inc, Burlington, Ontario, Canada.

AN/SQS-510 sonar

Terra Nova (259) only. *Terra Nova* has the AN/SQS-510 which combines a hull-mounted transducer with a towed array. The hull-mounted element is a 7 kHz medium-size search and attack sonar, which can be used in direct communication with a digital computer, either for the transfer of range and bearing information, or it can give assistance to the operator in detection and tracking. It is a deep water, omnidirectional, surveillance system, but is also able to operate in a directional mode that can maintain search ability while tracking defined targets. Three selectable frequencies are available so that several ships can survey an area in close proximity without cross-talk.

Specifications
Coverage: 360° (azimuth)
Range: 183-3,000 m (200-3,200 yd)
Doppler range: ±40 kts (7.2 kHz)
Displays: Range (A Scan); Bearing (B Scan)
Doppler frequencies: 6.4, 7.2 and 8.0 kHz

RADARS

Set	SPS-503 (CMR 1820)	SPS-10	Type 127E	SPG-515
Company	Canadian Marconi Radar (CMR)	Raytheon	Sperry	Bell
Role	Air/surface search	Surface search	Navigation	Fire control
Band	E/F	G	I	
Range	70 n miles (128 km)	—	120 n miles	
Beam	1.5 × csc² to 40°	1.5 × 16°	1°	2.6°
Peak power	20 kW	500 kW	25 kW	250 kW
Gain	30.75 dB	30 dB	—	39 dB
Pulsewidth	54 µs	0.25/1.3 µs	0.05/0.025/1.2 µs	0.25 µs
PRF	740 pps	650 pps	4,000/2,000/500 pps	1,000 pps
Scan rate	10/20 rpm	15 rpm	—	29 Hz

Gatineau *(236) showing the stern-mounted SQS 500 VDS 'fish' retracted into the transom. The ASROC launcher occupies a prominent position, but it was replaced by eight Harpoon launchers for the 1990-91 Gulf deployment* (Jane's/H M Steele)

Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT
Power level: High and low (10 dB reduction)

Manufacturers/Contractors

Computing Devices, Ottawa, Canada (prime and software).
Westinghouse Canada Inc, Burlington, Ontario, Canada (sonars).

C-Tech Spectra 3000

When these ships went to the Gulf in 1990-91 they were fitted with the C-Tech Spectra 3000 mine avoidance sonar, which appears to have remained aboard. This is a version of the same company's CTS-36 RDN system, installed in the Danish STANFLEX 300 vessels. CTS-36 is a hull-mounted system optimised for mine avoidance in coastal waters and is a scanning and multibeam sonar, using narrow receiving beams, high-speed scanning and digital processing techniques to provide instantaneous detection, classification and target data in a full 360° field of view. At least three tracking channels are provided with target and ship's track, target range, depth, bearing, speed and heading instantaneously displayed.

Manufacturer/Contractor

C-Tech Ltd, Cornwall, Ontario.

AN/SQS-501

The Kelvin Hughes AN/SQS-501 is the Canadian version of the British Type 162 ('Cockchafer') side-looking target detection sonar whose main use is in detecting and classifying seabed targets, such as a bottomed submarine. There are three transducers: one faces downwards at 25° below the horizontal, while the other two face sideways to cover a 3° wide and 40° vertical sector. The transmitter delivers 40 W to the central, downward-looking transducer and 80 W each to the side-looking transducers. The set operates at 50 kHz and accuracy is <2 per cent over ranges of 270 m (300 yd) and 550 m (600 yd).

Manufacturer/Contractor

Kelvin Hughes.

PROPULSION

Specifications

System: Steam turbine
Main machinery: 2 Babcock & Wilcox boilers; 43.3 kg/cm² (600 psi); 454°C (850°F); 2 English Electric turbines; 22.4 MW (30,000 hp);
Shafts: 2

FURTHER INFORMATION

PROGRAMME

When the Canadian post-war frigate programme started in the late 1940s the navy was able to draw on a wealth of ASW experience gained in the North Atlantic during the Second World War, coupled with an adventurous design team under the leadership of Rowland Baker, a British naval constructor on secondment to Canada. The result was the 'St Laurent' class, whose dramatic appearance and many innovations caused considerable astonishment in the naval world. Seven St Laurents were commissioned between 1955 and 1957, and they were succeeded by a developed version, the 'Restigouche' class, seven of which were ordered in 1952. Four of these were modernised between 1966 and 1973, and were then designated the 'Improved Restigouche' class.

The three unmodified ships were paid off into reserve in 1974 and eventually discarded. The 'Modified Restigouche' ships, however, remained in service and were modernised yet again under the 'Destroyer Life Extension' programme during the period 1983 to 1986. Two of those ships were paid off in the early 1990s and two now remain in service.

DESIGN

The 'Restigouche' class ships had exactly the same hull and propulsion system as the 'St Laurent' class, but the armament fit was considerably revised. The St Laurents had two US pattern twin 76 mm (3 in) mounts and in the Restigouche the forward of these was replaced by a twin Vickers 76 mm (3 in) Mk 6, which had, in fact, been specially designed for the Canadian frigates, but had been omitted from the earlier ships due to topweight problems.

MODERNISATION

Four ships were refitted in 1966 to 1973. The main change involved removing the after gun turret and one Mk 10 Limbo mortar and replacing them with the ASROC launcher and a variable depth sonar. A lattice foremast was also stepped.

There were also considerable improvements to the communications. The four 'Modernised Restigouche' ships were again refitted under the 1983 to 1986 DELEX programme when they were fitted with new air search radar, GFCS, communications and EW equipment. The Bofors rocket launcher was replaced by Super RBOC and Tacan fitted on a pole mast which replaced the top section of the lattice mast. Triple Mk 32 torpedo tubes were also fitted.

Terra Nova went to the Gulf in 1990 and was later relieved by *Restigouche*. For this deployment their ASROC launcher and the remaining Limbo Mk 10 ASW mortar were removed and replaced by eight Harpoon SSM and a Phalanx Mk 15 CIWS, while a number of the ship's boats were removed to make way for two single Bofors 40 mm/60. They were also fitted with Plessey Shield chaff launchers and a special mine avoidance sonar (see C-Tech Spectra 3000 above). On their return to Canadian waters they reverted to the standard fit, except that the Limbo mortar was not reinstalled and the mine avoidance sonar was retained.

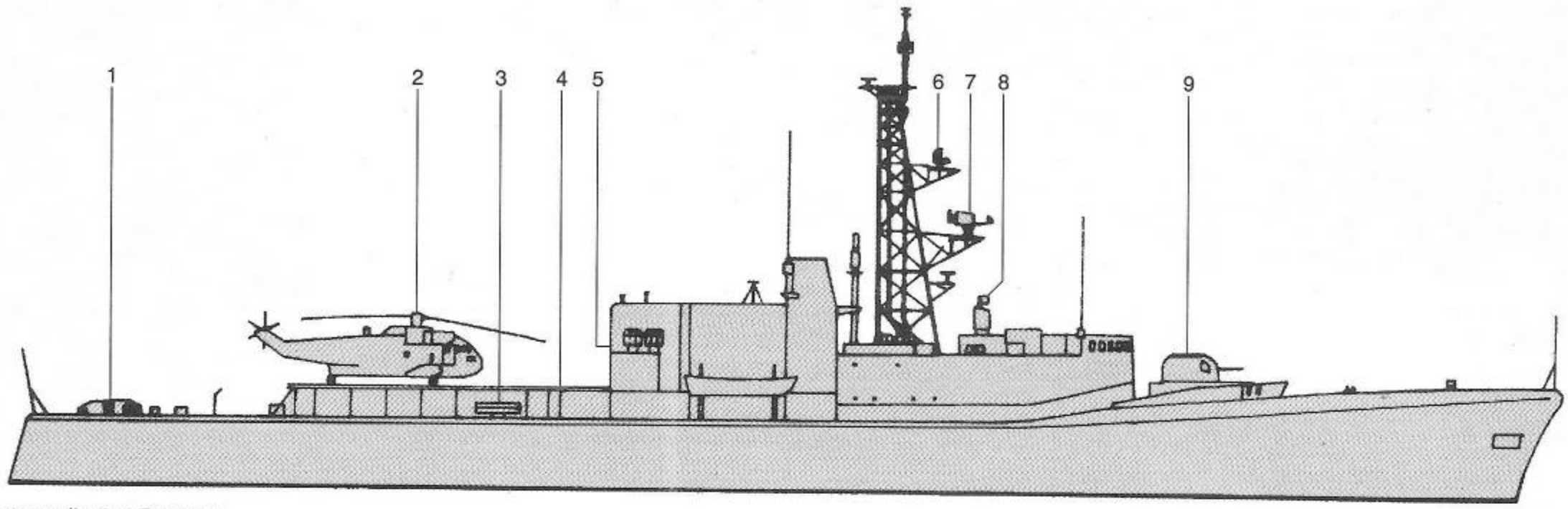
Since that time Satcom terminals have been fitted in both remaining ships, while *Terra Nova* alone has received AN/SQS-510 sonar system.

DEPLOYMENT

Both are now based in the Atlantic Fleet.

Contingency plans exist for air defence to be supplemented if further operational deployments take place. This will include carrying additional 12.7 mm MGs, plus Blowpipe and Javelin shoulder-launched SAMs.

ANNAPOLIS



Annapolis (Ian Sturton)
1 *CANTASS towed sonar array* **2** *Sikorsky CH-124A Sea King ASW helicopter* **3** *Triple Mk 32 324 mm torpedo tubes* **4** *Flight deck* **5** *Hangar* **6** *Raytheon/ Sylvania SPS-10 surface search radar* **7** *GEC-Marconi SPS-503 air/surface search radar* **8** *Bell SPG-48 fire-control director* **9** *Twin United Defense 76 mm(3 in)/50 Mk 33*

GENERAL SPECIFICATIONS

Operator: Canada

Class: ANNAPOLIS

Built: 2
Active: 2

Displacement:
standard: 2,400 t
full load: 2,930 t

Dimensions
Length: 113.1 m (371 ft)
Beam: 12.8 m (42 ft)
Draught: 4.4 m (14.4 ft)

Speed: 28 kts (30 kts on trials)
Range: 4,570 n miles at 14 kts

Complement: 210 (11 officers)

SHIPS

ANNAPOLIS (265)

Builder	Halifax Shipyards Ltd, Halifax, Canada
Laid down	Jul 1960
Launched	27 Apr 1963
Commissioned	19 Dec 1964

NIPIGON (266)

Builder	Marine Industries Ltd, Sorel, Canada
Laid down	Apr 1960
Launched	10 Dec 1961
Commissioned	30 May 1964

Annapolis *(265)* (Giorgio Arra)

WEAPONS SYSTEMS

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited either side of the flight deck.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant

Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

Mk 33 76 mm (3 in) L/50 gun mounting
There is a single US Navy Mk 33 76 mm (3 in) L/50 twin mounting on the foredeck. The gun tubes are 50 calibre

Mk 22s with autofretted monobloc barrels which are 3.81 m (12.5 ft) long, and weigh 562 kg (1,239 lb). The EFC life is 4,300 rounds. The Mk 33 is a twin gun, power-driven, base ring mount with remote control and local reversion. The Mod 7 closed mounting has an environmental shield made from GRP for protection against icing and bad weather. The mounting operates with the Mk 60 fire-control system. The fixed 10.9 kg (24 lb) round has a 5.9 kg (13 lb) projectile which includes 1.68 kg (3.70 lb) of nitrocellulose propellant.

Specifications
Calibre: 76.2 mm
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,700 ft/s) (new gun, nominal); 808 m/s (2,650 ft/s) (mid-life)
Range: 7 n miles (13 km)
Altitude: 8,951 m (29,368 ft)
Ammunition: 10.9 kg (24 lb)

Mk 33
Traverse: 360°
Elevation: −14/15 to +85°
Traverse rate: 30°/s
Elevation rate: 24°/s
Rate of fire: 100 rds/min

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

AN/SLQ-501 (CANEWS I) radar warning system
CANEWS is a real-time radar detection and analysis system, covering the frequency band 0.5-18 GHz in five bands, each with its own receiver. It has four major subsystems: an IFM-based (instantaneous frequency measurement) antenna and receiver subsystem; a data transfer unit incorporating a high-speed digital processor; twin processors for real-time analysis, supervision and interfacing with the ship's command and control system; and a display console. A library holds data on numerous radar modes and signatures, and analysis of the detected RF signals identifies the radar type and platform, as well as providing an indication of the confidence level. Many of the functions are automatic to reduce operator workload, but AN/SLQ-501 also provides facilities for manual control if required, with one operator only required to control the complete ESM system. Lockheed Canada is leading a consortium of Canadian EW companies to define and develop CANEWS II, which will retain existing antennas and receivers, but add a new processor and further receivers to handle more complex threats, higher signal densities and wider operating frequencies. CANEWS II was tested in 1994-95 and underwent sea trials in 1996.

Manufacturer/Contractor
Lockheed Canada Inc, Kanata, Ontario, Canada (CANEWS II): (prime).

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher
There are four Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

ADLIPS tactical data handling system
ADLIPS (Automatic Datalink Plotting System) is a modular system which collects and processes 'own ship' sensor data, together with transmitting, receiving, filtering and displaying target track data, from ships and aircraft through Link 11 and Link 14 data communications networks to compile a composite tactical display rapidly. It exchanges target track, weapon assignment and status data with 'own ship's weapon systems. All members of the operations room team have access to the complete tactical picture through a remote plasma display.

ADLIPS is a mainframe system using a 16-bit AN/UYK-20 general purpose computer with 96 k memory, CMS-2 program language and 750 nanosecond cycle time. The program loading, training and analysis facilities are provided by an AN/USQ-26 cartridge magnetic tape system with 9.6 Mbyte storage capacity. An HF Link 11 radio transceiver provides for communications over this link while an AN/USQ-76 modem allows operation in either picket or net controlled modes. The radio has independent transmitter and receiver sections digitally tuned in 100 Hz steps. For Link 14 a CV-2757/SGC interface converts the low-level signals from the computer to the high-level signals required by the cryptographic equipment and the inverse conversion.

The main presentation is on two Situation Information Displays (SID), each of which has a 51 cm (20 in) diameter CRT for presenting raw radar video, IFF data and computer-generated graphics to produce a picture of the tactical situation. Each system, which has a capacity of up to 140 tracks, also has a hard copy plotter.

Manufacturer/Contractor
Litton Systems Canada Ltd.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11; Link 14

Tacan: URN 25.

WEAPONS CONTROL

Mk 60 Gun Fire Control System (GFCS)
The Mk 60 GFCS is the Canadian designation for the digitised, solid-state version of the US Mk 69 GFCS. This is the fire-control system for the twin 76 mm guns and the director is mounted on the bridge roof together with the associated SPG-515 radar.

SONARS

AN/SQS-505 hull-mounted attack sonar
Annapolis (265) only. The AN/SQS-505 search and attack sonar is in a retractable, hull-mounted dome, and is a deep water, omnidirectional, sonar surveillance system, but can also be operated in a directional mode when tracking a defined target. There are three selectable frequencies to enable several ships to operate in close proximity without cross-talk. In high sea states which result in excess roll and pitch of the ship, the AN/SQS-505 utilises transmit beam stabilisation, which delays transmission until near optimum roll and submergence conditions prevail, in order to minimise the chances of the target being missed altogether.

Specifications
Coverage: 360° (azimuth)
Range: 183-975 m (200-3,200 yd)
Doppler range: ±40 kts (7.2 kHz)
Displays: Range (A Scan); Bearing (B Scan); Doppler

RADARS

Set	SPS-503 (CMR 1820)	SPS-502*	SPG-515	Type 127E
Company	Canadian Marconi Radar (CMR)	Norden	Bell	Sperry
Role	Air/surface search	Surface search	Fire control (GFCS Mk 60)	Navigation
Band	E/F	G	I/J	I
Range	70 n miles (128 km)	—	—	120 n miles
Beam	1.5 × csc² to 40°	1.5 × 20°	2.6°	1°
Peak power	20 kW	130 kW	250 kW	25 kW
Gain	30.75 dB	31 dB	39 dB	—
Pulsewidth	54 µs	0.12/1 µs	0.25 µs	0.05/0.025/1.2 µs
PRF	740 pps	2,250/750 pps	1,000 pps	4,000/2,000/500 pps
Scan rate	10.20 rpm	16 rpm	29 Hz	—

Note: * SPS-502 is essentially an AN/SPS-55 married to an AN/SPS-10D antenna.

Frequencies:
active: 6.4 kHz, 7.2 kHz, 8.0 kHz
passive: 4.5 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT

Manufacturer/Contractor
Westinghouse Canada Inc, Burlington, Ontario, Canada.

AN/SQS-510 sonar
Nipigon (266) only. The Computing Devices of Canada (CDC) AN/SQS-510(V) is installed in *Nipigon* only. This sonar is a development of the Canadian Westinghouse AN/SQS-505 sonar and is combined with the AN/SQR-501 towed array (see below). The hull-mounted element is a 7 kHz medium-size search and attack sonar, which can be used in direct communication with a digital computer, either for the transfer of range and bearing information, or it can give assistance to the operator in detection and tracking. It is a deep water, omnidirectional, surveillance system, but is also able to operate in a directional mode that can maintain search ability while tracking defined targets. Three selectable frequencies are available so that several ships can survey an area in close proximity without cross-talk.

Specifications
AN/SQS-510
Coverage: 360° (azimuth)
Range: 183-3,000 m (200-3,200 yd)
Doppler range: ±40 kts (7.2 kHz)
Doppler frequencies: 6.4, 7.2 and 8.0 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT
Power level: High and low (10 dB reduction)

Manufacturers/Contractors
Computing Devices, Ottawa, Canada (prime and software).
Westinghouse Canada Inc, Burlington, Ontario, Canada (sonars).

AN/SQR-501 CANTASS
The AN/SQR-501 is a passive, critical angle towed array consisting of a Computing Devices Canada display and processing subsystem, the Lockheed Martin AN/SQR-19A towed array and Indal Technologies OK-419 handling gear. The display subsystem uses two, four or six high-definition monochrome TV monitors specifically designed by Whittaker Electronics Inc for this application. The acoustic data processing system uses the Computing Devices AN/UYS-510 signal processor, modular interfacing and data management electronics. The acoustic data processing subsystem also provides for the storage and playback of raw acoustic data by means of a Sony DR 1000L high-density digital recorder.

The system provides frequency and bearing analysis of acoustic emissions from long ranges. Data are presented to the operator on programmable CRT displays in a variety of alternative formats. Audio data is presented as a further aid to detection and classification. Processing algorithms were developed by the Canadian Defence Research Establishment, Atlantic and implemented by Computing Devices Canada Ltd. Implementation of systems processing and data manipulation is entirely in software using Ada. The modular design offers a growth capability and adaptability to meet changing requirements.

The 'wet-end' is the AN/SQR-19A, with a 240 m (800 ft) array on a 1,700 m (5,600 ft) cable, which reaches depths of 360 m (1,200 ft).

Manufacturer/Contractor
Computing Devices Canada Ltd, Ottawa, Ontario, Canada (prime and processing elements).

Westinghouse AN/SQS-501
The Westinghouse AN/SQS-501 is the Canadian version of the British Kelvin Hughes Type 162 ('Cockchafer') side-looking target detection sonar, whose main use is in detecting and classifying seabed targets, such as a bottomed submarine. There are three transducers: one faces downwards at 25° below the horizontal, while the other two face sideways to cover a 3° wide and 40° vertical sector. The transmitter delivers 40 W to the central, downward-looking transducer and 80 W each to the side-looking transducers. The set operates at 50 kHz and accuracy is <2 per cent over ranges of 270 m (300 yd) and 550 m (600 yd).

Manufacturer/Contractor
Westinghouse Canada Inc, Burlington, Ontario, Canada.

Computing Devices UYS-503(V) sonar processor
UYS-503(V) is the processor for the SQS-510 and SQS-501 sonars.

AVIATION

HELICOPTERS

One CH-124B Heltas Sea King ASW

Specifications
Dimensions
main rotor diameter: 18.90 m (62.0 ft)
disc area: 280.5 m² (3,019 sq ft)
length overall (both rotors turning): 21.91 m (71.88 ft)
Weights:
empty: 5,601 kg (12,350 lb)
max take-off: 9,525 kg (21,000 lb)
Performance:
max speed (never exceed): 144 kts (267 km/h)
typical cruising speed: 110 kts (204 km/h)
service ceiling: 3,720 m (12,200 ft)
range (max standard fuel): 410 n miles (760 km)
Power plant: 2—1,118 kW (1,500 shp) General Electric T58-GE-100 turboshafts
Accommodation: Crew of 4 in ASW role (pilot, co-pilot, 2 sonar operators)
Sensors: ASW role: APS-503 radar; UYS-503 sonobuoy processor; GPS; sonobuoys; ASQ-504 MAD; radio altimeter; marine markers, smoke floats. FLIR and EW equipment can also be installed, according to requirements
Weapons: Maximum of four Mk 46 torpedoes

PROPULSION

Specifications
System: Steam turbines
Main machinery: 2 Babcock & Wilcox boilers; 43.3 kg/cm² (600 psi); 454°C (850°F); 2 English Electric turbines; 22.4 MW (30,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The 'Annapolis' class ships were the last of a line of archetypical Canadian ASW frigates, extending back through the 'Mackenzie' and 'Restigouche' classes to the 'St Laurent' class of the 1950s. Two ships were ordered in 1959 and were completed in 1964.

DESIGN

The design incorporated all the lessons learnt during the previous decade of frigate development. The ships provided full facilities for a CH-124 Sea King helicopter, a remarkably large helicopter for a 3,000 t displacement hull.

The design of the upperworks was based on the belief of the designer of the 'St Laurent' class (Baker) that, since water could not be prevented from coming aboard, then it should be allowed to drain away as easily as possible, which resulted in well-rounded deck edges and a turtle-back forecastle. In addition, the lower part of the mast was plated over to delay the build-up of ice.

The principle ASW weapon system was the CH-124 Sea King, but the ship also carried a Mk 10 Limbo three-barrelled mortar and two triple Mk 32 324 mm torpedo tubes. Surface armament was a twin US Navy 76 mm (3 in)/50 Mk 33, which replaced the British twin 76 mm (3 in)/70 Mk 6 mounted in earlier classes, in order to save topweight.

MODERNISATION

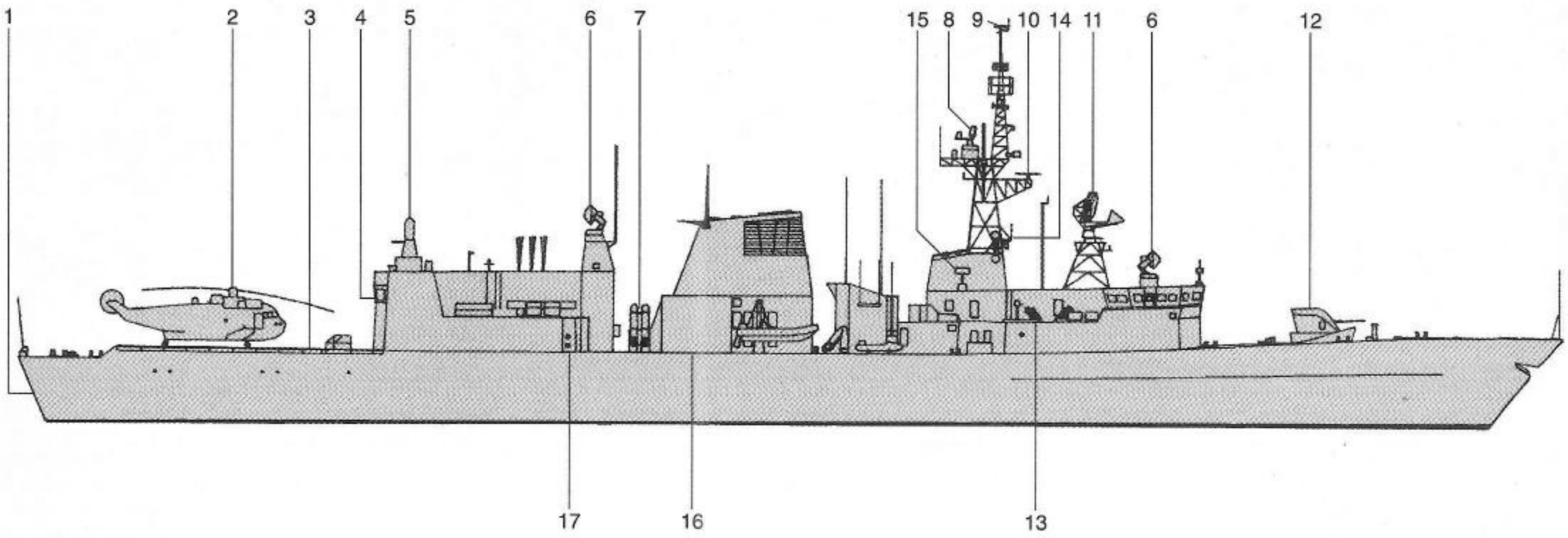
The ships both entered service in 1964 and underwent their first modernisation in 1977-79. They then were put through the full DELEX (Destroyer Life Extension) programme in 1982-85, which included a new air surveillance radar and sonar, the Mk 60 gun fire-control system, together with improved communications and EW equipment.

In 1987/88 both ships had their VDS removed and replaced by a trials CANTASS (AN/SQR-501), which is still installed.

OPERATIONAL

Annapolis is based in the Pacific Fleet, *Nipigon* in the Atlantic. *Nipigon* had her main armament, air search and fire-control radars removed in 1994, but they were replaced in 1995.

HALIFAX



Halifax (Ian Sturton)
1 *CANTASS towed sonar array* **2** *CH-124A/B helicopter* **3** *Flight deck* **4** *Hangar* **5** *Hughes Mk 15 20 mm CIWS* **6** *Signaal VM 25 STIR* **7** *McDonnell Douglas Harpoon anti-ship missiles (four)* **8** *CelsiusTech Sea Giraffe HC150 air/surface search radar* **9** *Lockheed CANEWS SLQ-504 radar intercept* **10** *Sperry Mk 340 navigation radar* **11** *Raytheon AN/SPS-49(V)5 air search radar* **12** *Bofors 57 mm/70 Mk 2 single gun* **13** *Plessey Shield decoy launchers* **14** *Lockheed Ramses (SLQ 503) jammers* **15** *Satellite communications antenna* **16** *Mk 48 launchers for Raytheon Sea Sparrow SAM* **17** *Two 324 mm torpedo tubes (fixed)*

GENERAL SPECIFICATIONS

Operator: Canada

Class: HALIFAX

Built: 12
Active: 12

Displacement:
operational light: 4,300 t
full load: 4,770 t

Dimensions
Length: 134.2 m (440.3 ft) (oa); 124.5 m (408.5 ft) (pp)
Beam: 16.4 m (53.8 ft)
Draught: 5.0 m (16.4 ft) (midships); 7.1 m (23.3 ft)(screws)

Speed: 28 kts
Range: 7,100 n miles at 15 kts (diesel); 4,500 n miles at 15 kts (gas turbines)
Endurance: 45 days

Complement: 225 (23 officers)

SHIPS

HALIFAX (330)
Builder St John SB Ltd, New Brunswick, Canada
Laid down 19 Mar 1987
Launched 30 Apr 1988
Completed 28 Jun 1991
Commissioned 29 Jun 1992

VANCOUVER (331)
Builder St John SB Ltd, New Brunswick, Canada
Laid down 19 May 1988
Launched 8 Jul 1989
Completed 11 Sep 1992
Commissioned 23 Aug 1993

VILLE DE QUEBEC (332)
Builder Marine Industries Ltd, Sorel, Canada
Laid down 16 Dec 1988
Launched 16 May 1991
Completed 23 Sep 1993
Commissioned 14 Jul 1994

TORONTO (333)
Builder St John SB Ltd, New Brunswick, Canada
Laid down 24 Apr 1989
Launched 18 Dec 1990
Completed 23 Dec 1993
Commissioned 29 Jul 1993

REGINA (334)
Builder Marine Industries Ltd, Sorel, Canada
Laid down 6 Oct 1989
Launched 25 Oct 1991
Completed 29 Mar 1994
Commissioned 30 Sep 1994

CALGARY (335)
Builder Marine Industries Ltd, Sorel, Canada
Laid down 15 Jun 1991
Launched 28 Aug 1992
Completed 30 Aug 1994
Commissioned Jul 1994

MONTREAL (336)
Builder St John SB Ltd, New Brunswick, Canada
Laid down 29 Feb 1991
Launched 19 Jun 1992
Completed 27 Jul 1993
Commissioned 21 Jul 1994

FREDERICTON (337)
Builder St John SB Ltd, New Brunswick, Canada
Laid down 25 Apr 1992
Launched 26 Jun 1993
Completed 27 Feb 1994
Commissioned 10 Sep 1994

Halifax *(F 330), nameship of the class of 12 Canadian Patrol Frigates* (St John Shipbuilding)

WINNIPEG (338)
Builder St John SB Ltd, New Brunswick, Canada
Laid down 21 Mar 1993
Launched 11 Dec 1993
Completed 11 Oct 1994
Commissioned 23 Jun 1995

CHARLOTTETOWN (339)
Builder St John SB Ltd, New Brunswick, Canada
Laid down 18 Dec 1993
Launched 13 Aug 1994
Completed May 1995
Commissioned Sep 1995

ST JOHN'S (340)
Builder St John SB Ltd, New Brunswick, Canada
Laid down 24 Aug 1994
Launched 12 Feb 1995
Completed 12 Dec 1995
Commissioned 24 Jun 1996

OTTAWA (341)
Builder St John SB Ltd, New Brunswick, Canada
Laid down 27 Apr 1995
Launched 22 Nov 1995
Completed 30 Jun 1996
Commissioned Jan 1997

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84D-1A Block 1C Harpoon

Eight Harpoon anti-ship missile canisters are mounted immediately abaft the stack; there are two groups of four launchers each, with one group pointing across the ship to the opposite beam. The missiles are the Block 1C version, which has additional options, compared to previous blocks, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

Mk 48 Mod 0 VLS

There are two Mk 48 Mod 0 VLS. The units are made up of pairs of vertical canisters, each with its own efflux system, which turns the gases through 180°. Two eight-canister launch units are assembled from four sets of twin canisters and are mounted on the ship's side, abreast the stack, screened from the elements by a large rectangular plate. In war, two additional pairs of canisters would be added on each side, bringing the total number of missiles from 16 to 24.

Raytheon Sea Sparrow point-defence missile system

The system uses RIM-7M Sea Sparrow missiles and the Signaal VM 25 STIR fire-control system, with two directors. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast fragmentation warhead and a dual-purpose proximity-impact fuze.

Specifications
RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

TUBES

Two twin 324 mm US Mk 32 Mod 9 torpedo tubes are sited aft, at the forward end of the hangar, one pair on either beam. The current torpedoes are a mix of Mk 46 Mod 1 and Mk 46 Mod 5.

TORPEDOES

Alliant Techsystems Mk 46 Mod 1/5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

BOFORS SAK 57 L/70 Mk 2

The success of the Bofors SAK 57 L/70 Mk 1 led Bofors to develop an improved Mk 2 version, the SAK 57 L/70 Mk 2. This is intended to engage air and surface targets and to provide gunfire in support of troops ashore. It is housed inside a 'stealthy' shield.

Specifications
Calibre: 57 mm
Length of barrel: 70 calibres
Traverse: 360° at 55°/s
Elevation: −10 to +77° at 40°/s
Crew: 3
Range: 9 n miles (17 km)
Rate of fire: 220 rds/min
Projectile weight: 2.4 kg

Manufacturer/Contractor
Bofors, Sweden.

Hughes Mk 15 CIWS Phalanx

A single Hughes Mk 15 CIWS Phalanx close in weapons system (CIWS) is mounted on the roof of the hangar aft to provide the innermost layer of defence against anti-ship missiles. The 20 mm M61A1 Vulcan, six-barrel, Gatling-principle gun has a cylindrical magazine with the feed mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA (system).

M2HB 12.7 mm (0.50 in) machine guns

Eight M2HB 12.7 mm machine guns are carried and can be mounted on flexible mounts.

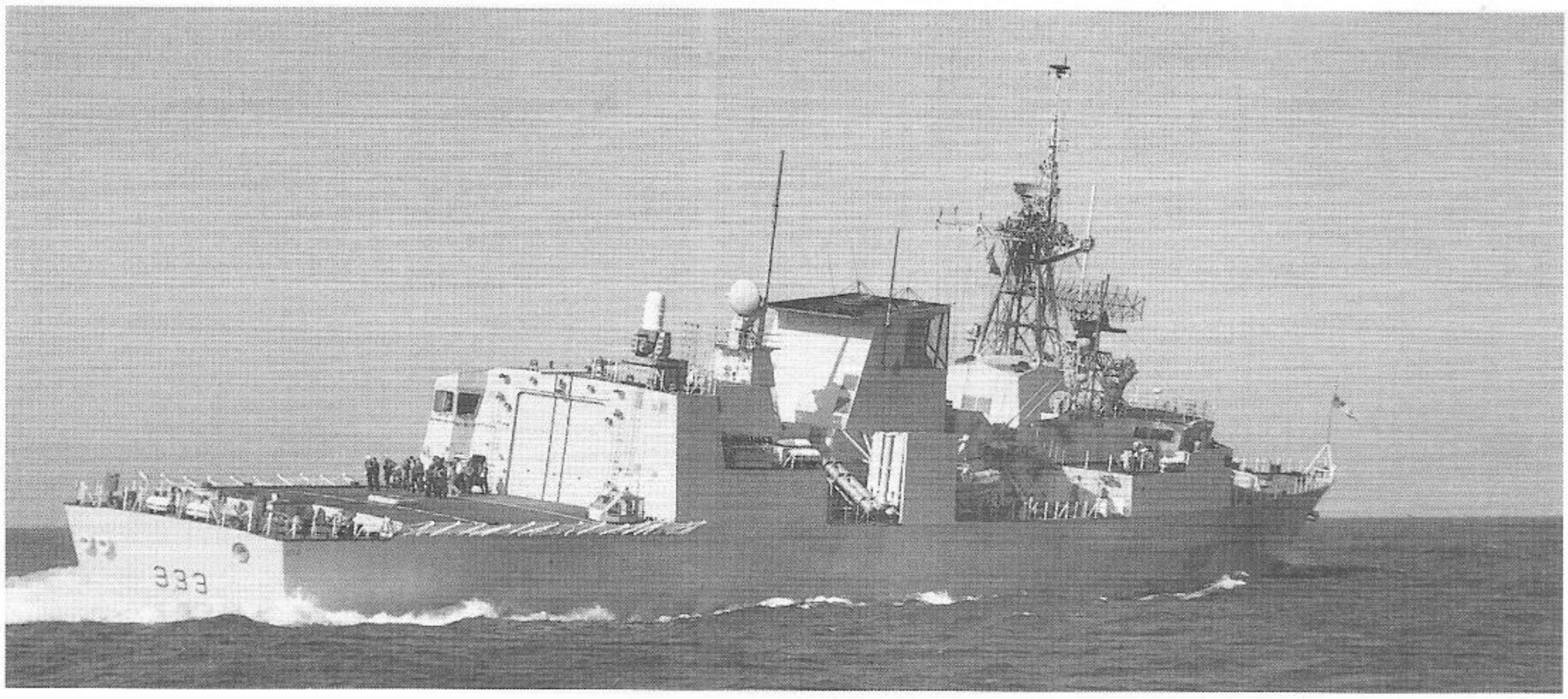
Specifications
Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rds/min
Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-air: 1,380 m (4,500 ft)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

AN/SLQ-501 (CANEWS I) radar warning system

CANEWS is a real-time radar detection and analysis system, covering the frequency band 0.5-18 GHz in five bands, each with its own receiver. It has four major subsystems: an IFM-based (instantaneous frequency measurement) antenna and receiver subsystem; a data transfer unit incorporating a high-speed digital processor; twin processors for real-time analysis, supervision and interfacing with the ship's command and control system; and a display console. A library holds data on numerous radar modes and signatures, and analysis of the detected RF signals identifies the radar type and platform, as well as providing an indication of the confidence level. Many of the functions are automatic to reduce operator workload, but AN/SLQ-501 also provides facilities for manual control if required, with one operator only required to control the complete



Toronto *(F 333). The fairleads in the transom are for AN/SLQ-25 Nixie (port) and CANTASS (starboard). The flight deck accommodates a Sikorsky CH-124 Seaking and, using the Indal RAST recovery system, can be used in extreme conditions in the north Atlantic* (Jane's/H M Steele)

ESM system. Lockheed Canada is leading a consortium of Canadian EW companies to define and develop CANEWS II, which will retain existing antennas and receivers, but add a new processor and further receivers to handle more complex threats, higher signal densities and wider operating frequencies. CANEWS II was tested in 1994-95 and is undergoing sea trials in 1996.

Manufacturer/Contractor
(CANEWS II) Lockheed Canada Inc, Kanata, Ontario, Canada (prime).

AN/SRD-502
Little is known about this equipment, except that its designation suggests that it has a communications direction-finding and intercept role

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ELECTRONIC COUNTERMEASURES (ECM)

AN/SLQ-503 (RAMSES) ECM system
The AN/SLQ-503 Reprogrammable Advanced Multimode Shipborne ECM System (RAMSES) is a modular naval electronic countermeasures system designed principally to provide protection for ships against I/J-band radar threats. It is an integrated responsive jammer capable of long-range jamming of search radars and the deception of missiles once launched. In its normal mode of operation, RAMSES is interconnected to and controlled from a system such as the AN/SLQ-501 or similar ESM systems. A dedicated ECM operator is not therefore required. In the back-up mode, RAMSES can be manually controlled (target designation and jamming) from a remote-control panel located conveniently near the EW operator. RAMSES operates in I/J-band and is capable of high pulse and CW Effective Radiated Power (ERP). Multimode jamming operation is possible with multitarget handling capability. The system is reprogrammable and power management is provided. The antennas are fully trainable (port and starboard each through 180°) and are stabilised for roll and pitch.

Manufacturer/Contractor
Lockheed Canada Inc, Kanata, Ontario, Canada.

DECOYS

Plessey Shield Tactical Decoy System
There are four launchers, each with six barrels in two superimposed groups of three, for the Plessey Shield system. Two launchers are located on either beam, just forward of the foremast. Shield is a microprocessor-controlled, fully automatic missile decoy system, which is designed to provide effective protection for various sizes of ship, including fast attack craft, corvettes, frigates and destroyers. On detecting a threat, Shield selects the most appropriate response from up to six million scenarios held in its EPROM memory, using data obtained from onboard sensors such as radar and ESM and then automatically deploys the pattern of decoys that will give the highest probability of success. GEC-Marconi chaff rockets are fitted with a variable fuze which allows the chaff to be dispersed at optimum positions along the trajectory. To counter threats with a dual-mode capability, both chaff and infra-red decoys can be deployed automatically. Shield offers four protection modes — confusion; distraction; seduction/breaklock; and seduction dump — and uses two types of decoy — chaff and infra-red — which may be used on their own, or in combination with each other.

Manufacturer/Contractor
Plessey, UK.

AN/SLQ-25 Nixie noisemaker
One AN/SLQ-25 Nixie (Phase 1), solid-state, modular design electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom or in a partially or totally enclosed location on the main deck. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm (3.10 ft) long, 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.

Prairie Masker
Two Prairie air masker belts are fitted, together with propeller masking systems.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

AN/UYC-501(V) SHINPADS (SHipboard INtegrated Processing And Display System)
SHINPADS is an automated command and weapon control system, with a distributed architecture, which is based on up to 18 32-bit computers using CMS-2M software language.

Links within the ship use the SHINPADS Serial Databus, which has a data transfer rate of 9.5 Mbits/s and a clock rate of 10-12 MHz. The databus itself is a low-loss, impedance-matched, double-shielded triaxial transmission line, accessed through nodes embedded in the processors and via Bus Access Modules (BAMs). The transmission protocol and levels comply with the MIL-STD-1397 specification for Type E NTDS communications.

The system uses 33 AN/UYK-507 computers, using replacement cards and with a minimum memory of 256 k static RAM (random access memory), expandable to 512 k, which can be further expanded to 8 M in dynamic RAM. The operating speed of the UYK-507 is 5 Mips. 28 of these are dedicated to the C2 task. One of the software functions is automatic reconfiguration of the system to bypass failed elements and the system will remain fully operational with just five AN/UYK-507 computers intact.

SHINPADS normally has 14 to 15 workstations including a bridge display and in the combat direction centre (CDC) there are workstations for the commanding officer, operations room officer, the sensor weapons controller (SWC) and assistant SWC.

Manufacturers/Contractors
Unisys GSG Canada Ltd, Montreal, Canada (prime contractor).
Computing Devices Canada, Nepean, Ontario, Canada (subcontractor).

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11, Link 14
Satcom: AN/SSR-1A (UHF)
Underwater telephone: Safare/Crouzet AN/WQC-501

Halifax *(F 330). At masthead is a plate array associated with CANEWS, while the two cicular arrays below are VHF DF arrays. On the platform three of the four CANEWS VHF Band O DF arrays can be seen, together with the Sea Giraffe radar (behind the mast) and a VHF transmit/receive antenna for ship-to-ship line of sight communications. The two small radomes on the side of the lower mast are jammers and the bin-like object is a satellite antenna* (Jane's/H M Steele)

HF: RF-1130-01 (tx); RF-590 (rx)
UHF: RT-5073 V1/WSC
VHF: MRT-66; PRC-512 (portable); MX-300-5 (portable)
Tacan: AN/URN 25
IFF Mk XII.

WEAPONS CONTROL

AN/SWG-1A Harpoon Launch Control System (LCS)

AN/SWG-1A is the Harpoon Shipboard Command and Launch Control System HSCLCS), which activates the missile, selects the flight pattern and sets seeker search modes (with small, medium or large acquisition windows), as well as providing target range and bearing data. Alternatively, the missile can simply be launched along the bearing of the target, with the seeker activated early to scan a 90° sector; if, after a set time, no target has been acquired the missile commences a preset search pattern. SWG-1A takes account of other ships in the general target area and generates indirect flight plans for the missile, including waypoints to optimise angles of approach which will achieve the highest possibility of success while minimising the chances of the missile being destroyed by hostile fire. It can also be used to compute flight plans in a multiple attack so that several missiles, from either the same or different ships, arrive on target simultaneously, thus swamping the defences.

RADARS

	AN/SPS-49(V)5	Sea Giraffe HC 150	VM 25 STIR	Type 1007
Manufacturer	Raytheon	Ericsson	Signaal	Kelvin Hughes
Role	2D air search	Air/surface search	Fire control	Navigation
Band	C/D (0.5-2 GHz)	G/H (5.4-5.9 GHz)	K/I	H/I (9,410 MHz)
Beam	3.4 × 9°	1.8°	1.4°	1.0 × 18°/0.75 × 18°
Peak power	360 kW	60 kW	220 kW	25 kW
Gain	28.5 dB	36 dB		
Pulsewidth	125 µs/2 µs	3.2/6.4 µs; 0.2 µs for fire control	0.29 µs	0.08/0.3/0.8 µs
PRF	280/800/1,000 pps	1,000-7,000 pps	1,800/3,600 pps	1,600/800/400 pps
Scan rate	6/12 rpm	30/30 rpm	—	26 rpm
Typical range	250 n miles (475 km)	55 n miles (100 km) against missiles in clear conditions	76 n miles (140 km) for 1 m² target	—

SONARS

CDC AN/UYS-503(V)1

The AN/UYS-301(V)1 sonobuoy processing system receives signals from sonobuoys via the masthead antenna and the AN/ARR-75 receiver.

AN/SQS-505(V)6 sonar hull-mounted and VDS search and attack sonar

As built, the ships were fitted with an AN/SQS-505 (V)6 search and attack sonar in a retractable, hull-mounted dome. This is a deep water, omnidirectional, sonar surveillance system, but can also be operated in a directional mode when tracking a defined target. There are three selectable frequencies to enable several ships to operate in close proximity without cross-talk. In high sea states which result in excess roll and pitch of the ship, the AN/SQS-505(V)6 utilises transmit beam stabilisation, which delays transmission until near optimum roll and submergence conditions prevail, in order to minimise the chances of the target being missed altogether. The (V)6 differs from earlier versions in having a new transmitter and receiver, and is designed specifically to work with SHINPADS.

Specifications

Coverage: 360° (azimuth)
Range: 183-975 m (200-3,200 yd)
Doppler range: ±40 kts (7.2 kHz)
Displays: Range (A Scan); Bearing (B Scan); Doppler
Frequencies:
active: 6.4 kHz, 7.2 kHz, 8.0 kHz
passive: 4.5 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT

Manufacturer/Contractor

Westinghouse Canada Inc, Burlington, Ontario, Canada.

AN/SQS-510 sonar

The ships are having their AN/SQS-505(V)6 progressively upgraded to AN/SQS-510(V) standard. The hull-mounted element is a 7 kHz medium-size search and attack sonar, which can be used in direct communication with a digital computer, either for the transfer of range and bearing information, or it can give assistance

to the operator in detection and tracking. It is a deep water, omnidirectional, surveillance system, but is also able to operate in a directional mode that can maintain search ability while tracking defined targets. Three selectable frequencies are available so that several ships can survey an area in close proximity without cross-talk.

Specifications
Coverage: 360° (azimuth)
Range: 183-3,000 m (200-3,200 yd)
Doppler range: ±40 kts (7.2 kHz)
Displays: Range (A Scan); Bearing (B Scan)
Doppler frequencies: 6.4, 7.2 and 8.0 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT
Power level: High and low (10 dB reduction)

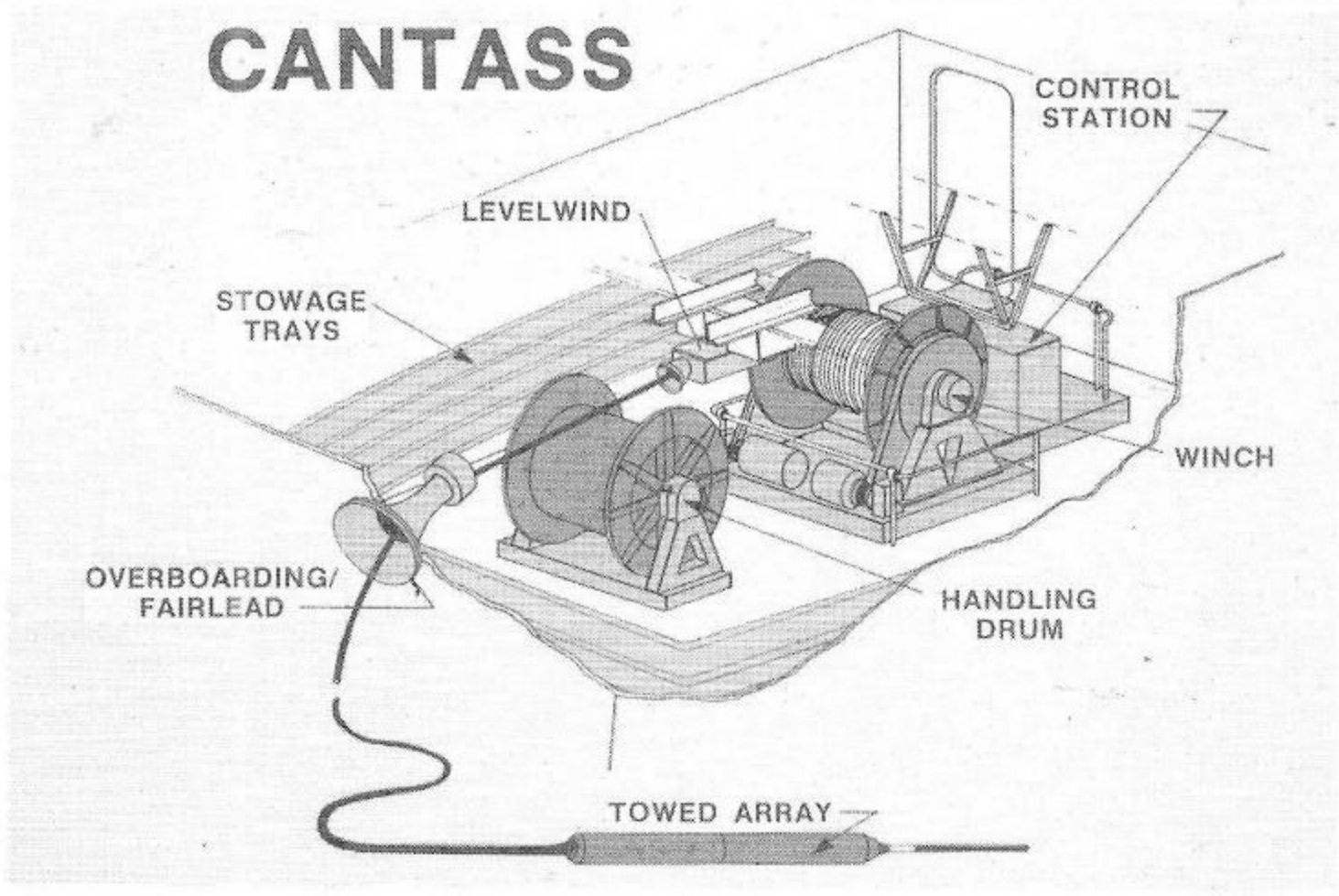
Manufacturers/Contractors
Computing Devices, Ottawa, Canada (prime and software).
Westinghouse Canada Inc, Burlington, Ontario, Canada (sonars).

AN/SQR-501 CANTASS
The AN/SQR-501 is a passive, critical angle towed array consisting of a Computing Devices Canada display and processing subsystem, the Lockheed Martin AN/SQR-19A towed array and Indal Technologies OK-419 handling gear. The display subsystem uses two, four or six high-definition monochrome TV monitors specifically designed by Whittaker Electronics Inc for this application. The acoustic data processing system uses the Computing Devices AN/UYS-510 signal processor, modular interfacing and data management electronics. The acoustic data processing subsystem also provides for the storage and playback of raw acoustic data by means of a Sony DR 1000L high-density digital recorder.

The system provides frequency and bearing analysis of acoustic emissions from long ranges. Data are presented to the operator on programmable CRT displays in a variety of alternative formats. Audio data is presented as a further aid to detection and classification. Processing algorithms were developed by the Canadian Defence Research Establishment, Atlantic and implemented by Computing Devices Canada Ltd. Implementation of systems processing and data manipulation is entirely in software using Ada. The modular design offers a growth capability and adaptability to meet changing requirements.

The 'wet-end' is the AN/SQR-19A, with a 240 m (800 ft) array on a 1,700 m (5,600 ft) cable, which reaches depths of 360 m (1,200 ft).

Manufacturer/Contractor
Computing Devices Canada Ltd, Ottawa, Ontario, Canada (prime and processing elements).



CANTASS was developed specifically for the Canadian frigates (St John Shipbuilding)

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 23 × 16 m (75 × 53.8 ft)
Hangar: 23 × 16 m (75 × 53.8 ft)
Helicopter handling system: Indal RAST

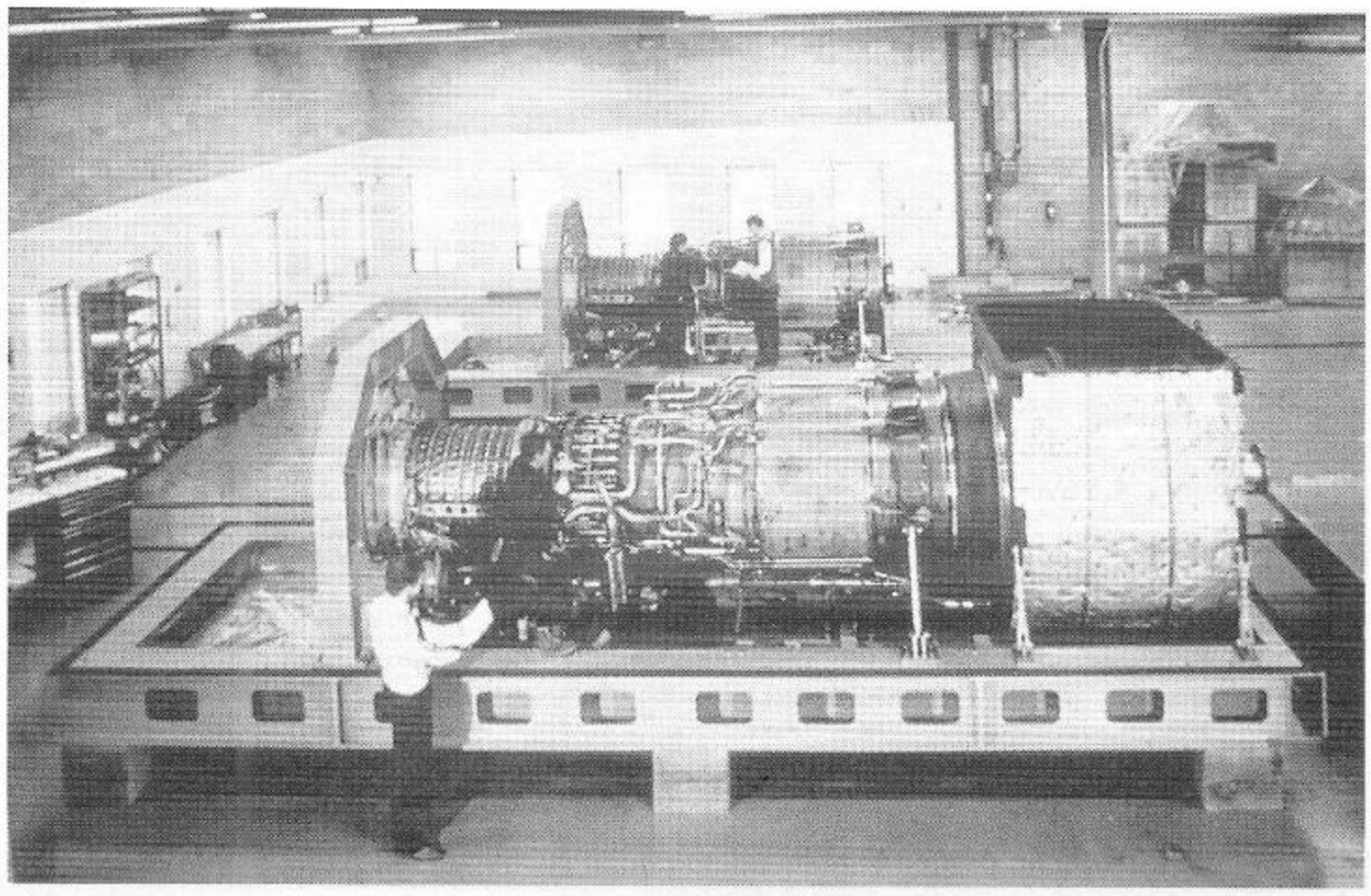
HELICOPTERS

One Sikorsky CH-124A ASW Sea King

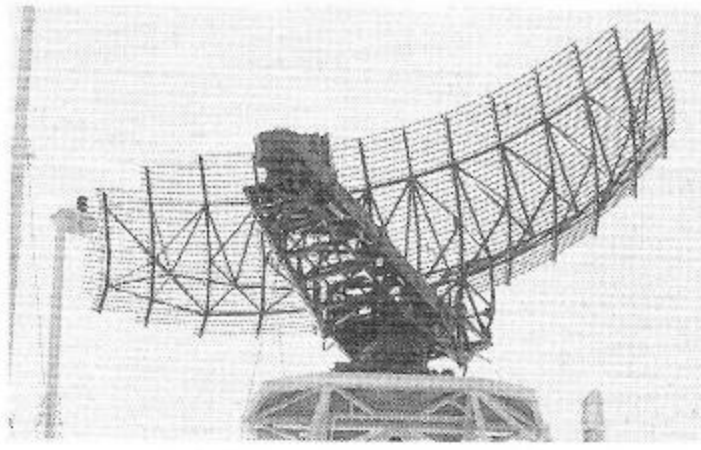
Specifications
Role: Anti-submarine and general utility helicopter
Dimensions:
main rotor diameter: 18.90 m (62.0 ft)
length overall (both rotors turning): 21.91 m (71.88 ft)
height to rotor head: 4.74 m (15.55 ft)
Weights:
empty: 5,601 kg (12,350 lb)
max take-off: 9,525 kg (21,000 lb)
Performance:
max speed (never exceed): 144 kts (267 km/h)
cruising speed: 120 kts (222 km/h)
service ceiling: 3,720 m (12,200 ft)
range with max standard fuel: 630 n miles (1,166 km)
Power plant: 2—1,118 kW (1,500 shp) General Electric T58-GE-100 turboshafts
Accommodation: 4 (pilot, co-pilot, two sonar operators)
Sensors (AS-3H)
ASW role: AQS-18/AQS-13F sonar; Doppler radar and ASW automatic navigation system; SMA/APS-707 radar with 1/2 transceivers; radio altimeter; marine markers, smoke floats
MAD and EW equipment can also be installed, according to user's requirements
Weapons: 2/4 torpedoes (A 244 AS; Mk 44; Mk 46) or four depth bombs

PROPULSION

Specifications
System: Combined diesel or gas (CODOG)
Main machinery: 2 General Electric LM-2500 gas turbines; 35.43 MW (47,494 hp) sustained; 1 SEMT-Pielstick 20 PA6 V 280 MPC diesel; 6.48 MW (8,800 hp(m)) sustained
Shafts: 2
Propellers: 2 Escher-Wyss-Sulzer controllable/reversible pitch propellers
Ship's services: 4—850 kW diesel generator sets



General Electric LM-2500 gas turbine (St John Shipbuilding)



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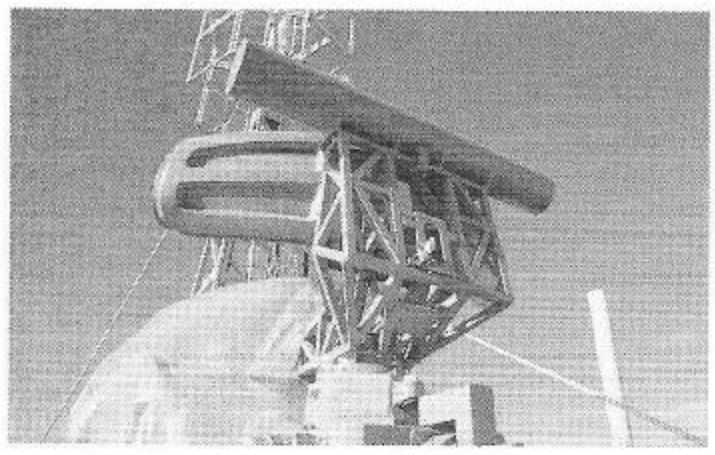

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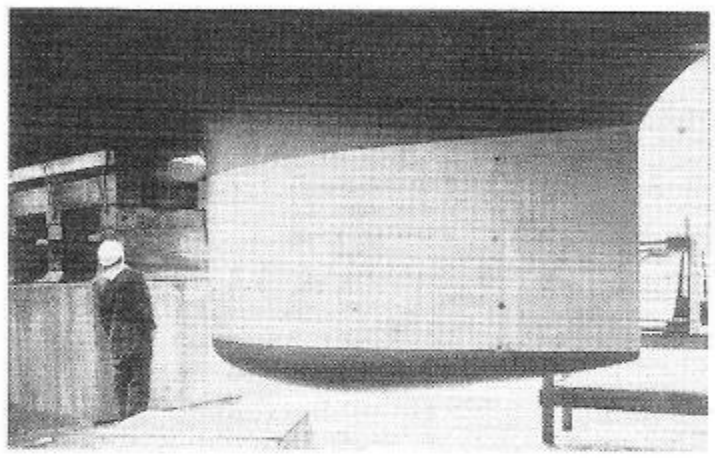

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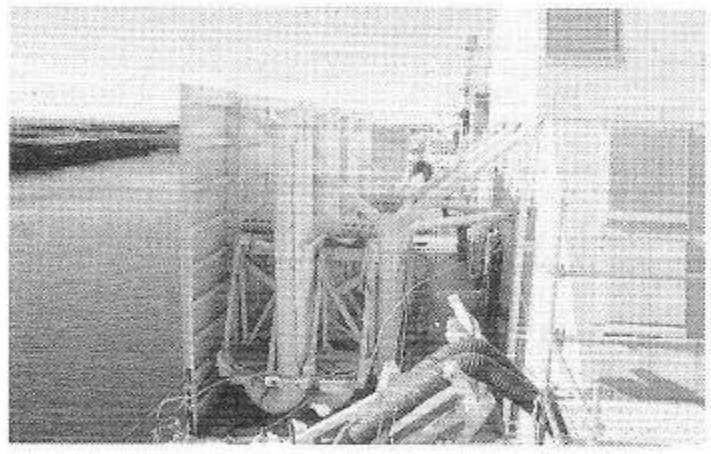

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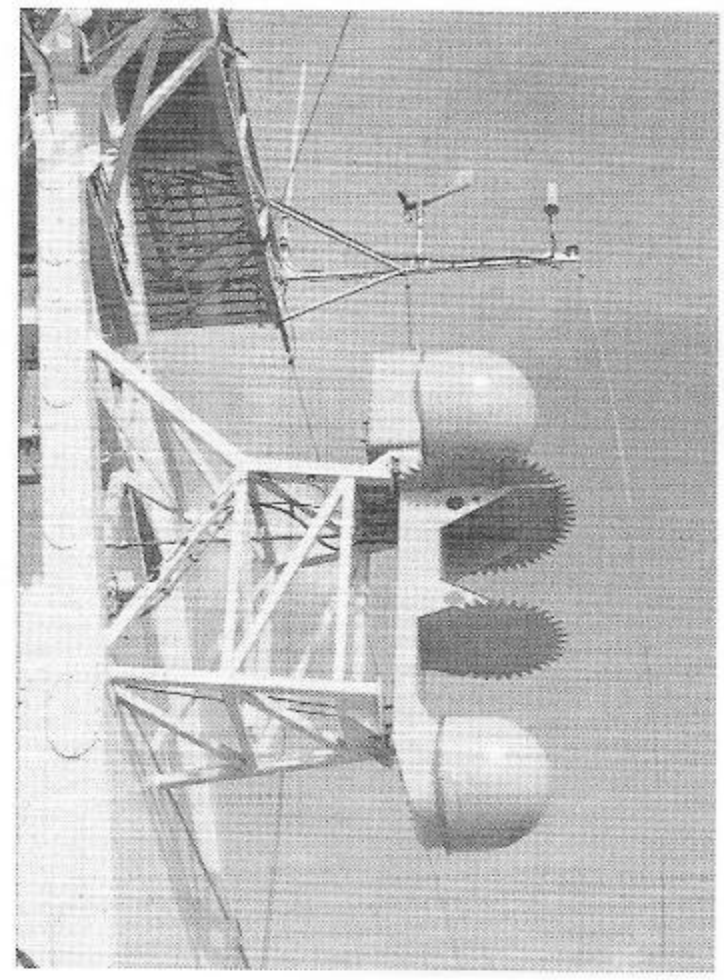

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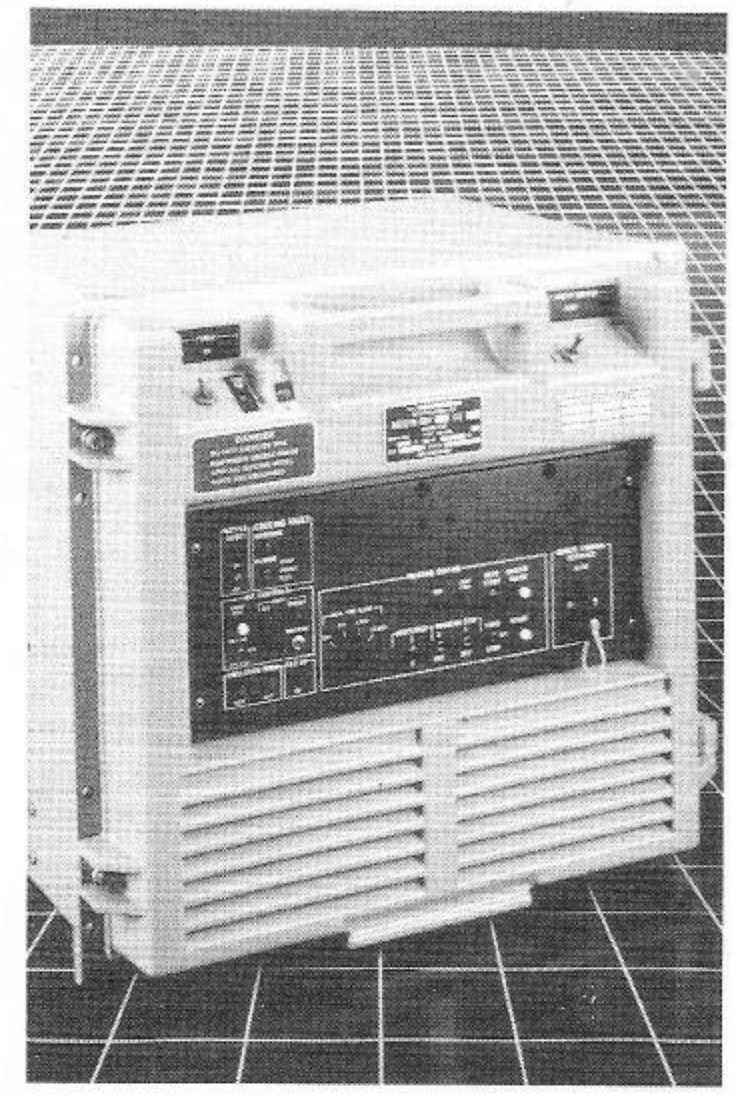

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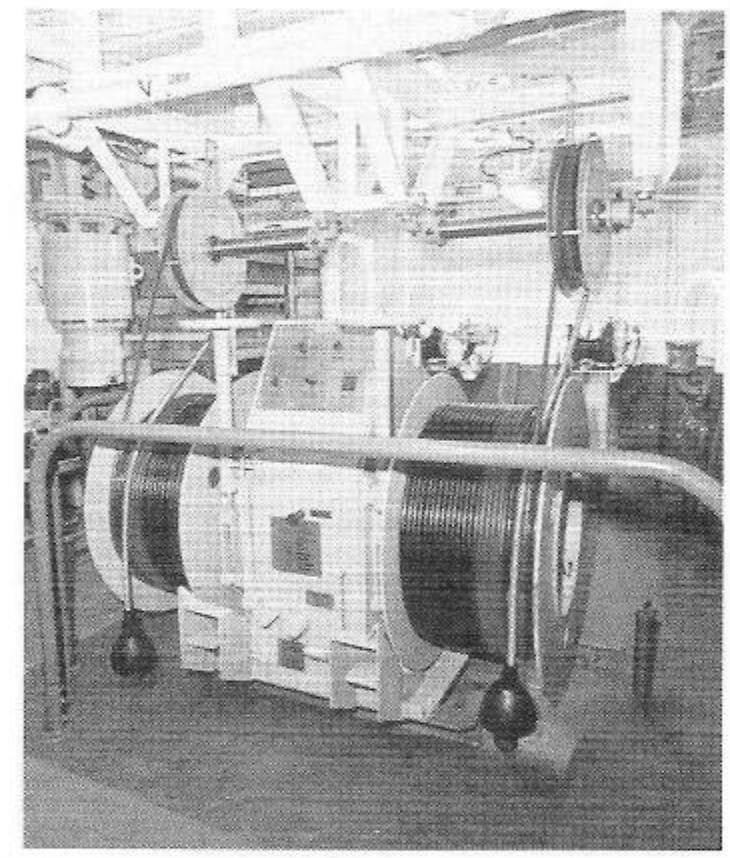


H

***A** Raytheon AN/SPS-49(V)5 air search radar **B** Celsius Tech Sea Giraffe HC 150 air/surface search radar **C** Dome for Westinghouse AN/SQS-505(V)6 sonar **D** Mk 48 vertical launchers for Raytheon Sea Sparrow SAM **E** Lockheed /Martin Canada AN/SLQ 503 (RAMSES) jammer units **F** Satcom antenna **G** AN/UYK 507 computer **H** Indal handling gear for AN/SLQ-25 towed acoustic decoy*

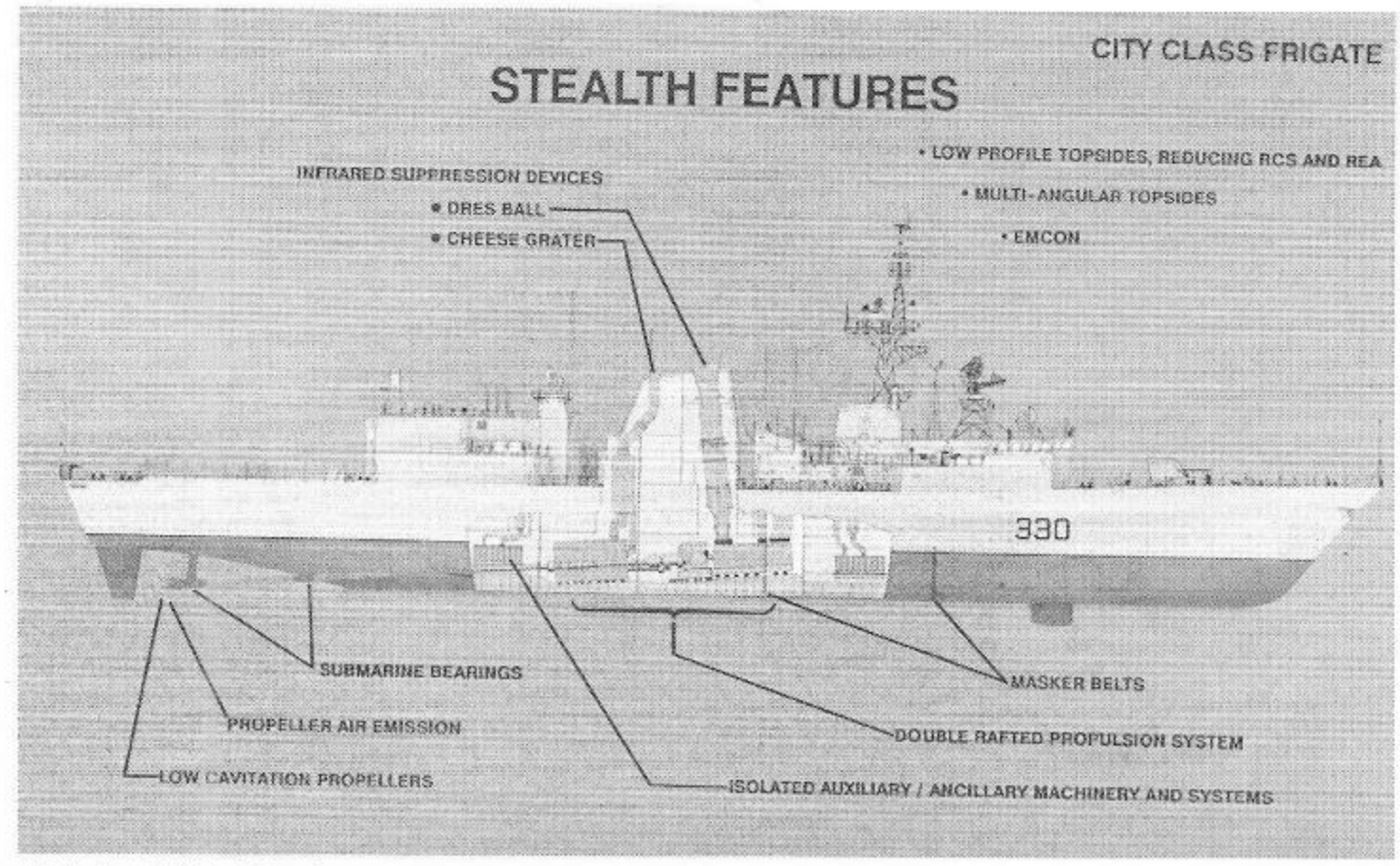
FURTHER INFORMATION

PROGRAMME

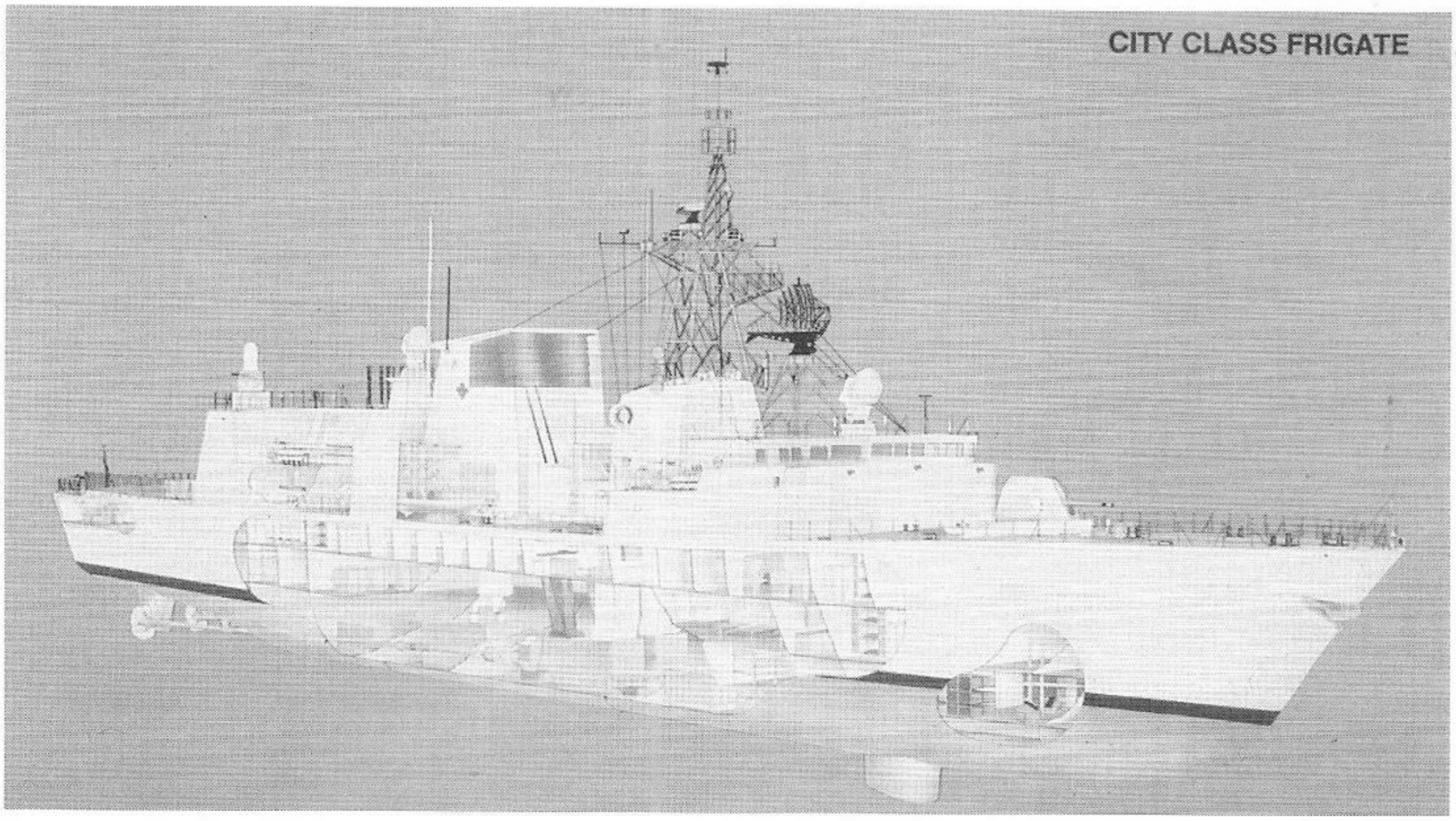
Although the decision to order this class was taken in December 1977 the order was not placed until 29 June 1983, when it was announced that the competition for the first six of a new class of patrol frigates had been won by St John Shipbuilding Ltd supported by Paramax Electronics Inc of Montreal, a subsidiary of Unisys Co. Three ships were then subcontracted to Marine Industries Ltd (now MIL-Davie) in Lauzon and Sorel, Canada. On 18 December 1987 six additional ships of the same design were ordered from St John SB Ltd with delivery by 1997. There have been problems keeping to the planned construction programme, but the dispute between St John and MIL was finally resolved in 1993. The original intention was for a class of twenty, but it appears highly unlikely that a further eight will be built.

DESIGN

The Canadian Forces Maritime Command (CFMC) has extensive experience of operating in the hostile environment of the North Atlantic, which has been brought to



(St John Shipbuilding)



Fredericton *(F 337)* (St John's Shipbuilding)

bear in this design. Deck wetness has been reduced by the high freeboard, flush deck and the broad beam, which is carried well forward, while the deep draught and fine lines of the bow prevent the sonar dome being lifted clear of the water. The same features also reduce slamming and minimise pitch and roll, which are of benefit to both helicopter operations, and to general crew comfort and efficiency.

The hull and superstructure are fabricated mainly from low-alloy, high-tensile steel, with selective use of high-yield steels to give additional strength in high-stress areas and for ballistic protection.

Considerable efforts have been made to enhance the ship's stealth characteristics, one element of which is reducing the radar cross-section (RCS) through careful design of the hull and superstructure. In the hull, the sides are flared and the transom is angled, while in the superstructure all vertical surfaces have been angled, the number of radar-reflecting corners has been minimised, the number of decks reduced, and the design of the mast carefully analysed to combine the necessary strength with minimum radar reflections.

The IR signature has been reduced in the 3-5 and 8-13 µm bands, with particular attention being paid to exhaust ducts and heat plumes. Among the cooling measures in use are the Canadian-designed DRESball (DRES = Defence Research Establishment Suffield) devices in the gas-turbine uptakes.

Since the ships' primary mission is ASW, particular attention has been paid to underwater radiated noise. The propellers are designed to maximise the speed at which cavitation occurs; gas turbines, diesels and gearboxes are raft-mounted and, where necessary, housed in acoustic enclosures; and both magnetic and heat signatures are carefully controlled. Resilient mountings and flexible connections are widely used. In addition, underwater hull openings have been kept to a minimum and those that are unavoidable are designed to reduce turbulence and resonance.

MODERNISATION

At one stage there was a plan to lengthen the second group of six hulls in order to increase SAM capacity and to improve living conditions (particularly in order to provide female accommodation), but these were shelved. This means that there is limited weight reserve for mid-life modernisation, the absolute displacement limit being reported as 5,100 tonnes.

OPERATIONAL

There were problems on first of class trials, which included higher than designed radiated noise levels, which were reported to be speed associated. These have been rectified.

DEPLOYMENT

Vancouver, Regina, Calgary, Winnipeg and *Ottawa* are based in the Pacific, the remainder in the Atlantic.

Vancouver *(F 331)* (H & L van Ginderen Collection)

JIANGHU CLASS

OVERVIEW

The 'Jianghu' class has been of considerable importance to the Chinese shipbuilding industry, being built in some numbers over many years, and introducing many new features novel to the PLA-N. Four Soviet-designed 'Riga' class frigates (1,488 t) were assembled in Chinese yards from kits supplied by the (then) USSR, being launched in 1956-57. These were followed by the 'Jiangnan' class (1,600 t) which was based on the Riga design but incorporated a number of Chinese ideas; five were built between 1965 and 1969. Next came two 'Jiandong' class ships, which were somewhat larger, displacing 2,200 t, and were the first to be armed with missiles, carrying two RQ-61 SAMs. Launched in 1973 and 1974, they appear to have been failures, probably because the designers were trying to do too much on a relatively small hull.

The first of the 'Jianghu' class was launched in 1975 and had the same hull as the 'Jiandong' class, but a considerably smaller displacement, and have proved to be a relative success, even though they are unsophisticated in comparison to most other contemporary international designs. Nevertheless, they provide an effective platform for the missions currently undertaken by the PLAN.

Design

There are a number of variants in the class, but all have the same length, 103.0 m (337.75 ft) with relatively minor variations in the beam and draught. The versions of the design are as follows:

Type I. This is the original version with four HY-2 SSMs and two 100 mm guns. Five variants have been reported:

Version 1. Oval stack and square bridge wings.
Version 2. Square stack with bevelled bridge face.
Version 3. Bevelled bridge face, but with octagonal stack.
Version 4. Bevelled bridge face, but with oval stack.
Version 5. Has a distinctive fluting arrangement with cowls on the funnel, as well as gunhouses on the 37 mm guns.

Some ships of all five versions have bow bulwarks, of which there appear to be two variations; *Zhenjiang* (514), for example, has a short bulwark, while that in *Zigong* (558) is much longer.

Type II. Commissioned in November 1986, the single Type II has a helicopter flight deck and hangar, and several foreign systems including a Creusot Loire 100 mm gun, Italian torpedo tubes and torpedoes, and US Mk 33 SRBOC decoy launchers.

Type III. The two Type IIIs have a raised shelter deck and are armed with the YJ-1 turbojet-powered missile in fixed container-launchers, in place of the earlier HY-2 rocket-powered missile in large, heavy, trainable launchers.

Type IV. The sole Type IV has the same hull form as the Type III, but is armed with the longer-range C-802 version of the HY-2 missile and with a slightly different arrangement of the launcher-containers.

Egyptian ships. The version exported to Egypt is essentially a Type I Version 4 with bevelled bridge screen and oval funnel, but with the important difference that the 100 mm gun turrets are replaced by twin 57 mm guns in open mounts.

Bangladesh ship. This is a Type I Version 1 with flat bridge front and oval stack, and does not have bow bulwarks.

Thai ships. The Thai ships are based on the Type III, but with the missile tubes at 90° to the centreline and there are two variants. Two ships have two twin 100 mm gun mounts and eight missiles, while the other two have one 100 mm mount and a new helicopter flight deck (but no hangar) aft.

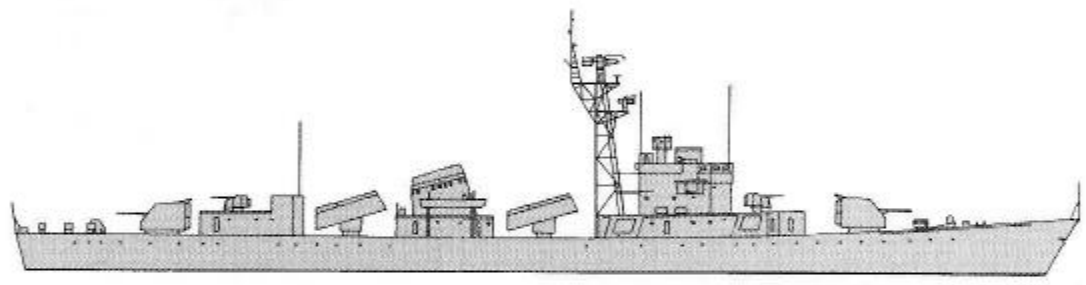
Sales

Two were transferred to Egypt: one in September 1984, the other in March 1985.

One, *Xiangtan* 556, then serving with the PLA-N, was transferred to Bangladesh in November 1989.

Four have been sold to Thailand.

Two 'Jianghu' class frigates were to have been sold to Iraq in 1991 but this was prevented by the Gulf War and the subsequent embargo. The contract may, however, be honoured in due course.



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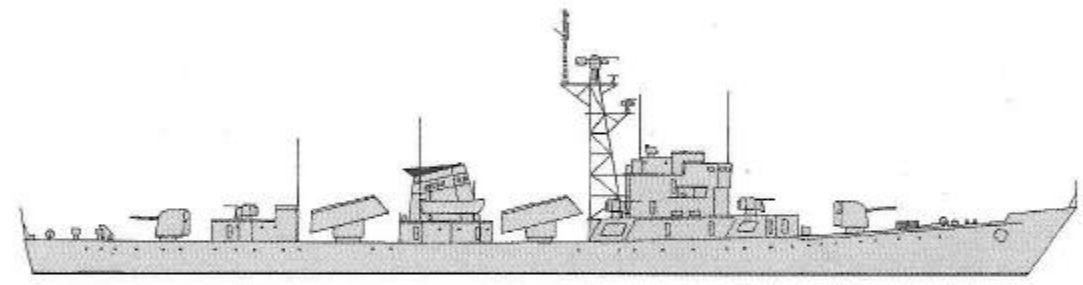

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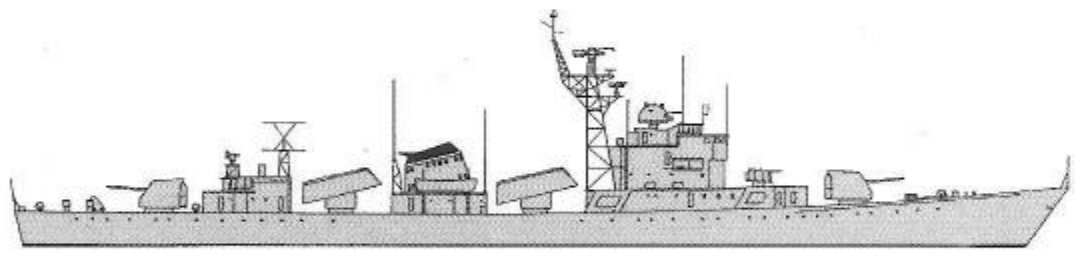

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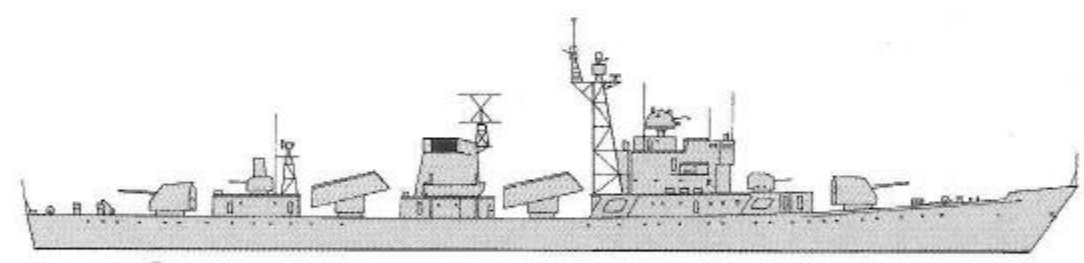

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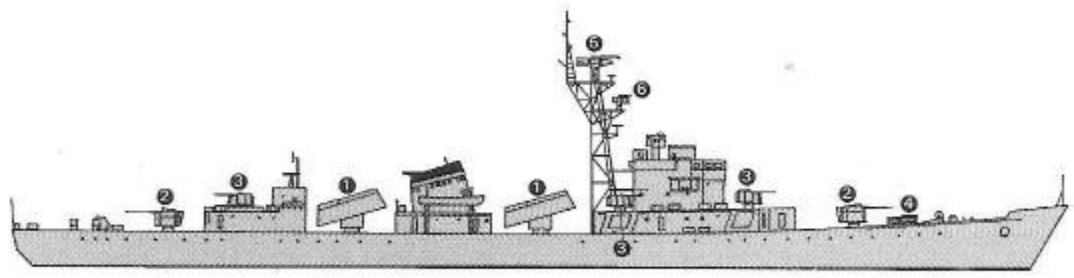

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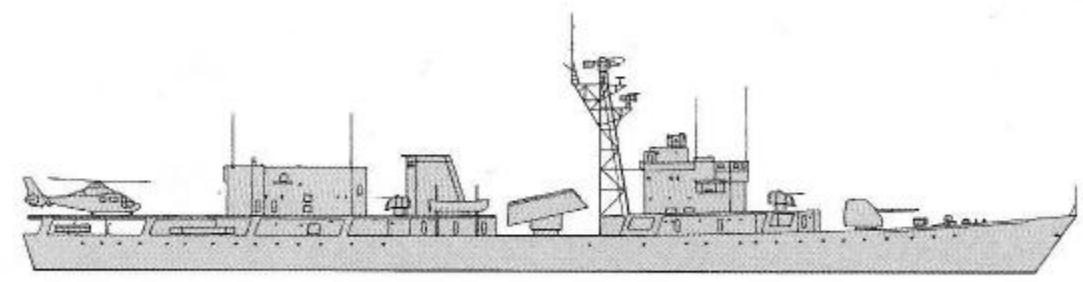

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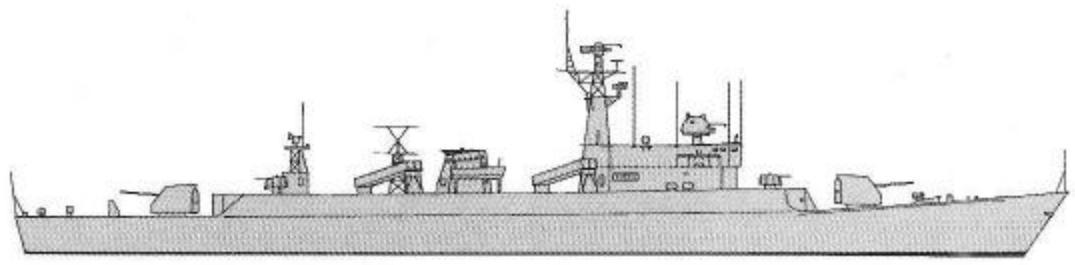

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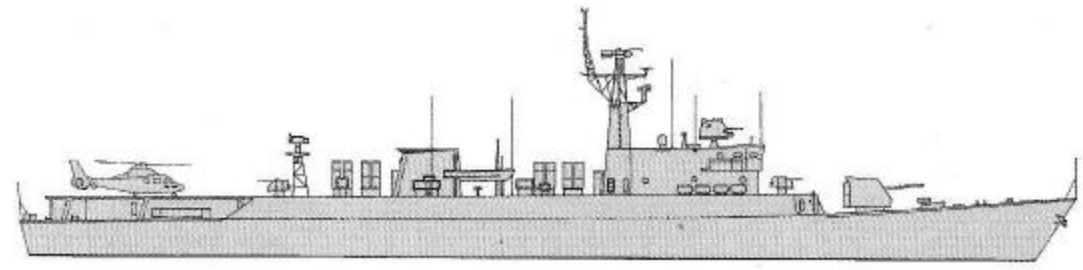
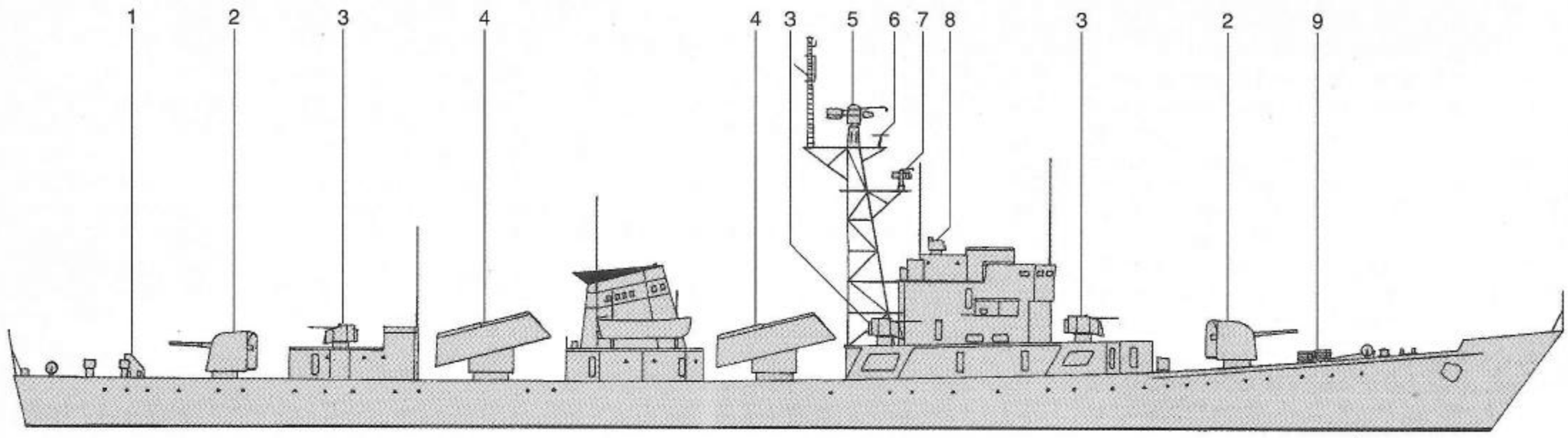


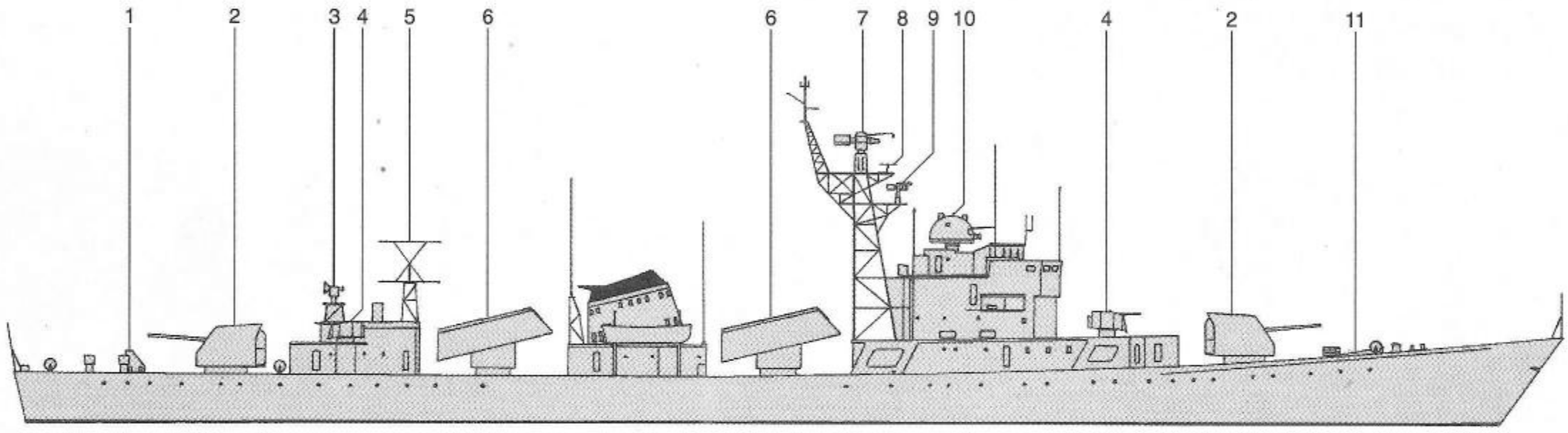
H

*The Jianghu class has been produced in four major 'Types' with a number of versions within Types I and III. **Type I Version 1** (sideview A) has an oval stack, while **Type I Version 2** (sideview B) has a square stack and Type I Version 3 (not shown) has an octagonal stack. **Type I Version 4** (sideview C) is generally similar to Version 1, but with an oval stack and a Knife Rest radar on the after deckhouse. **Type I Version 5** (sideview D) has a unique fluted stack, with the Knife Rest radar on its front edge. The **Egyptian ships** (sideview E) are essentially Type I Version 4, but with 57 mm guns in open mountings. The sole **Jianghu II** (sideview F) has a hangar and flight deck. The **Jianghu III** (sideview G) has an extended shelterdeck and different weapons, while the **Thai Navy** has purchased two Type IIIs and two variants with a flight deck (sideview H)*

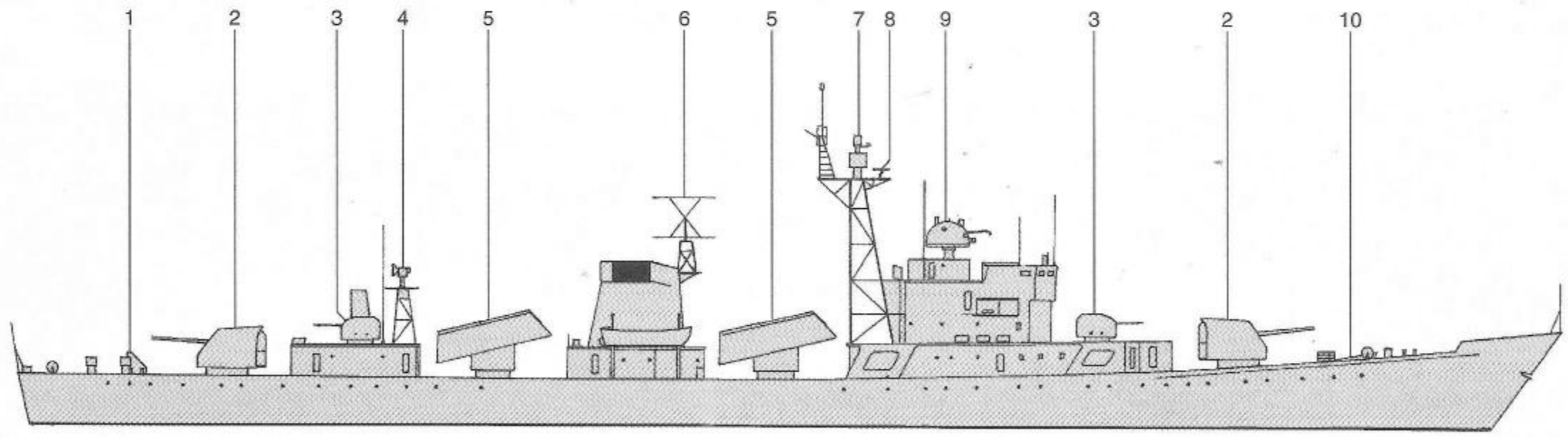
JIANGHU I



Zhenjiang (Jianghu Type I Version 2) (Ian Sturton)
1 *BMB-2 depth-charge projector* **2** *Single 100 mm (3.9 in)/56 gun* **3** *Twin 37 mm/63 anti-aircraft in open mount* **4** *Twin HY-2 (C-201) anti-ship missile launcher* **5** *Eye Shield (Type 765) air/surface search radar* **6** *Navigation radar (Don 2 or Fin Curve)* **7** *Square Tie (Type 354) surface search/fire-control radar* **8** *Wok Won fire-control director* **9** *RBU-1200 anti-submarine rocket launcher*



Ningpo (Jianghu Type I Version 4) (Ian Sturton)
1 *BMB-2 depth-charge projector* **2** *Single 100 mm (3.9 in)/56 gun* **3** *Rice Lamp fire-control director* **4** *Twin 37 mm/63 anti-aircraft cannon in open mount* **5** *Knife Rest-type radar array* **6** *Twin HY-2 (C-201) anti-ship missile launcher* **7** *Eye shield (Type 354) air/surface search radar* **8** *Navigation radar* **9** *Square Tie (Type 352) surface search/fire-control radar* **10** *Sun Visor fire-control director* **11** *RBU-1200 anti-submarine rocket launcher*



Dongguan (Jianghu Type I Version 5) (Ian Sturton)
1 *BMB-2 depth-charge projector* **2** *Twin 100 mm (3.9 in)/56 gun* **3** *Twin 37 mm/63 anti-aircraft cannon in gunhouse* **4** *Rice Lamp fire-control director* **5** *Twin HY-2 (C-201) anti-ship missile launcher* **6** *Knife Rest-type radar array* **7** *Rice Screen air/surface search radar* **8** *Navigation radar* **9** *Sun Visor fire-control radar* **10** *RBU-1200 anti-submarine rocket launcher*

GENERAL SPECIFICATIONS

Operator: China, People's Republic
Type: 053

Class: JIANGHU I

Built: 27
Active: 27

Displacement:
standard: 1,425 t
full load: 1,702 t

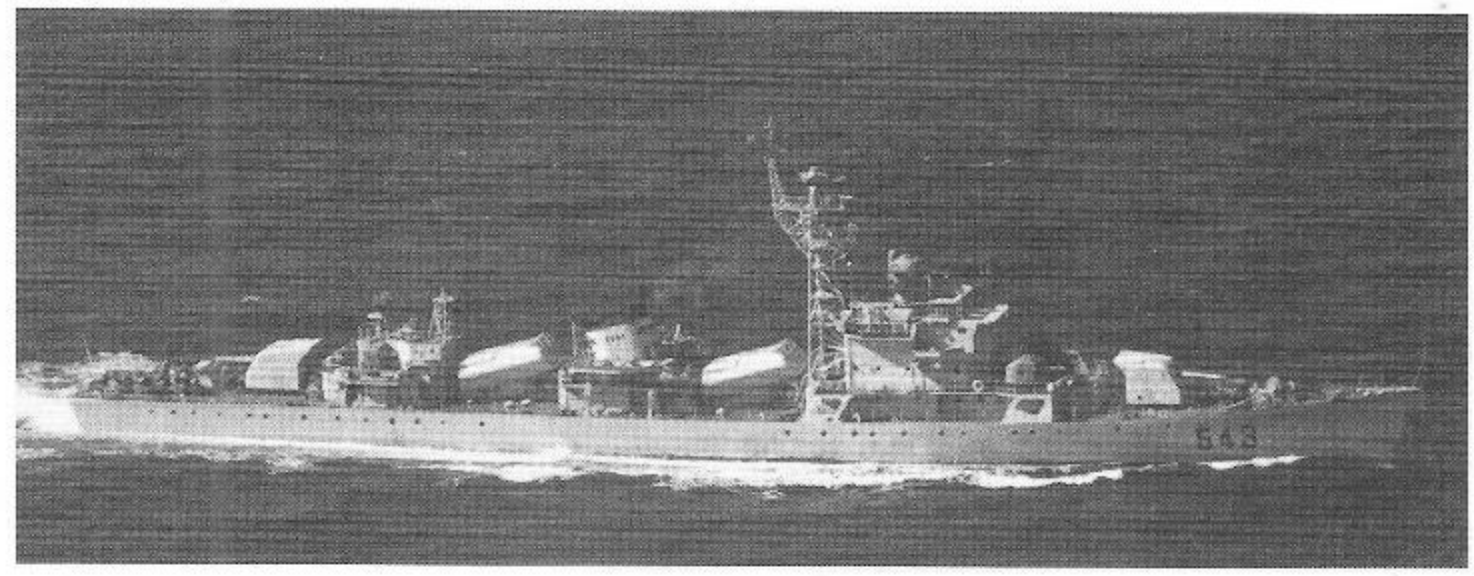
Dimensions
Length: 103.2 m (338.5 ft)
Beam: 10.8 m (35.4 ft)
Draught: 3.1 m (10.2 ft)

Speed: 26 kts
Range: 4,000 n miles at`15 kts; 2,700 n miles at 18 kts

Complement: 200 (30 officers)

SHIPS

CHANG DE (509)
NANTONG (511)
HUAYIN (513)
XIAMEN (515)
NANPING (517)
CHANGZHI (519)
JINHUA (534)
LINFEN (545)
YIBIN (552)
ANSHUN (554)
JISHOU (557)
KANGDING (559)
SHANTOU (561)
SHAOXING (510)
WUXI (512)
ZHENJIANG (514)
JIUJIANG (516)
JIAN (518)
NINGPO (533)
DANDONG (543)
MAOMING (551)
SHAOGUAN (553)
ZHAOTONG (555)
ZIGONG (558)
DONGGUAN (560)



Dandong, *a Jianghu Type I Version 4*

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

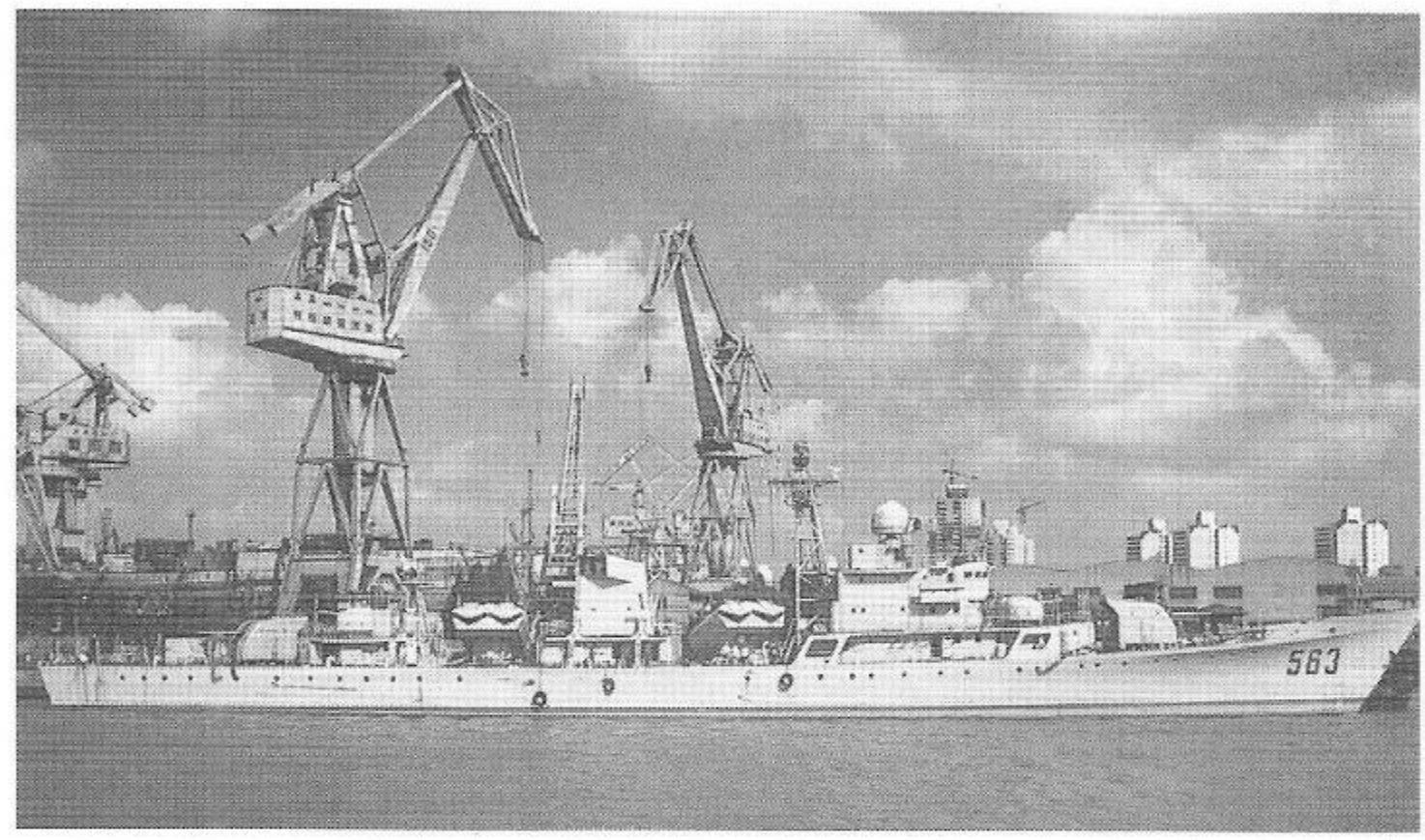
HY-2 (NATO = CSSC-3 'Seersucker') medium-range anti-ship missile

Jianghu I frigates are armed with four HY-2 (Hai Ying = Sea Eagle) (export designation = C-201) anti-ship missiles, mounted in two twin launchers. These launchers are located before and aft of the after stack and must be trained to either beam to fire, but are fixed in elevation. The HY-2 missile was developed from the HY-1, which, in its turn, was developed from the Soviet SS-N-2 Styx.

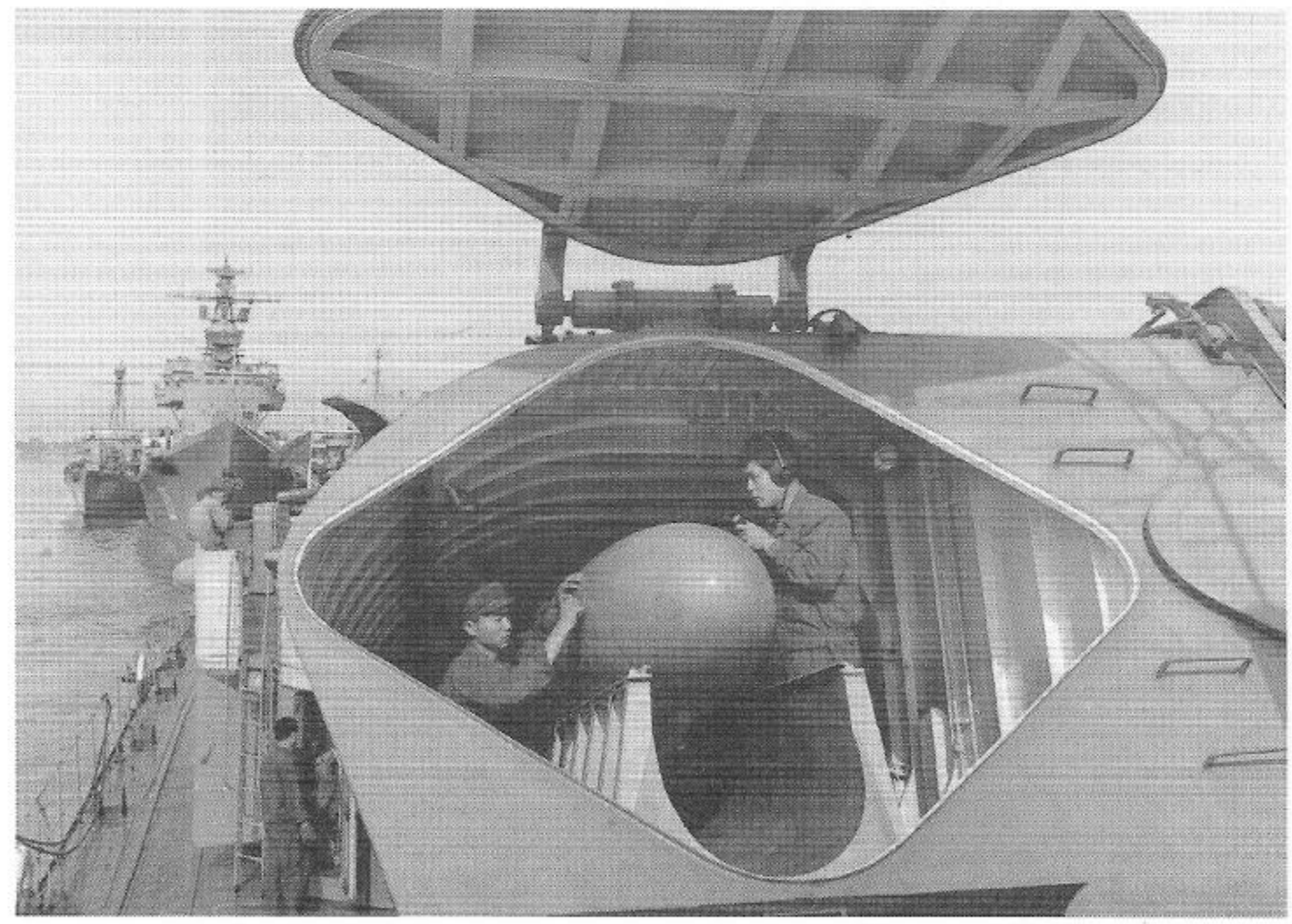
The firing sequence is operated from a dedicated console with its own analogue computer and ripple launches are possible. Once the target is confirmed as hostile the operator manually sets a range gate around it and feeds in location, speed and ballistic data. The computer then feeds the firing solution to the missile autopilot. After launch the HY-2 climbs to its cruise altitude of 30 m (100 ft), which it maintains until entering the terminal phase when it descends to about 8 m (26 ft).

Specifications
Length: 7.36 m (24.15 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.87 m)
Launch weight: 2,500 kg (5,511 lb)
Speed: Mach 0.9
Warhead: 454 kg (1,000 lb) hollow charge
Range: 51 n miles (95 km)
Guidance: Autopilot and active radar, with an alternative IR seeker instead of radar

Manufacturer/Contractor
China Precision Machinery Import and Export Corporation (CPMIEC), Beijing, China.



A Jianghu I *Version 5 with the unusual fluted funnel and four twin 37 mm with gunhouse* (Harald Carstens)



Technicians of the PLAN work on an HY-2 missile. The large size of the launchers is due to the fixed wings and rudder on the missile (CMIEC)

GUNS

100 mm L/56 medium-calibre dual-purpose gun

All Type I ships have two gun turrets, but some are single, others twin. The Chinese 100 mm L/56 is developed from the Soviet B34 100 mm gun, examples of which were supplied in the 1950s, and the same gun is used in both mounts.

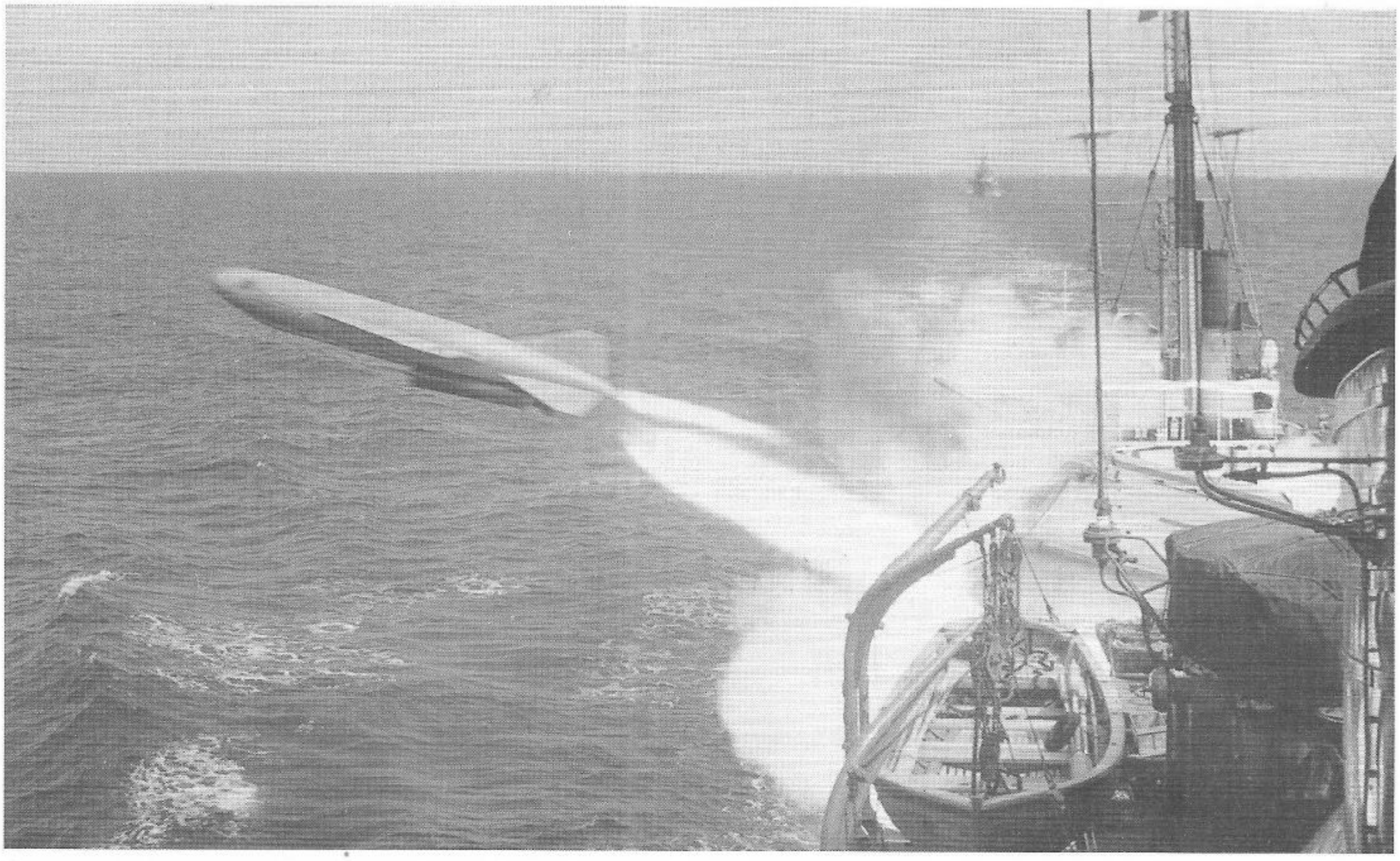
In the twin mounting the two barrels share a common cradle, with the trunnions set far back from the front of the turret to achieve high angles of fire. Spent rounds are ejected forward with the chutes running parallel to, but below, the guns. The turret is manned with a crew of five. Within the turret the gun captain occupies a position in front of, and on the left of, the trunnions.

Specifications
L/56 twin
Length of barrel: 56 calibres
Muzzle velocity: 900 m/s (2,953 ft/s)
Traverse: 360°
Elevation: −15 to + 85°
Weight of projectile: 6.31 kg (13.9 lb)
Rate of fire: 18 rds/min
Range:
anti-surface: 12 n miles (22 km)
anti-air: 15,000 m (49,000 ft)

37 mm (W-11-M) mountings

There are two fits: some ships have six twin 37 mm/62.8 mountings, others have four twin mountings. The barrels are enclosed in separate water jackets with exposed spring recuperators, and a hydraulic recoil buffer underneath the barrel. The loading mechanism consists of guides for ammunition, which is in five-round clips, the clips being automatically removed on the loading tray. The first round is loaded manually into the breech. The breech block rises and the gun fires when the firing pin strikes the cartridge percussion cap. Upon recoil, the breech block opens and extractor arms propel the case along the loading tray and down an ejection chute. The recoil forces activate the loading mechanism and allow following rounds to be rammed automatically into the breech.

Specifications
W-11-M
Calibre: 37 mm



An HY-2 is launched from a PLAN ship at sea, using both the main motor and the under-fuselage booster (CMIEC)

Length of barrel: 62.8 calibres
Muzzle velocity: 860 m/s (2,821 ft/s)
Traverse: 360° at 17°/s
Elevation: −10 to +85° at 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.61 lb)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,842 ft)
Crew: 3

Ammunition (HE-T)
Projectile Weight: 708 g (25 oz)
Explosive charge: 36 g (1.27 oz) (RDX/aluminium)

ANTI-SUBMARINE MORTARS

RBU 1200 5-tubed fixed launchers

Some ships have two RBU 1200 launchers, others four. This mounting is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm (9.8 in), is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (74.95 lb) warhead and a range of about 0.8 n miles. The RBU 1200 is associated with the old short-range HF (25-30 kHz), 'searchlight' attack sonar which was given the NATO codename Stag Ear and has the Soviet designation Tamir.

DEPTH CHARGES

There are two BMB-2 depth-charge projectors and two depth-charge racks.

MINES

These ships can carry up to 60 mines.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Jug Pair (Watch Dog)

There are two small domes on the foremast yard-arm. These are designated by NATO as Jug Pair, and appear to be a Chinese-produced version of the Russian Watch Dog radar warning system.

DECOYS

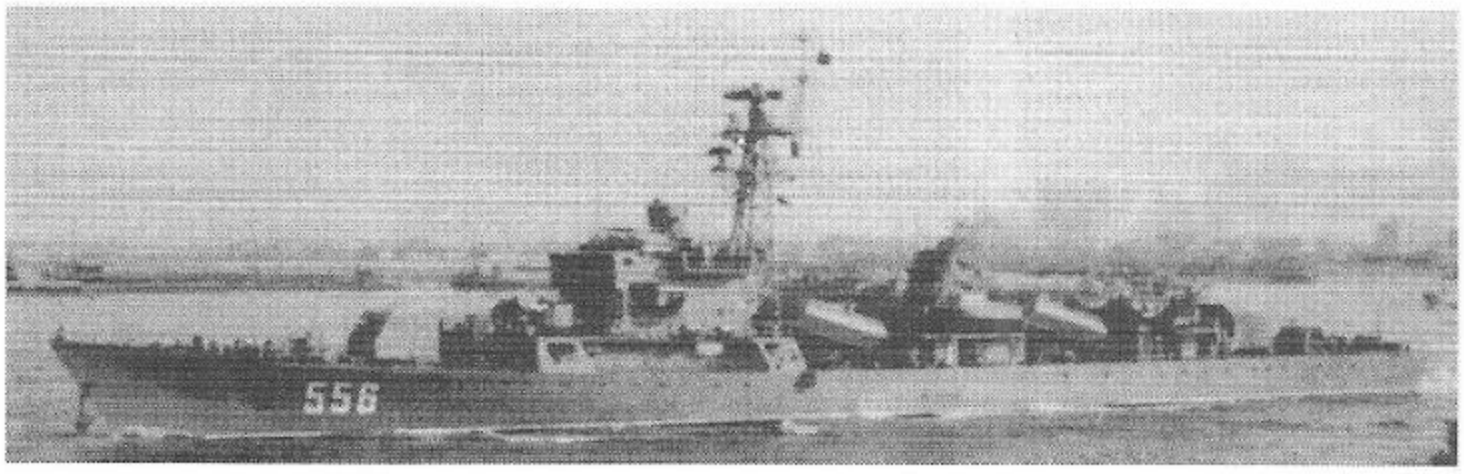
Mk 33 countermeasures system

There are either two Loral Hycor Mk 33 Rapid Bloom Offboard Countermeasures (RBOC) or two Chinese Type 945 26-barrelled launchers. Both launching systems comprise mortar launchers, countermeasures cartridges, and appropriate control and support arrangements.

Specifications (munitions)

	Dimensions (L × D)	Weight
CHAFFSTAR I	412.1 × 112.3 mm	4.15 kg
CHAFFSTAR II	1,067 × 112 mm	18.2 kg
GEMINI	434 × 112 mm	5.2 kg
HIRAM I	416.8 × 112.3 mm	4.1 kg
HIRAM II	889 × 203 mm	13.3 kg
LOROC	1,200 × 112 mm	14.74 kg

Manufacturers/Contractors
Loral Hycor Inc (launcher).
Lundy Electronics & Systems Inc (Mk 171 cartridges).



Jianghu I *Variant 1,* Xiangtan *(556), with oval stack and squared bridge wings. Note the Eye Shield air/surface search radar antenna at the masthead with the Square Tie surface search radar below and before the mast. This ship is now with the Bangladeshi Navy*

COMMAND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

IFF

High Pole A; Yard Rake; or Square Head.

WEAPONS CONTROL

Fire-control director

A small gunfire control director is installed in the bridge roof of some ships. Other ships have the large hemispherical director similar to the Russian Round Top.

RADARS

Eye Shield

Most 'Jianghu' class frigates have an Eye Shield antenna at the masthead. Also known as MX 902 and Type 354, Eye Shield is an air/surface search

Ningpo *(533), a Type I version 4 ship, with oval funnel and a variety of new sensors including Sun Visor fire control on the bridge roof and Knife Rest (partially obscured by exhaust smoke) atop the after deckhouse. The two triple launchers for the HY-2 missiles are clearly shown*

equipment which is reported to operate in the E band. This may be a development of the Russian Slim Net radar.

Rice Screen

Rice Screen is a 3D pulse-compression radar with a large, rectangular planar array antenna. According to brochures this can track ten targets and has a range of some 120 km. It has been fitted in ships 558 and 561.

Square Tie

Square Tie is an I-band, surface search and fire-control radar (also known as Type 352). The antenna is mounted on a small platform on the forward side of the mainmast.

Don 2, Fin Curve, Racal-Decca

The navigation set varies between ships. Don 2, Fin Curve and Racal-Decca (model unknown) sets have all been seen.

Rice Lamp

The Rice Lamp fire-control director is fitted in some ships. Operating in the I/J band, it is located aft, either atop a small deckhouse or at the head of a small tower in others.

Sun Visor

Sun Visor is an I-band, fire-control radar installed on the Round Top director, which is fitted in some ships.

Knife Rest

Some ships have a large open work antenna mounted either on a small tower on the forward edge of the stack or at the head of a similar tower on the after deckhouse. The Chinese Navy array has two side by side Yagi antennas and appears to be similar to the Knife Rest found on 1950s-vintage Soviet Navy ships. The (then) Soviet Army used Knife Rest B, which operated over the 79-93 MHz band, with a peak power of 100 kW and has an effective range of 185-280 km.

SONAR

Echo Type 5

One sonar set is fitted to all ships: the hull-mounted, active search and attack, Echo Type 5, operating in the medium-sonar frequency band. One ship has been seen with what may be a VDS or towed array, possibly as a trials installation.

PROPULSION

Specifications
System: diesel
Main machinery: 2 Type 12E 390V diesels; 10.6 MW (14,400 hp (m)) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These ships have all been built in Shanghai, but at three different yards at Hudong, Jiangnan and Huangpo. The first ship entered service in the mid-1970s and the ships then followed in the order: 515, 516, 517, 511, 512, 513, 514, 518, 509, 510, 519, 520, 551, 552, 533, 534, two for Egypt, 543, 553, 554, 555, 545, 556 (transferred to Bangladesh), 557, 544, 558, 560, 561, 559 and 563, with the last of the class, 564, completing in 1996.

DESIGN

The basic hull design is identical to that of the earlier Jiangdong frigate, an air defence ship, armed with a SAM system which appears to have been unsuccessful as it never entered service. The Jianghu I, however, differs in having two large twin SSM launchers.

A variety of versions of the Jianghu I have been observed.

There are various designs of stack. One design is square with a prominent rear 'lip', while another is slightly smaller, rounded and much more streamlined. In some of the most recently built ships, however, the stacks have a totally flat top, with the exhausts being led out through two 'wings'.

The earlier ships had a flat foredeck, which may have proved too wet in rough weather, as a number of ships have been seen with a bulwark, although the actual length appears to differ between ships.

Armament also differs. Some ships have two single 100 mm mountings while others have two twins. Similarly, there are differences in the 37 mm outfits, some ships having six twin mounts and others eight while the earlier ships have open mounts and the latest gunhouses.

The differences, all of which are relatively minor, may arise from the fact that the ships have been built in three different shipyards.

MODERNISATION

These ships are being modernised during a current refit programme. New fire-control and electronics equipment are being fitted, with Sun Visor and Rice Lamp being seen on newly refitted Type Is. One ship appears to be fitted with a VDS or towed sonar array, possibly as a trials installation.

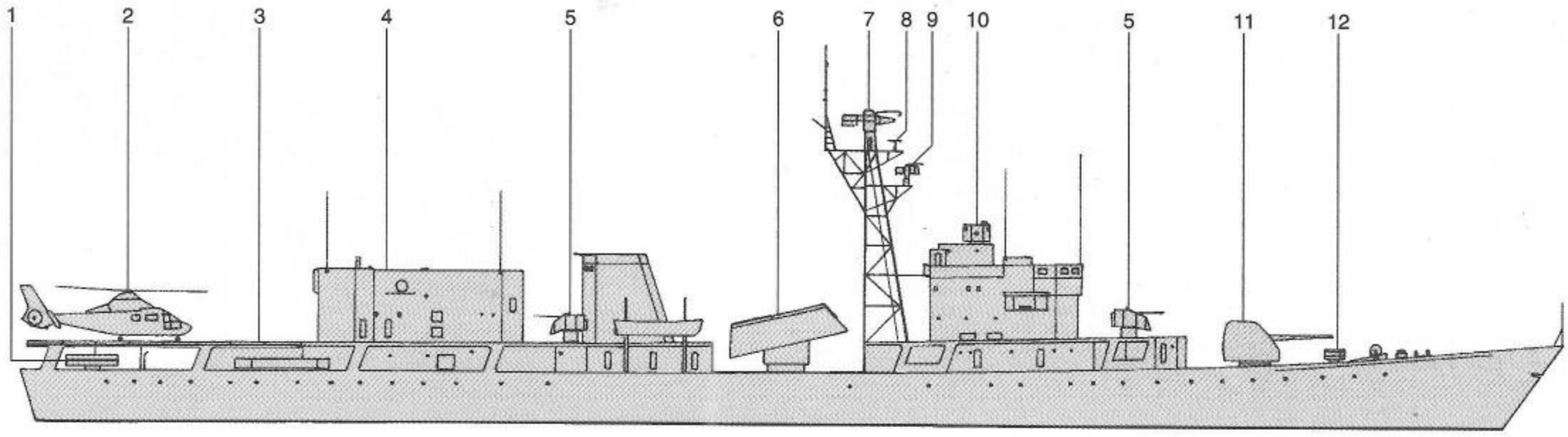
DEPLOYMENT

Seven are based in the Eastern Fleet, five in the North and the remainder in the South.

DISPOSALS

Kaifeng (520) paid off in 1993.

JIANGHU II



Siping (Ian Sturton)

1 Three Whitehead ILAS 324 mm torpedo tubes 2 Harbin Z-9A (licence-built Dauphin 2) helicopter 3 Flight deck 4 Hangar 5 Twin 37 mm/63 anti-aircraft cannon in open mount 6 Twin HY-2 (C-201) anti-ship missile launchers 7 Eye Shield (Type 354) air/surface search radar 8 Navigation radar 9 Square Tie surface search/fire-control radar 10 Fire director (unidentified) for 100 mm gun 11 Single Creusot-Loire 100 mm (3.9 in)/55 gun 12 RBU-1200 anti-submarine rocket launcher

GENERAL SPECIFICATIONS

Operator: China, People's Republic
Type: 053

Class: JIANGHU II

Built: 1
Active: 1

Displacement:
standard: 1,500 t
full load: 1,865 t

Dimensions
Length: 103.2 m (338.5 ft)
Beam: 10.8 m (35.4 ft)
Draught: 3.1 m (10.2 ft)

Speed: 26 kts
Range: 4,000 n miles at 15 kts; 2,700 n miles at 18 kts

Complement: 200 (30 officers)

SHIPS

SIPING (544)

Builder	Hudong Shipyard, Shanghai, China
Laid down	1984
Launched	Sep 1985
Commissioned	Nov 1986

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

HY-2 (NATO = CSSC-3 'Seersucker') medium-range anti-ship missile

The sole Jianghu II frigate is armed with two HY-2 (Hai Ying = Sea Eagle) (export designation = C-201) anti-ship missiles, mounted in one twin launcher. This launcher is located between the stack and the mast and must be trained to either beam to fire, but is fixed in elevation. The HY-2 missile was developed from the HY-1, which, in its turn, was developed from the Soviet SS-N-2 Styx.

The firing sequence is operated from a dedicated console with its own analogue computer and ripple launches are possible. Once the target is confirmed as hostile the operator manually sets a range gate around it and feeds in location, speed and ballistic data. The computer then feeds the firing solution to the missile autopilot. After launch the HY-2 climbs to its cruise altitude of 30 m (100 ft), which it maintains until entering the terminal phase when it descends to about 8 m (26 ft).

Specifications
Length: 7.36 m (24.15 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.87 m)
Launch weight: 2,500 kg (5,511 lb)
Speed: Mach 0.9
Warhead: 454 kg hollow charge
Range: 51 n miles (95 km)
Guidance: Autopilot and active radar, with an alternative IR seeker instead of radar

Manufacturer/Contractor
China Precision Machinery Import and Export Corporation (CPMIEC), Beijing, China.

Chinese HY-2 missile on a land-based launcher; the shipborne missile is identical, but uses a different launcher

TORPEDOES

B515 anti-submarine torpedo launching system

B515 (also known as ILAS) consists of three 324 mm diameter torpedo tubes mounted on the quarterdeck, with one installation on each side of the ship. The tubes are manually loaded and trained but remotely operated from the combat information centre, although emergency local operation is possible.

Specifications
Length: 3.4 m (11.15 ft)
Height: 1.2 m (3.94 ft)

Width: 1.285 m (4.22 ft)
Weight: 1,050 kg (2,315 lb) (unloaded)

Manufacturer/Contractor
Whitehead SpA, Salviano, Italy.

A244/S lightweight air-/surface-launched anti-submarine weapon
The torpedo used by the Jianghu II is the Whitehead A244/S.

Specifications
Length: 2.7 m (8.86 ft)
Diameter: 324 mm (12.75 in)
Weight: 215 kg (warshot version) (474 lb)
Warhead: 34 kg (75 lb) shaped charge HBX-3 HE
Propulsion: Electric; silver/zinc batteries
Range: 3.5 n miles (6 km)
Speed: 30 kts
Guidance: Active/passive sonar, self-adaptive programmed patterns

Manufacturer/Contractor
Whitehead SpA, Salviano, Italy.

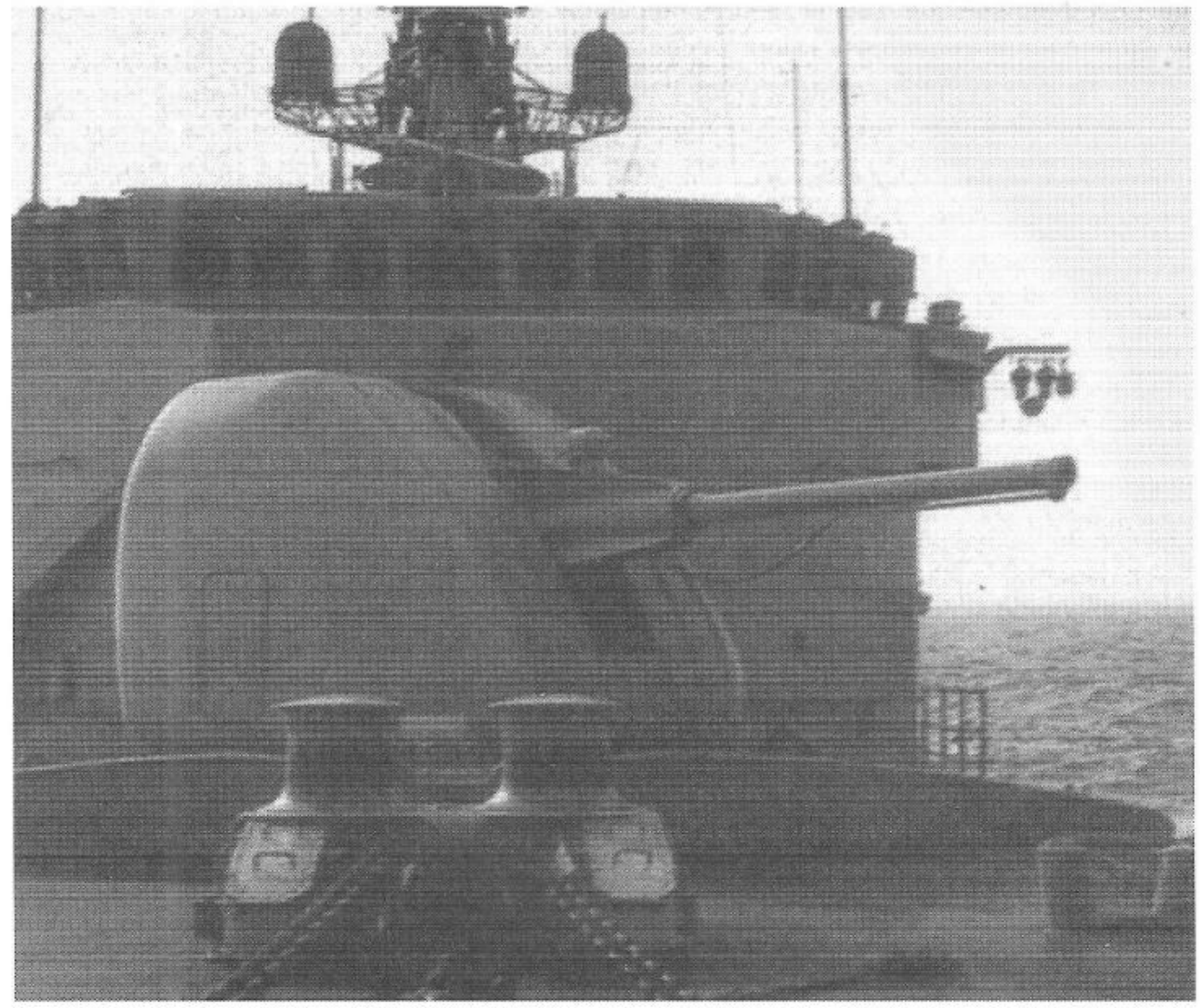
GUNS

Creusot-Loire 100 mm/55 Modèle 1968
There is a single 100 mm/55 Modèle 1968 dual-purpose mounting located on the foredeck ('A' position). This is normally operated in the fully automatic remote mode with an unmanned turret, although there is a fall-back manual mode, which requires two men in the turret. The mounting appears to be the CADAM *(CADence AMéliorée)* standard with improved recoil and feed systems, and a firing rate raised from 60 rds/min to 78 rds/min.

Specifications
Calibre: 100 mm
Length of barrel: 55 calibres
Muzzle velocity: 870 m/s (2,854 ft/s)
Traverse: 360° at 40°/s
Elevation: −15 to +80° at 25°/s
Crew: 2 (optional) and 2 loaders
Range:
anti-surface: 9.15 n miles (17 km)
anti-air: 8,000 m (26,000 ft)
Rate of fire: 78 rds/min
Ammunition: 13.5 kg (29.76 lb) (multipurpose projectile); 9.7 kg (21.4 lb) (charge)

Manufacturers/Contractors
Direction des Constructions Navales (DCN) (prime).
Mécanique Creusot-Loire, Marine Products (mountings).
DCN Ruelle (gun).
CSEE Défense (servo equipment).

37 mm (W-11-M) mountings
This ship has eight 37 mm/62.8 cannon in four twin mountings. The barrels are enclosed in separate water jackets with exposed spring recuperators, and a hydraulic recoil buffer underneath the barrel. The loading mechanism consists of guides for ammunition, which is in five-round clips, the clips being automatically removed on the loading tray. The first round is loaded manually into the breech. The breech block rises and the gun fires when the firing pin strikes the cartridge percussion cap. Upon recoil the breech block opens and extractor arms propel the case along the loading tray and down an ejection chute. The recoil forces activate the loading mechanism and allow following rounds to be rammed automatically into the breech.



The Creusot-Loire 100 mm/56 Compact mounting. Two such guns have been sold to China, but there is no production licence. One of the two is aboard Siping *(544)*

Specifications
W-11-M
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 886 m/s (2,906 ft/s)
Traverse: 360° at 17°/s
Elevation: −10 to +85° at 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.61 lb)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,842 ft)
Crew: 3

Ammunition (HE-T)
Projectile Weight: 708 g (25 oz)
Explosive charge: 36 g (1.27 oz) (RDX/aluminium)

ANTI-SUBMARINE MORTARS

RBU 1200 5-tubed fixed launchers
There are two RBU 1200 launchers on the foredeck. This mounting is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm (9.8 in), is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (74.95 lb) warhead and a range of about 0.8 n miles. The RBU 1200 is associated with the old short-range HF (25-30 kHz), 'searchlight' attack sonar which was given the NATO codename Stag Ear and has the Soviet designation Tamir.

DEPTH CHARGES

There are two BMB-2 depth-charge projectors and two depth-charge racks.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Jug Pair (Watch Dog)
There are two small domes on the foremast yard-arm. These are designated by NATO as Jug Pair, and appear to be a Chinese-produced version of the Russian Watch Dog radar warning system.

DECOYS

Mk 33 countermeasures system
There are either two Loral Hycor Mk 33 Rapid Bloom Offboard Countermeasures (RBOC) or two Chinese Type 945 26-barrelled launchers. Both launching systems comprise mortar launchers, countermeasures cartridges, and appropriate control and support arrangements.

Specifications (munitions)

	Dimensions (L × D)	Weight
CHAFFSTAR I	412.1 × 112.3 mm	4.15 kg
CHAFFSTAR II	1,067 × 112 mm	18.2 kg
GEMINI	434 × 112 mm	5.2 kg
HIRAM I	416.8 × 112.3 mm	4.1 kg
HIRAM II	889 × 203 mm	13.3 kg
LOROC	1,200 × 112 mm	14.74 kg

Manufacturers/Contractors
Loral Hycor Inc (launcher).
Lundy Electronics & Systems Inc (Mk 171 cartridges).

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

IFF
High Pole A. Yard Rake or Square Head.

WEAPONS CONTROL

Naja electro-optical/optical director
There is one Naja, which is used as a fire director for the 100 mm gun. Naja is an improved version of the Panda Mk 2 with CILAS TMY 113 high-repetition rate Nd:YAG laser rangefinder, an automatic tracking capability, local or remote control, a three-axis gyro unit and multiple weapon capability. The laser rangefinder operates in the 1.06 µm wavelength, has a peak power of >5 MW and a PRF of 20 pps.

Specifications
Naja
Height: 1.35 m (4.43 ft)
Width: 1.5 m (4.92 ft)
Weight: 480 kg (1,058 lb)
Elevation: −20 to +70°
Max velocity
(traverse): 60°/s
(elevation): 60°/s

Manufacturer/Contractor
CSEE Défense, Paris, France.

Fire director
There is a small fire director for the 100 mm gun on top of a small deckhouse on the bridge roof.

RADARS

Eye Shield
Jianghu II has an Eye Shield antenna at the masthead. Also known as MX 902 and Type 354, Eye Shield is an air/surface search equipment which is reported to operate in the E band. This may be a development of the Russian Slim Net radar.

Square Tie
Square Tie is an I-band, surface search and fire-control radar (also known as Type 352). The antenna is mounted on a small platform on the forward side of the mainmast.

Don 2, Fin Curve
The navigation set is either Don 2 or Fin Curve and is mounted on the mast between Eye Shield and Square Tie.

SONAR

Echo Type 5
One sonar set is fitted to all ships: the hull-mounted, active search and attack, Echo Type 5, operating in the medium-sonar frequency band. One ship has been seen with what may be a VDS or towed array, possibly as a trials installation.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 19.3 × 10.8 m (63 × 35 ft)
Landing aid: Alcatel 'Safecopter'

HELICOPTERS

One Harbin Zhi-9A Haitun (Dauphin).

Specifications
Dimensions:
main rotor diameter: 11.94 m (39.17 ft)
Fenestron diameter: 1.10 m (3.61 ft)
length, overall: 13.68 m (44.88 ft)
height: 3.99 m (13.09 ft)
Weights:
empty (standard aircraft): 2,262 kg (4,987 lb)
max take-off: 4,250 kg (9,370 lb)
Radius of action:
anti-shipping mission: 4 missiles, 135 n miles (250 km); 2 missiles, 150 n miles (278 km)
search and rescue: 130 n miles (241 km)
Performance:
never-exceed speed (VNE): 160 kts (296 km/h)
cruising speed at sea level: 148 kts (274 km/h)
max rate of climb (sea level): 420 m (1,380 ft)/min
hovering ceiling (in ground effect): 2,600 m (8,530 ft)
Power plant: 2 Turbomeca Arriel 1M1 turboshafts, each giving 558 kW (749 shp) for take-off and 487 kW (653 shp) continuously
Accommodation: Pilot, co-pilot. The cabin can hold up to 10 passengers

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Type 12E 390V diesels; 10.6 MW (14,400 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

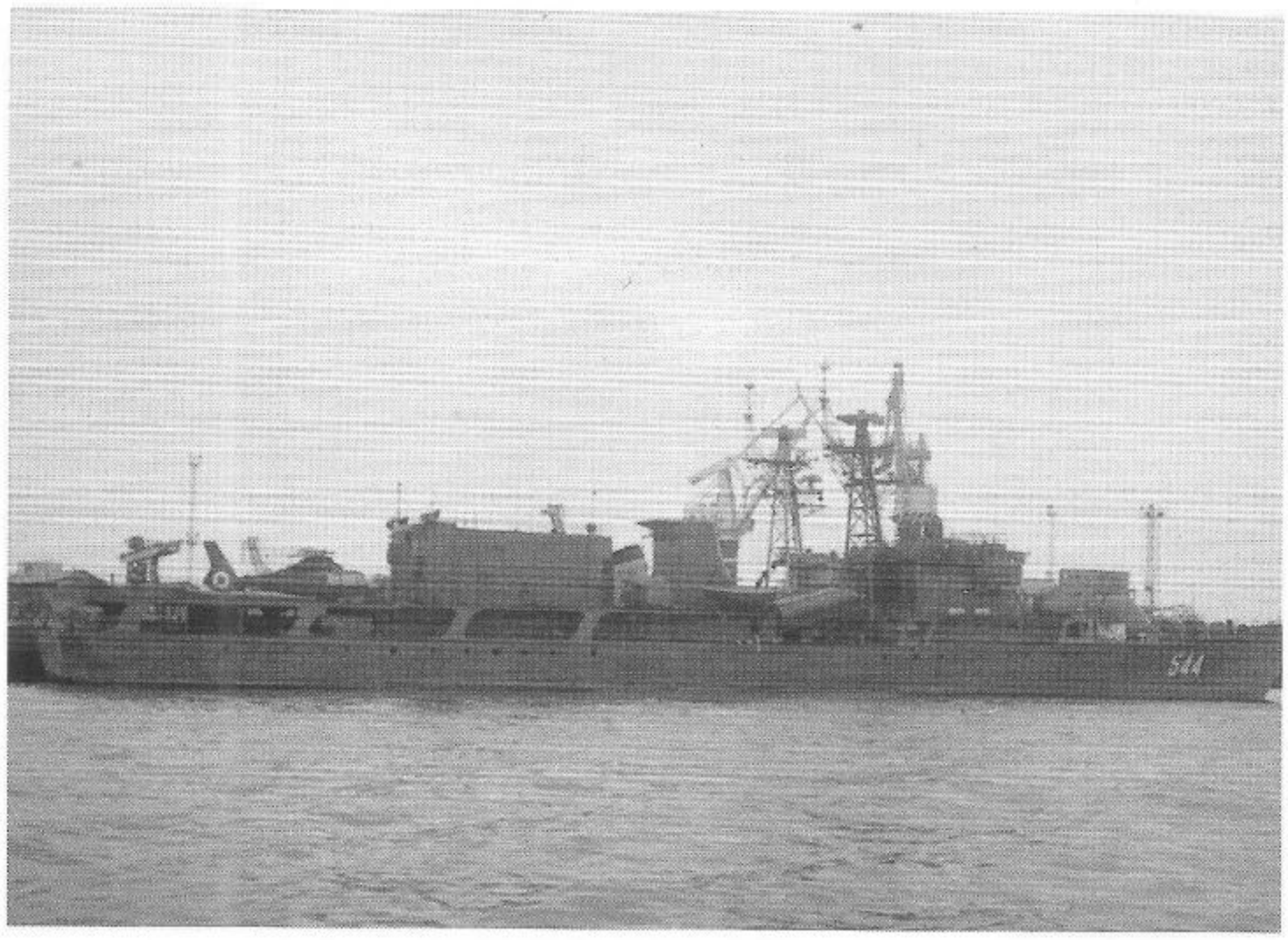
Siping (544) was built in 1984 as a standard Jianghu I and then converted, apparently before being commissioned. It was expected that more of the class would be converted, but it now appears that this was a 'one-off' trials ship for the aviation installation in the Jiangwei frigate design.

DESIGN

The after HY-2 missile launcher, deckhouse and gun found in the Jianghu I frigates have been deleted and replaced by a large hangar and flight deck.

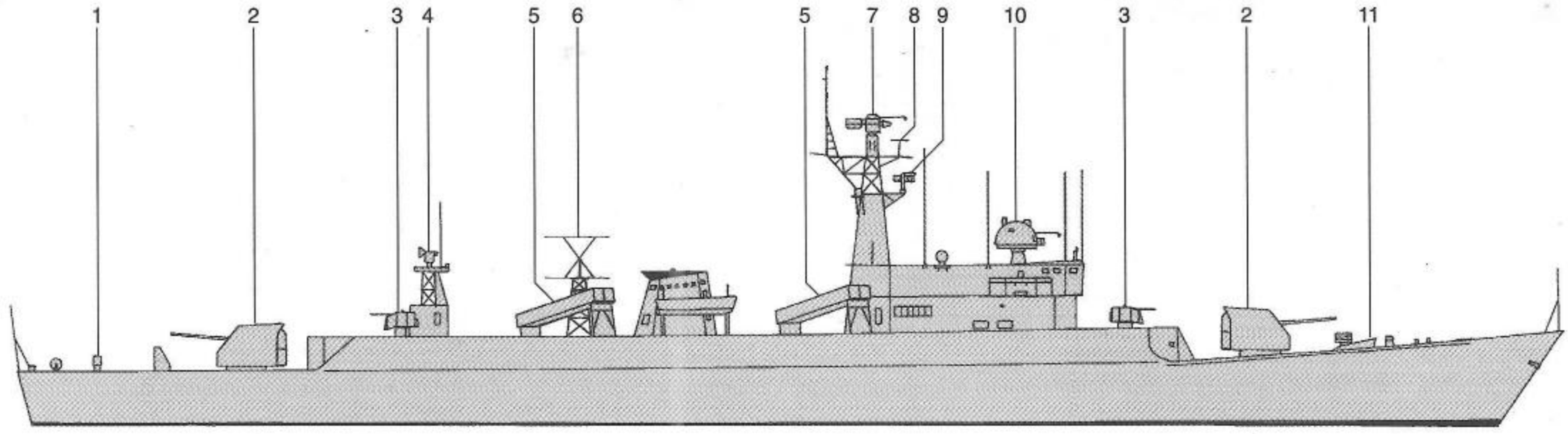
OPERATIONAL

Even though this appears to have been a trials ship, *Siping* (544) is a fully operational unit and is based in the North Sea Fleet.



Siping *(544) remains the only Jianghu II to be built*

JIANGHU III/IV



Zhoushan (Jianghu Type IV) (Ian Sturton)
1 *BMB-2 depth-charge projectors* **2** *Twin 100 mm (3.9 in)/56 guns* **3** *Twin 37 mm/63 anti-aircraft cannon in open mounts* **4** *Rice lamp fire-control director* **5** *Twin YJ-1 (C-801) anti-ship missile launcher* **6** *Knife Rest-type radar array* **7** *Eye Shield air/surface search radar* **8** *Navigation radar* **9** *Square Tie surface search/fire-control radar* **10** *Sun Visor B fire-control director* **11** *RBU-1200 anti-submarine rocket launcher*

GENERAL SPECIFICATIONS

Operator: China, People's Republic
Type: 053 HT

Classes: JIANGHU III/IV

Built: Type III — 2; Type IV — 1
Active: Type III — 2; Type IV — 1

Displacement:
standard: 1,655 t
full load: 1,924 t

Dimensions
Length: 103.0 m (337.9 ft)
Beam: 10.83 m (35.53 ft)
Draught: 3.1 m (10.2 ft)

Speed: 28 kts
Range: 4,000 n miles at 15 kts; 3,000 n miles at 18 kts
Endurance: 10 days

Complement: 180 (30 officers)

SHIPS

Type III
HUANGSHI (535); **WU HU** (536)

Type IV
ZHOUSHAN (537)

WEAPONS SYSTEMS

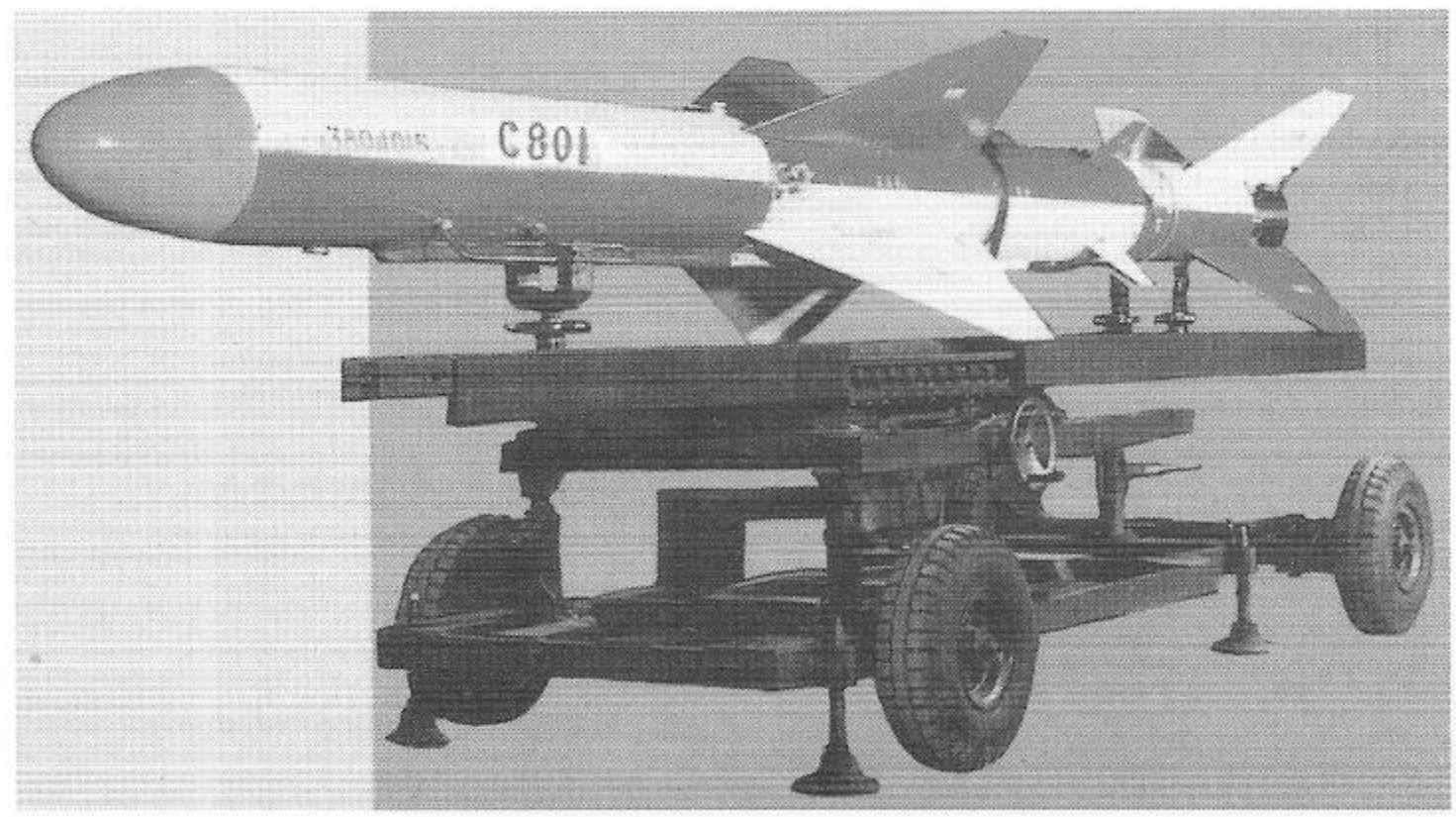
SURFACE-TO-SURFACE MISSILES (SSM)

Ying Ji (Eagle Strike) YJ-1 (C-801) missiles

Jiangu III only. There are eight container-launchers for Ying Ji-1 (YJ-1) (export designation = C-801) SSMs. These container-launchers are mounted in two groups of four, with the forward group located between the stack and the mainmast and the after group abaft the stack. In each group, two container-launchers face to port and two to starboard, pointing forward at an angle of about 30° to the centreline, and with each pair staggered. The YJ-1 is rocket-propelled with a rocket booster, and on launch it climbs to about 50 m (160 ft) then descends to 20-30 m (66-100 ft) until its radar seeker has acquired the target. It then descends to 5-7 m (16-23 ft) using the nose-mounted, monopulse (probably J-band) radar seeker for the terminal approach phase.

Specifications
Length: 5.81 m (19.06 ft)
Diameter: 36 cm (14.17 in)
Wing span: 1.18 m (3.87 ft)
Propulsion: Rocket motor
Weight: 815 kg (1,797 lb)
Range: 8-42 km (4.5-23 n miles)
Speed: Mach 0.9
Guidance: Inertial and active radar
Warhead: 165 kg (363.7 lb) semi-armour-piercing

Manufacturer/Contractor
China Precision Machinery Import and Export Corporation (CPMIEC), Beijing, China.



YJ-1 (C-801) missile on transporter. The missile is 5.81 m (19.06 ft) long (CPMIEC)

YJ-2 (C-802) medium-range anti-ship missile

Jianghu IV only. *Zhoushan* (537) has the same layout for the eight container-launchers as in the Jianghu III, except that in each pair the two container-launchers are close together and side by side, rather than staggered. Also, in the Jianghu IV the missile is the new YJ-2 missile, not the earlier YJ-1. The YJ-2 has the Chinese export designation C-802 and is known to NATO as CSSC-X-8 Saccade. The missile is generally similar to the YJ-1 but is powered by a turbojet with paraffin-based fuel to give a considerable increase in range. To accommodate the new power-plant the fuselage has been extended forward of the wing leading edge with the fuel tank behind the instrument compartment, and an air intake is fitted between the wings on the underside. The wings are slightly modified and now fold, while the launch rail fittings are on the sides, all of which result in a very much slimmer container-launcher. Few details are available about performance but it is reported that it is similar to that of the C-801 but with a lower terminal phase. On launch the missile climbs to about 50 m (160 ft) then descends to 20-30 m (66-100 ft) until the radar seeker has acquired the target. It then descends to wave-top height for the terminal approach phase using the nose-mounted, monopulse (probably J-band), radar seeker.

Specifications
YJ-2 (C-802)
Length: 6.39 m (20.96 ft)
Diameter: 36 cm (14.17 in)
Wing span: 1.18 m (3.87 ft)
Propulsion: Turbojet
Weight: 715 kg (1,576 lb)
Range: 15-120 km (14.5-65 n miles)
Speed: Mach 0.9
Guidance: Inertial and active radar

Manufacturer/Contractor
China Precision Machinery Import and Export Corporation (CPMIEC).

GUNS

100 mm L/56 medium-calibre dual-purpose gun

All Type III and IV ships have two twin-gun turrets. The Chinese 100 mm L/56 is developed from the Soviet B34 100 mm gun, examples of which were supplied in the 1950s. The air-cooled B34 barrel is 5.6 m (18.4 ft) long and of monobloc construction with a horizontal sliding breech block and fits into a sleeve. The recoil cylinder is housed under the gun which fires a 15.6 kg (34.4 lb) shell (6.31 kg (14 lb) projectile) and features a pneumatic rammer. The two barrels share a common cradle, with the trunnions set far back from the front of the turret to achieve high angles of fire. Spent rounds are ejected forward with the chutes running parallel to, but below, the guns. The turret is manned with a crew of five. Within the turret the gun captain occupies a position in front of, and on the left of, the trunnions. It is mounted on a pedestal and originally had an E-band ranging radar, with the NATO codename 'Egg Cup B', on the right at the front.

Specifications

L/56 twin
Length of barrel: 56 calibres
Muzzle velocity: 900 m/s (2,953 ft/s)
Traverse: 360°
Elevation: −15 to +85°
Weight of projectile: 6.31 kg (13.9 lb)
Rate of fire: 18 rds/min
Range:
anti-surface: 12 n miles (22 km)
anti-air: 15,000 m (49,000 ft)

37 mm (W-11-M) mountings

Both Type III and Type IV have four twin 37 mm/62.8 mountings. The barrels are enclosed in separate water jackets with exposed spring recuperators, and a hydraulic recoil buffer underneath the barrel. The loading mechanism consists of guides for ammunition, which is in five-round clips, the clips being automatically removed on the loading tray. The first round is loaded manually into the breech. The breech block rises and the gun fires when the firing pin strikes the cartridge percussion cap. Upon recoil the breech block opens and extractor arms propel the case along the loading tray and down an ejection chute. The recoil forces activate the loading mechanism and allow following rounds to be rammed automatically into the breech.

Specifications

W-11-M
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 860 m/s (2,821 ft/s)
Traverse: 360° at 17°/s
Elevation: −10 to +85° at 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.61 lb)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,842 ft)
Crew: 3

Ammunition (HE-T)
Projectile Weight: 708 g (25 oz)
Explosive charge: 36 g (1.27 oz) (RDX/aluminium)

YJ-2 (C-802) anti-ship missile leaves a land-based launcher (CPMIEC)

ANTI-SUBMARINE MORTARS

RBU 1200 5-tubed fixed launchers

Both Type III and Type IV ships have two RBU 1200 launchers. This mounting is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm (9.8 in), is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (74.95 lb) warhead and a range of about 0.8 n miles. The RBU 1200 is associated with the old short-range HF (25-30 kHz), 'searchlight' attack sonar which was given the NATO codename Stag Ear and has the Soviet designation Tamir.

DEPTH CHARGES

There are two BMB-2 depth-charge projectors and two depth-charge racks.

MINES

These ships can carry up to 60 mines.

Wu Hu *(536), a Jianghu III. The neat layout of the launchers for the YJ-1 (C-801) missile is in marked contrast to the large, bulky — and heavy — launchers for the earlier HY-2 (C-201) missiles*

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Newton-Beta EW suite

All three ships are fitted with an Elettronica Newton-Beta system consisting of an ESM section and an ECM section, with the related antennas, controlled from an operator console. The ESM section provides 100 per cent intercept probability, passive surveillance, automatic instantaneous warning of programmed threat, automatic analysis of threat parameters, automatic identification and tracking of threats, a synthetic data display, instantaneous DF, and broad frequency coverage. The ECM section provides self-protection by noise jamming using an Elettronica jammer.

Manufacturer/Contractor

Elettronica SpA, Rome, Italy.

DECOYS

Type 945 26-barrelled chaff launchers

There are two Chinese-designed and manufactured Type 945 26-barrelled chaff launchers. Their specifications are not known.

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

IFF

High Pole A. Square Head

WEAPONS CONTROL

Round Top

There is a large hemispherical fire-control director, similar to the Russian Round Top with a Sun Visor antenna, as found in some of the Jianghu Is.

RADARS

Eye Shield

Jianghu III/IV ships have an Eye Shield antenna at the masthead. Also known as MX 902 and Type 354, Eye Shield is an air/surface search equipment which is reported to operate in the E band. This may be a development of the Russian Slim Net radar.

Square Tie

Square Tie is an I-band, surface search and fire-control radar (also known as Type 352). The antenna is mounted on a small platform on the forward side of the mainmast.

Fin Curve

The navigation set is the Chinese Fin Curve.

Rice Lamp

The Rice Lamp fire-control director, operating in the I/J band, is located aft at the head of a small tower.

Sun Visor B

Sun Visor B is an I-band, fire-control radar installed on the Round Top director.

Knife Rest

***Zhoushan* (537) only.** *Zhoushan* has a large open work antenna mounted either on a small tower on the forward edge of the stack or at the head of a similar tower on the after deckhouse. The Chinese Navy array has two side by side Yagi antennas and appears to be similar to the Knife Rest found on 1950s-vintage Soviet Navy ships. The (then) Soviet Army used Knife Rest B, which operated over the 79-93 MHz band, with a peak power of 100 kW and has an effective range of 185-280 km.

SONAR

Echo Type 5

One sonar set is fitted to all ships: the hull-mounted, active search and attack, Echo Type 5, operating in the medium sonar frequency band.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Type 18E 390V diesels; 17.6 MW sustained
Auxiliary engines: 4—400 kW; 1—120 kW
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These ships were hulls number 27, 28 and 30 in the Jianghu construction programme and are referred to by the PLA-N as New Missile Frigates. *Huangshi* (535) was commissioned on 14 December 1986 and *Zhoushan* (537), currently the only Jianghu IV, was completed in early 1993. A fourth of the class may be building, but this cannot be confirmed.

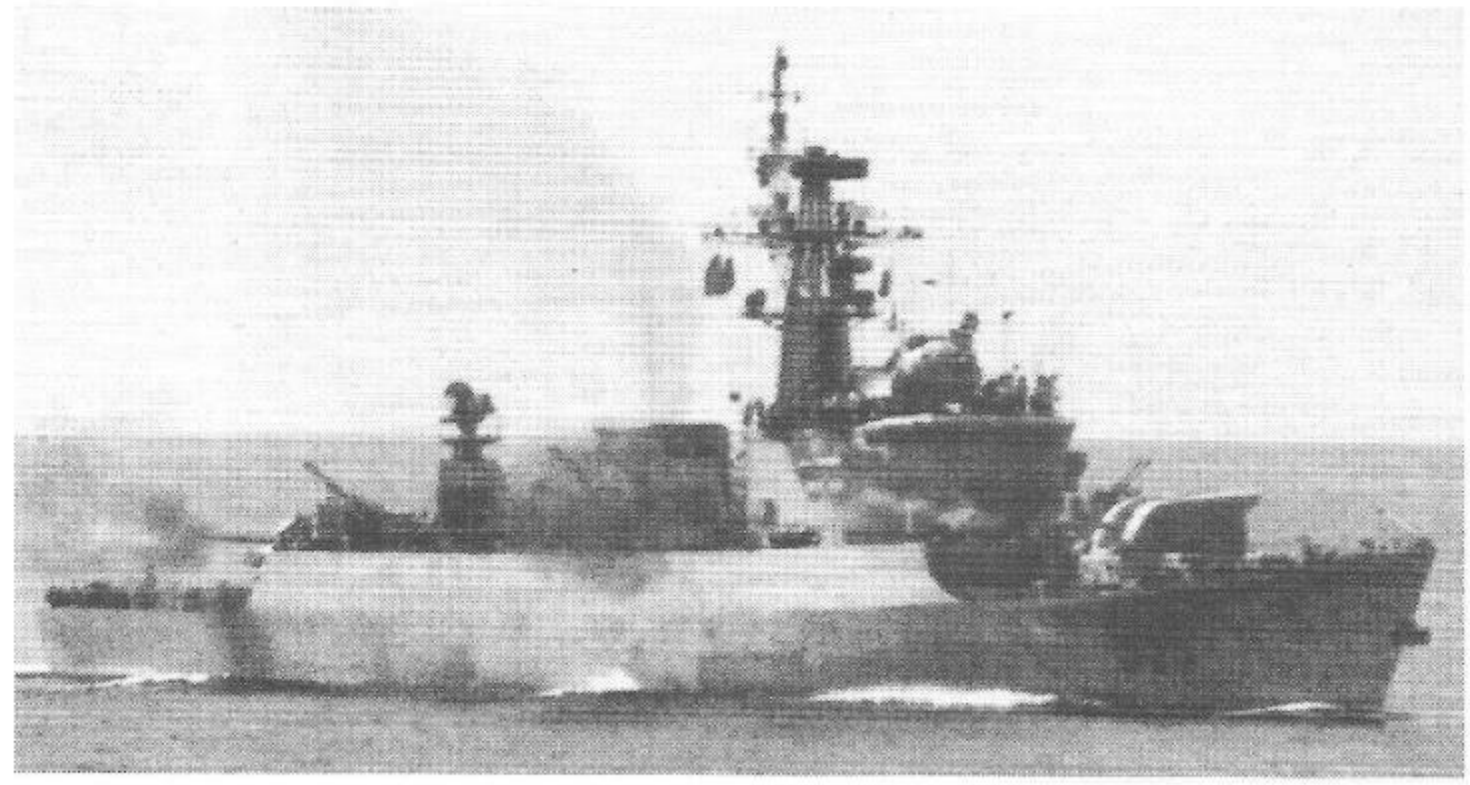
DESIGN

Hull dimensions are identical with Jianghu I and II but the centre section of the main deck is raised by one deck level for about two-thirds of the ship's length. This has enabled the entire working part of the ship to be enclosed and air conditioned for the first time in a Chinese warship.

The lower half of the mast is plated over, but, somewhat surprisingly, the bulwarks fitted in earlier ships are not to be found in these three ships.

MODERNISATION

It has been reported that a CIWS mounting designated PL-8H may be fitted in place of some of the twin 37 mm guns. The same reports indicate that this weapon is a combined 37 mm and SAM system, with the missiles using IR homing.



Huangshi *(535) on a firepower demonstration* (Chien Chung)

OPERATIONAL

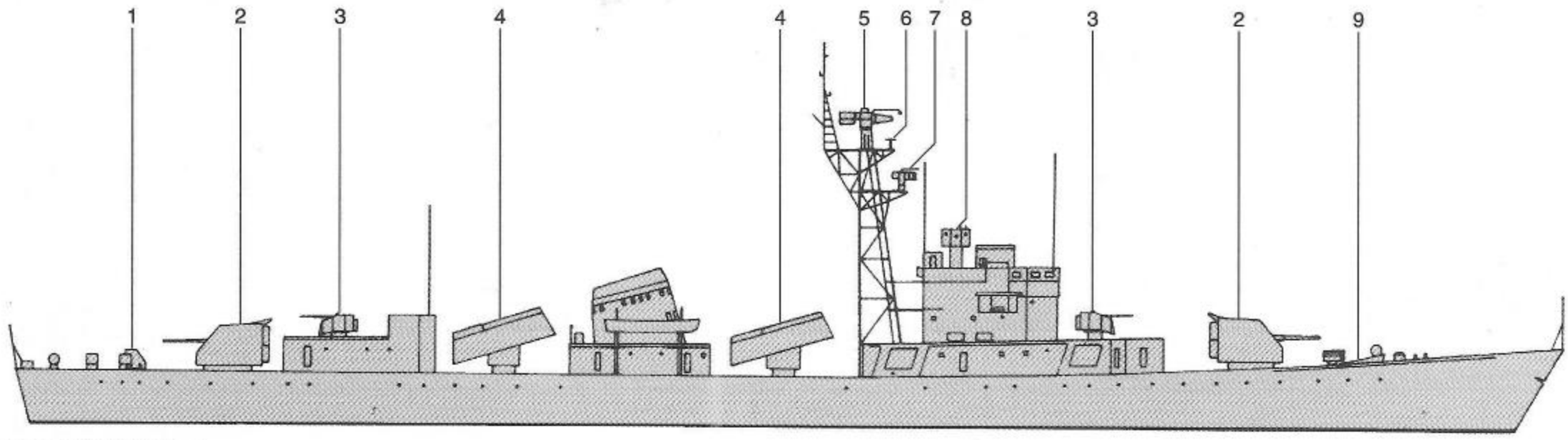
All four units are based in the East Sea Fleet.

EXPORTS

Four modified Type III were delivered to Thailand in 1991/92.

Two versions are on general offer for export. Version 1 is virtually identical to that delivered to Thailand. Version 2 is powered by four MTU 20V1163B TB 83 diesels and has a helicopter landing deck, but not a hangar.

OSMAN (JIANGHU I)



Osman (Ian Sturton)
1 *BMB-2 depth-charge projector* **2** *Twin 100 mm (3.9 in) gun* **3** *Twin 37 mm/63 in open mount* **4** *Twin HY-2 (C-20) anti-ship missile launcher* **5** *Eye Shield (Type 354) air/surface search radar* **6** *Navigation radar* **7** *Square Tie (Type 352) radar* **8** *Fire-control director* **9** *RBU-1200 anti-submarine rocket launcher*

GENERAL SPECIFICATIONS

Country of origin: China, People's Republic
Operator: Bangladesh
Type: Jianghu I (053 H1)

Class: OSMAN

Purchased: 1
Active: 1

Displacement:
standard: 1,425 t
full load: 1,702 t

Dimensions:
Length: 103.2 m (338.6 ft)
Beam: 10.7 m (35.4 ft)
Draught: 3.1 m (10.2 ft)

Speed: 26 kts
Range: 2,700 n miles at 18 kts

Complement: 300 (27 officers)

SHIPS

OSMAN (F 18)		**Launched**	—
Builder	Hudong Shipyard, Shanghai	**Commissioned (PLA-N)**	— (*Xiangtan* (556))
		Commissioned (Bangladesh)	4 Nov 1989
Laid down	—		

WEAPONS SYSTEMS

HY-2 (NATO = CSSC-3 'Seersucker') medium-range anti-ship missile

The Bangladeshi ship is fitted with four HY-2 (Hai Ying = Sea Eagle) (export designation = C-201) anti-ship missiles, mounted in two twin launchers, which must be trained to either beam to fire, but are fixed in elevation. The HY-2 missile was developed from the HY-1, which, in its turn, was developed from the Soviet SS-N-2 Styx. The firing sequence is operated from a dedicated console with its own analogue computer and ripple launches are possible. Once the target is confirmed as hostile the operator manually sets a range gate around it and feeds in location, speed and ballistic data. The computer then feeds the firing solution to the missile autopilot. After launch the HY-2 climbs to its cruise altitude of 30 m (100 ft), which it maintains until entering the terminal phase when it descends to about 8 m (26 ft).

Specifications

Length: 7.36 m (21.15 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.87 m)
Launch weight: 2,500 kg (5,511 lb)
Speed: Mach 0.9
Warhead: 454 kg (1,000 lb) hollow charge
Range: 51 n miles (95 km)
Guidance: Autopilot and active radar, with an alternative IR seeker instead of radar

Manufacturer/Contractor

China Precision Machinery Import and Export Corporation (CPMIEC), Beijing, China.

GUNS

100 mm L/56 medium-calibre dual-purpose gun

Osman has the same fit as PLA-N ships, with two twin Chinese 100 mm L/56. The air-cooled B34 barrel is 5.6 m (18.4 ft) long and of monobloc construction with a horizontal sliding breech block and fits into a sleeve. The recoil cylinder is housed under the gun which fires a 15.6 kg (34.4 lb) shell (6.31 kg (14 lb) projectile) and features a pneumatic rammer.

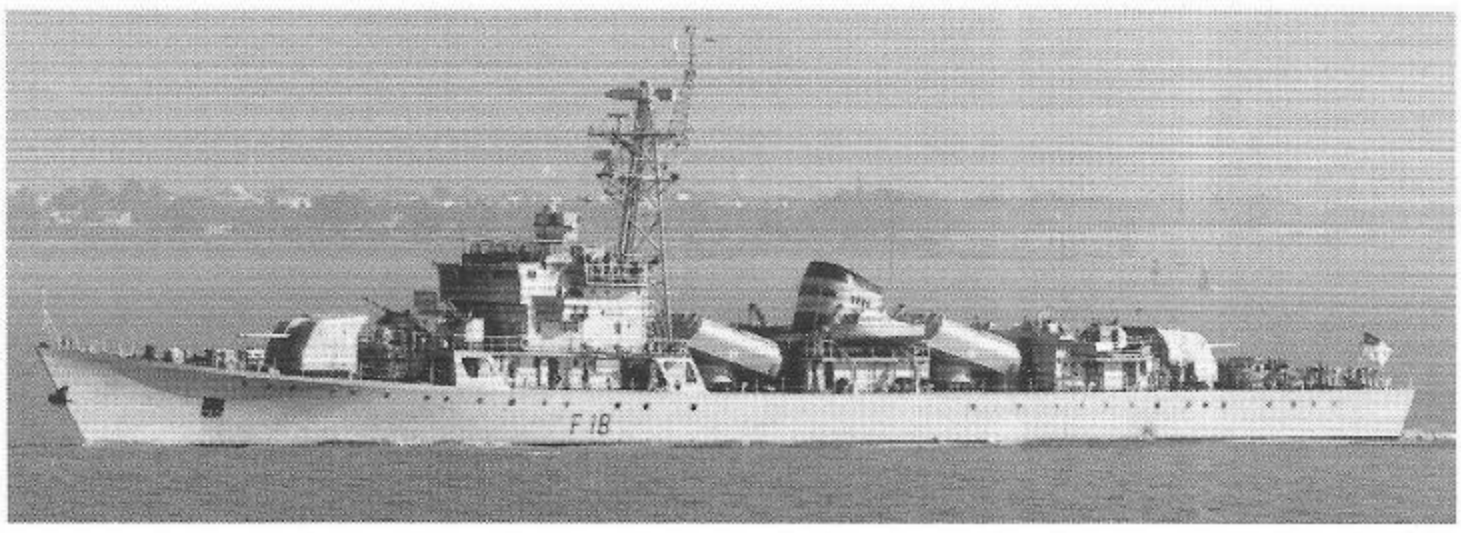
In the twin mounting the two barrels share a common cradle, with the trunnions set far back from the front of the turret to achieve high angles of fire. Spent rounds are ejected forward with the chutes running parallel to, but below, the guns. The turret is manned with a crew of five. Within the turret the gun captain occupies a position in front of, and on the left of, the trunnions. The turret weighs about 15 tonnes and is 6 m (10 ft) high, 7 m (23 ft) long and 5 m (16.4 ft) wide.

Specifications

L/56 twin
Length of barrel: 56 calibres
Muzzle velocity: 900 m/s (2,952 ft)
Traverse: 360°
Elevation: −15 to +85°
Weight of projectile: 6.31 kg (13.9 lb)
Rate of fire: 18 rds/min
Range:
anti-surface: 12 n miles (22 km)
anti-air: 15,000 m (49,000 ft)

37 mm (W-11-M) mountings

Osman has four twin 37 mm/62.8 mountings. The barrels are enclosed in separate water jackets with exposed spring recuperators, and a hydraulic recoil buffer underneath the barrel. The loading mechanism consists of guides for ammunition, which is in five-round clips, the clips being automatically removed on the loading tray. The first round is loaded manually into the breech. The breech block rises and the gun fires when the firing pin strikes the cartridge percussion cap. Upon recoil the breech block opens and extractor arms propel the case along the loading tray and down an ejection chute. The recoil forces activate the loading mechanism and allow following rounds to be rammed automatically into the breech.



Osman *is a Jianghu I Version 4 ship. Unlike the Egyption Jianghu Is, this ship has twin 100 mm guns in gunhouses, rather than 57 mm guns in open mounts*

Specifications
W-11-M
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 860 m/s (2,821 ft/s)
Traverse: 360° at 17°/s
Elevation: −10° at 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.61 lb)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,842 ft)
Crew: 3

Ammunition (HE-T)
Projectile Weight: 708 g (25 oz)
Explosive charge: 36 g (RDX/aluminium) (1.27 oz)

ANTI-SUBMARINE MORTARS

RBU 1200 5-tubed fixed launchers
Some ships have two RBU 1200 launchers, others four. This mounting is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm (9.8 in), is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (74.95 lb) warhead and a range of about 0.8 n miles. The RBU 1200 is associated with the old short-range HF (25-30 kHz), 'searchlight' attack sonar which was given the NATO codename Stag Ear and has the Soviet designation Tamir.

DEPTH CHARGES

There are two BMB-2 depth-charge projectors and two depth-charge racks.

MINES

These ships can carry up to 60 mines.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Jug Pair (Watch Dog)
There are two small domes on the foremast yard-arm. These are designated by NATO as Jug Pair, and appear to be a Chinese-produced version of the Russian Watch Dog radar warning system.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher
There are two Mk 36 SRBOC (Super Rapid Bloom Off-board Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

IFF
High Pole A. Yard Rake or Square Head.

WEAPONS CONTROL

Wok Won
The fire director on the bridge roof is designated Wok Won.

RADARS

Eye Shield
Jianghu III/IV ships have an Eye Shield antenna at the masthead. Also known as MX 902 and Type 354, Eye Shield is an air/surface search equipment which is reported to operate in the E band. This may be a development of the Russian Slim Net radar.

Square Tie
Square Tie is an I-band, surface search and fire-control radar (also known as Type 352). The antenna is mounted on a small platform on the forward side of the mainmast.

Fin Curve
The navigation set is the Chinese Fin Curve.

SONAR

Echo Type 5
One sonar set is fitted to all ships: the hull-mounted, active search and attack, Echo Type 5, operating in the medium sonar frequency band.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Type 12 E 390V diesels; 10.6 MW (14,400 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

Osman was transferred from the PLAN to the Bangladeshi Navy on 26 September 1989 and arrived in Bangladesh waters on 8 October 1989. It was expected that a second ship would transfer in 1991, but this did not take place and whether it was postponed or cancelled has not been established.

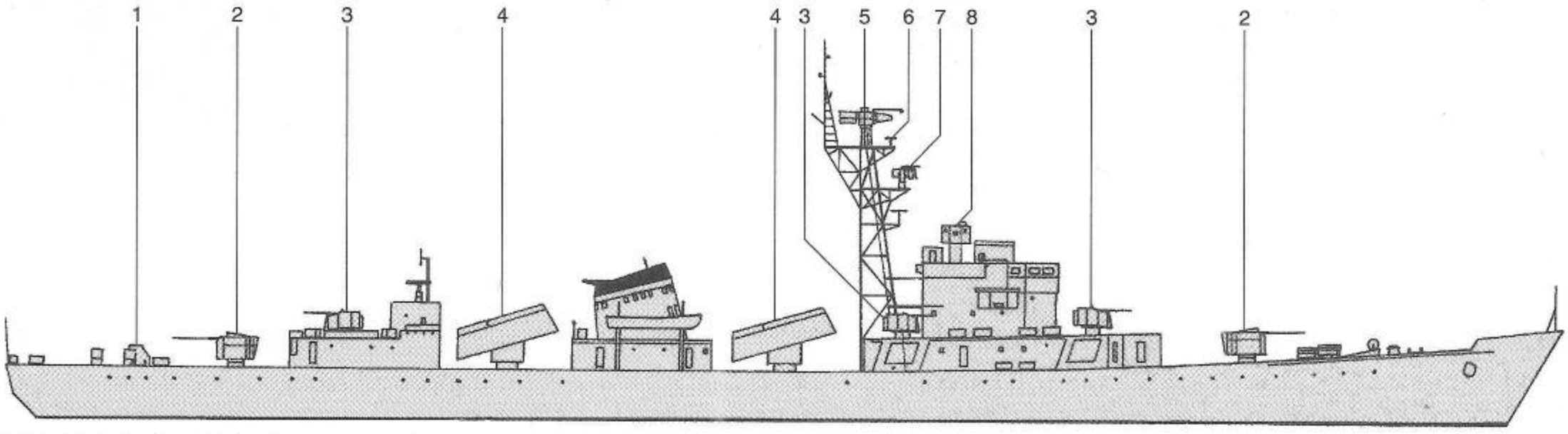
DESIGN

This is a Jianghu Type I (version 4) hull with twin 100 mm guns, a Wok Won director and a rounded stack. It is noteworthy that this ship has the same twin 100 mm guns as the ships in the PLA-N and not the 57 mm guns in open mounts that are in the ships sold to Egypt.

OPERATIONAL

Osman was in collision with a merchant ship in August 1991. Damage was extensive and included one 37 mm mounting uprooted, and several SSM and RBU mountings misaligned. The ship was repaired in 1992/93 and has returned to service.

NAJIM AL ZAFFER (JIANGHU I)



Najim Al Zaffer (Ian Sturton)
1 *BMB-2 depth-charge projector* **2** *Twin 57 mm/70 guns in open mounts* **3** *Twin 37 mm/63 anti-aircraft cannon* **4** *Twin HY-2 (C-201) anti-ship missile launcher* **5** *Eye Shield (Type 765) air/surface search radar* **6** *Navigation radar* **7** *Square Tie (Type 354) surface search/fire-control radar* **8** *Fire-control director*

GENERAL SPECIFICATIONS

Country of origin: China, People's Republic
Operator: Egypt
Type: Jianghu I

Class: NAJIM AL ZAFFER

Purchased: 2
Active: 2

Displacement:
standard: 1,425 t
full load: 1,702 t

Dimensions
Length: 103.2 m (338.5 ft)
Beam: 10.8 m (35.4 ft)

Draught: 3.1 m (10.2 ft)

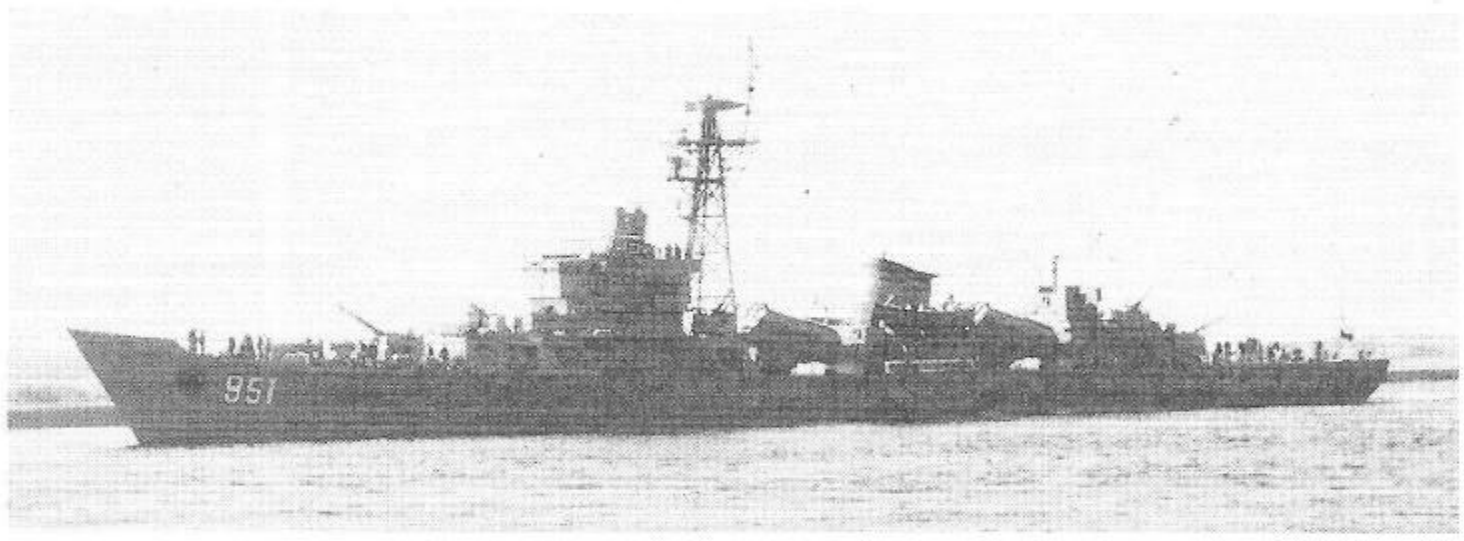
Speed: 26 kts
Range: 4,000 n miles at 15 kts

Complement: 195

SHIPS

NAJIM AL ZAFFER (951)
Builder Hudong, Shanghai, China
Commissioned 27 Oct 1984

EL NASSER (956)
Builder Hudong, Shanghai, China
Commissioned 16 Apr 1985



Najim Al Zaffer *(951)*
(H & L van Ginderen Collection)

WEAPONS SYSTEMS

HY-2 (NATO = CSSC-3 'Seersucker') medium-range anti-ship missile

The Egyptian ships are armed with four HY-2 (Hai Ying = Sea Eagle) (export designation = C-201) anti-ship missiles, mounted in two twin launchers, which must be trained to either beam to fire, but are fixed in elevation. The HY-2 missile was developed from the HY-1, which, in its turn, was developed from the Soviet SS-N-2 Styx. The firing sequence is operated from a dedicated console with its own analogue computer and ripple launches are possible. Once the target is confirmed as hostile the operator manually sets a range gate around it and feeds in location, speed and ballistic data. The computer then feeds the firing solution to the missile autopilot. After launch the HY-2 climbs to its cruise altitude of 30 m (100 ft), which it maintains until entering the terminal phase when it descends to about 8 m (26 ft).

Specifications
Length: 7.36 m (24.15 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.87 m)
Launch weight: 2,500 kg (5,511 lb)
Speed: Mach 0.9
Warhead: 454 kg (1,000 lb) hollow charge
Range: 51 n miles (95 km)
Guidance: Autopilot and active radar, with an alternative IR seeker instead of radar

Manufacturer/Contractor
China Precision Machinery Import and Export Corporation (CPMIEC), Beijing, China.

GUNS

Type 76 57 mm L/70

There are two twin Type 76 57 mm/70 calibre mounts: one in 'A' position on the foredeck, the other in 'Y' position aft. The Chinese Type 76 is a twin barrelled, water-cooled weapon in an open 'bucket' gun mount. It is reported to have an ammunition hoist, feeding and ramming system. Tracking, laying and engagement are either automatic or semi-automatic with manual back-up. The Fog Lamp fire-control device is mounted on the bridge roof.

Specifications
Type 76
Calibre: 57 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Traverse: 360°
Elevation: −5 to +85°
Traverse speed: 25°/s
Elevation speed: 40°/s
Crew: 5

Range:
anti-surface: 4.52 n miles (8.4 km)
anti-air: 4,500 m (15,000 ft)
Rate of fire: 120 rds/min/barrel
Ammunition: 2.81 kg (6.2 lb)

Manufacturer/Contractor
Norinco, Beijing, China.

37 mm (W-11-M) mountings

There are twelve 37 mm/62.8 cannon in six twin mountings. The barrels are enclosed in separate water jackets with exposed spring recuperators, and a hydraulic recoil buffer underneath the barrel. The loading mechanism consists of guides for ammunition, which is in five-round clips, the clips being automatically removed on the loading tray. The first round is loaded manually into the breech. The breech block rises and the gun fires when the firing pin strikes the cartridge percussion cap. Upon recoil, the breech block opens and extractor arms propel the case along the loading tray and down an ejection chute. The recoil forces activate the loading mechanism and allow following rounds to be rammed automatically into the breech.

Specifications
W-11-M
Calibre: 37 mm

El Nasser *(956) in 1994. Note the open mounts for both 37 mm and 57 mm guns* (Camil Busquets i Vilanova)

Length of barrel: 62.8 calibres
Muzzle velocity: 886 m/s (2,906 ft/s)
Traverse: 360° at 17°/s
Elevation: −10 to +85° at 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.61 lb)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,840 ft)
Crew: 3

Ammunition (HE-T)
Projectile weight: 708 g
Explosive charge: 36 g (RDX/aluminium)

ANTI-SUBMARINE MORTARS

RBU 1200 5-tubed fixed launchers

There are two RBU 1200 launchers on the foredeck. This mounting is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm, is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (81.6 lb) warhead and a range of about 0.8 n miles. The RBU 1200 is associated with the old short-range HF (25-30 kHz), 'searchlight' attack sonar which was given the NATO codename Stag Ear and has the Soviet designation Tamir.

DEPTH CHARGES

There are two BMB-2 depth-charge projectors and two depth-charge racks.

MINES

These ships can carry up to 60 mines.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Newton-Beta EW suite

An Elettronica EW suite was fitted after these two ships arrived in Egypt. The Newton-Beta system consists of an ESM section and an ECM section, with the related antennas, controlled from an operator console. The ESM section (ELT/211 receiver) provides 100 per cent intercept probability, passive surveillance, automatic instantaneous warning of programmed threat, automatic analysis of threat parameters, automatic identification and tracking of threats, a synthetic data display, instantaneous DF, and broad frequency coverage. The ECM section provides self-protection by noise jamming using the ELT/318 jammer.

Manufacturer/Contractor
Elettronica SpA, Rome, Italy.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

There is an optical fire-control director on the bridge roof.

RADARS

Eye Shield

Both frigates have an Eye Shield antenna at the masthead. Also known as MX 902 and Type 354, Eye Shield is an air/surface search equipment which is reported to operate in the E band. This may be a development of the Russian Slim Net radar.

Square Tie

Square Tie is an I-band, surface search and fire-control radar (also known as Type 352). The antenna is mounted on a small platform on the forward side of the mainmast.

Racal-Decca RM 1290A

There are two RM 1290A I-band navigation radar antennas: one is on the yard-arm, the other on the after deckhouse.

SONAR

Echo Type 5

One sonar set is fitted to all ships: the hull-mounted, active search and attack, Echo Type 5, operating in the medium-sonar frequency band.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Type 12 E 390V diesels; 10.6 MW (14,400 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

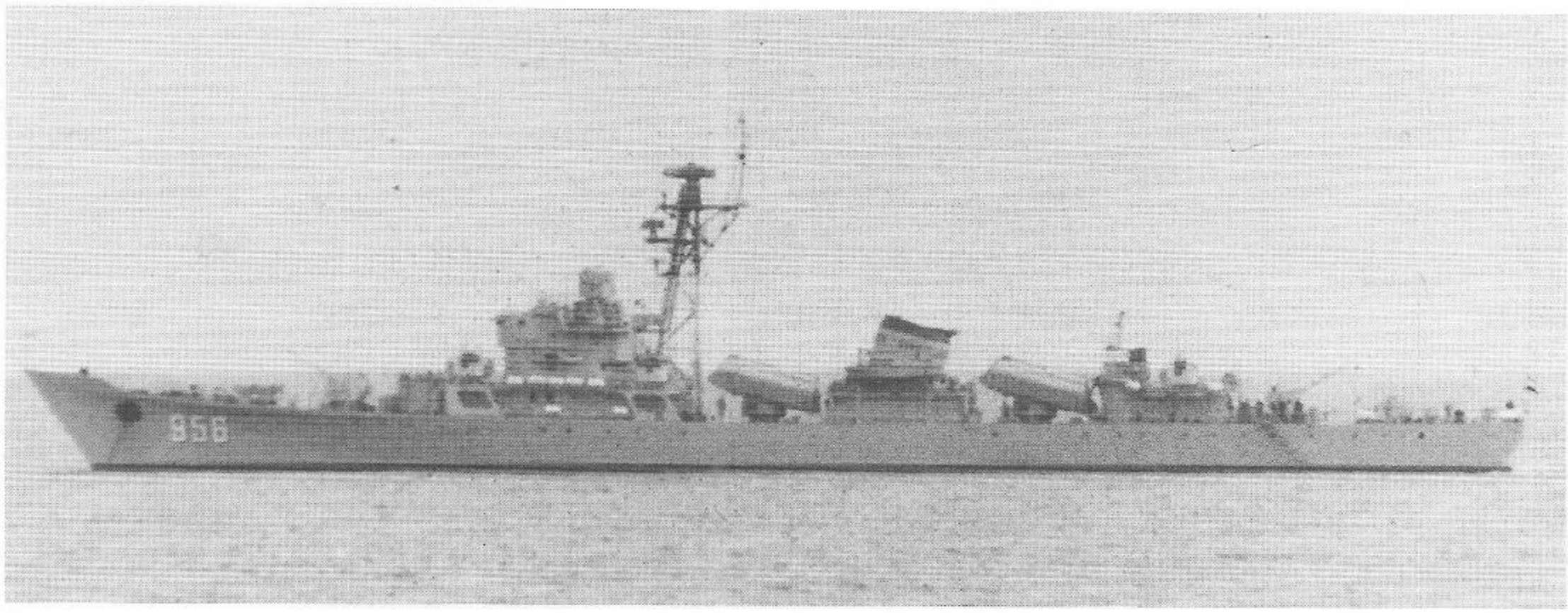
These two ships were ordered from China in 1982 and were taken from the PLA-N's production line; they were the 17th and 18th in the series. Following modifications, they were delivered in 1984/85.

DESIGN

The 'Najim al Zaffer' class is basically a Jianghu I frigate design, but with some major modifications. Instead of the 100 mm guns in the Chinese originals, the Egyptian ships are fitted with two twin 57 mm mounts, which, in addition to being a somewhat elderly design and very light for this size of ship, have no gun housing or radar control. Operating under local control and in the open, their efficiency, especially at night or in bad weather must be impaired. The funnel is the rounded version of the 'Jianghu' class and the short-type bulwarks are fitted.

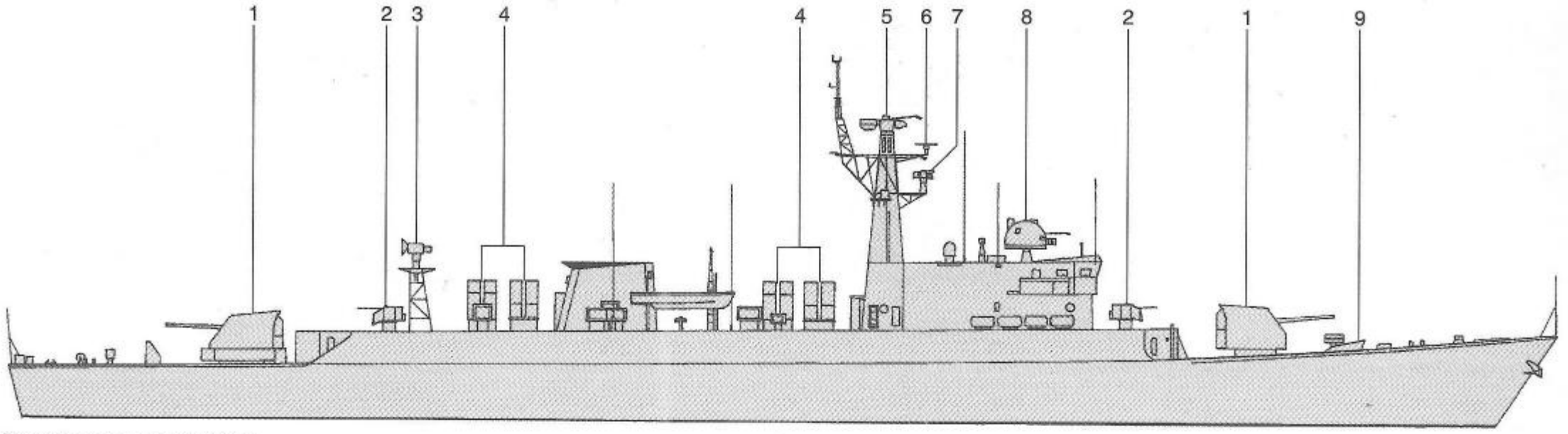
MODERNISATION

The Egyptian Navy has wanted to modernise these ships for some years, but has been frustrated by a lack of money. Funds are now believed to be available and a combat data system is to be fitted, together with CSEE Naja electro-optic fire-control directors. There are also plans, confirmed in October 1994, to remove the after superstructure and guns and build a flight deck for an SH-2G Seasprite helicopter.



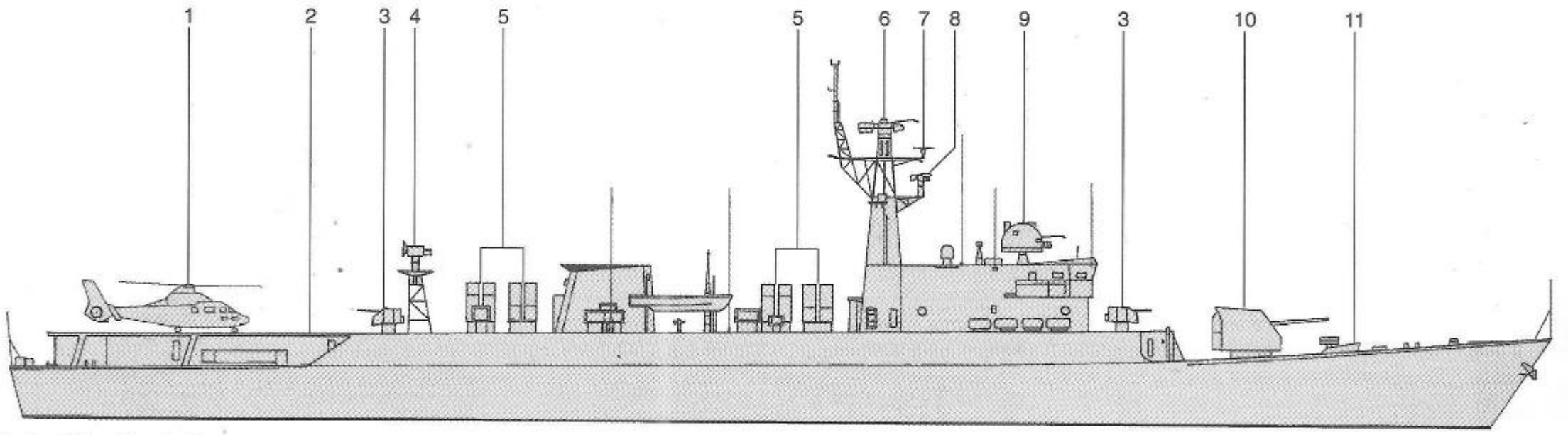
El Nasser *(956). The Egyptian Navy has been seeking to modernise these ships for some years, but has been frustrated by lack of funds* (Jane's/H M Steele)

CHAO PHRAYA (JIANGHU)



Chao Phraya (Ian Sturton)

1 *Twin 100 mm/56 gun* **2** *Twin 37 mm/76 anti-aircraft cannon in open mount* **3** *Rice Lamp (Type 341) fire director* **4** *Four Ying Ji (YJ-1/C-801) anti-ship missiles* **5** *Eye shield (Type 354) air/surface search radar* **6** *Racal-Decca 1290 navigation radar* **7** *Rice Lamp (Type 341) radar* **8** *Sun Visor (Type 343) fire-control director* **9** *RBU-1200 anti-submarine rocket launcher*



Kraburi (Ian Sturton)

1 *Helicopter* **2** *Flight deck* **3** *Twin 37 mm/76 anti-aircraft cannon in open mount* **4** *Rice Lamp (Type 341) fire director* **5** *Four Ying Ji (YJ-1/(C-801) anti-ship missiles* **6** *Eye Shield (Type 354) air/surface search radar* **7** *Racal-Decca 1290 navigation radar* **8** *Rice Lamp (Type 341 radar)* **9** *Sun Visor (Type 343) fire-control director* **10** *Twin 100 mm/56 gun* **11** *RBU-1200 anti-submarine rocket launcher*

GENERAL SPECIFICATIONS

Country of origin: China, People's Republic
Operator: Thailand
Type: 053 HT/053 HT (H)

Class: CHAO PHRAYA

Purchased: 4
Active: 4

Displacement:
standard: 1,676 t
full load: 1,924 t

Dimensions
Length: 103 m (338 ft)
Beam:
455, 456: 10.83 m (35.5 ft)
457, 458: 10.7 m (35.1 ft)
Draught: 3.1 m (10.2 ft)

Speed:
455, 456: 28 kts
457, 458: 30 kts
Range:
455, 456: 3,500 n miles at 18 kts
457, 458: 2,500 n miles at 18 kts
Endurance: 10 days

Complement: 168 (22 officers)

SHIPS

CHAO PHRAYA (455)
Builder Hudong Shipyard, Shanghai, China
Laid down 1989
Launched 24 Jun 1990
Commissioned 5 Apr 1991

BANGPAKONG (456)
Builder Hudong Shipyard, Shanghai, China
Laid down 1989
Launched 25 Jul 1990
Commissioned 20 Jul 1991

KRABURI (457)
Builder Hudong Shipyard, Shanghai, China
Laid down 1990
Launched 28 Dec 1990
Commissioned 16 Jan 1992

SAIBURI (458)
Builder Hudong Shipyard, Shanghai, China
Laid down 1990
Launched 27 Aug 1991
Commissioned 4 Aug 1992

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Ying Ji (Eagle Strike) YJ-1 (C-801) missiles

There are eight container-launchers for Ying Ji-1 (YJ-1) (export designation = C-801) SSMs. The mountings differ from those in the PLA-N's Jianghu IIIs in that they point outwards at 90° to the centreline, as opposed to some 30° in the Chinese ships. The YJ-1 is rocket-propelled with a rocket booster, and on launch it climbs to about 50 m (160 ft) then descends to 20-30 m (66-100 ft) until its radar seeker has acquired the target. It then descends to 5-7 m (16-23 ft) using the nose-mounted, monopulse (probably J-band) radar seeker for the terminal approach phase.

Specifications

Length: 5.81 m (19.06 ft)
Diameter: 36 cm (14.17 in)
Wing span: 1.18 m (3.87 ft)
Propulsion: Rocket motor
Weight: 815 kg (1,797 lb)
Range: 4.5-45.9 n miles (8-85 km)
Speed: Mach 0.9
Guidance: Inertial and active radar
Warhead: 165 kg (363.7 lb) semi-armour-piercing

Manufacturer/Contractor

China Precision Machinery Import and Export Corporation (CPMIEC), Beijing, China.

GUNS

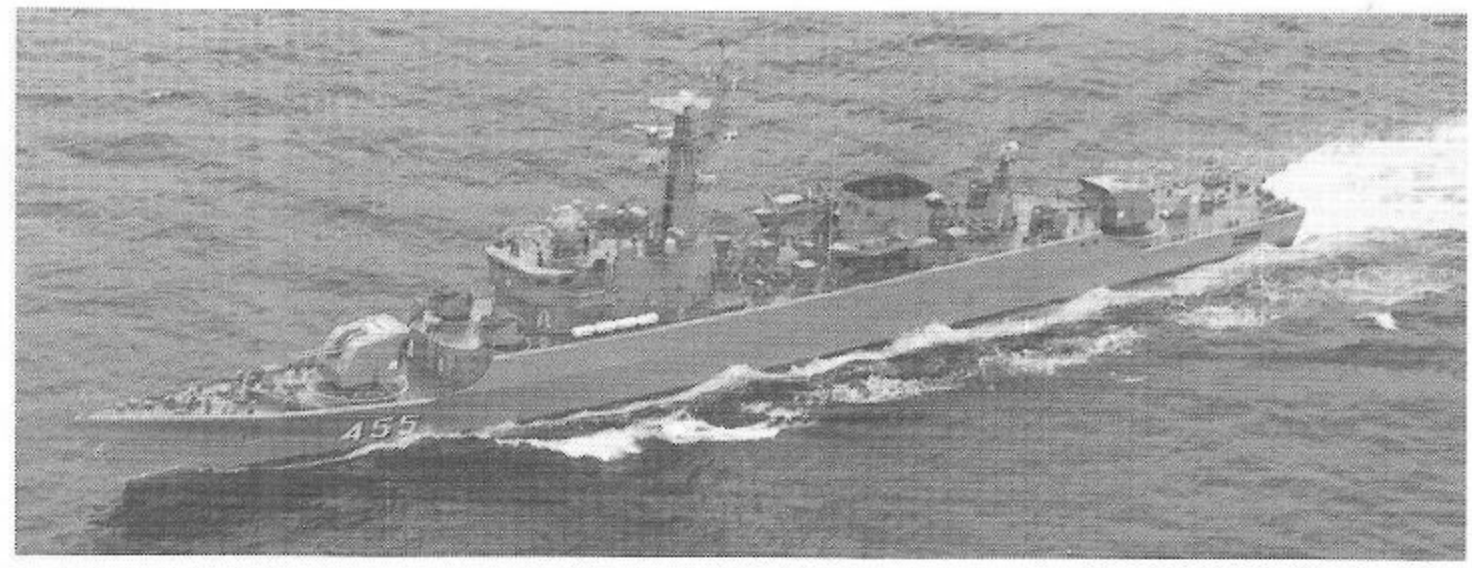
100 mm L/56 medium-calibre dual-purpose gun

455, 456 — two twin 100 mm L/56; 457, 458 — one twin 100 mm L/56. Two of the Thai ships have two twin turrets, one in 'A' position, the other in 'Y' position. The other two ships have a single turret in 'A' position. The air-cooled B34 barrel is 5.6 m (18.4 ft) long and of monobloc construction with a horizontal sliding breech block and fits into a sleeve. The recoil cylinder is housed under the gun which fires a 15.6 kg (34.4 lb) shell (6.31 kg (14 lb) projectile) and features a pneumatic rammer. The two barrels share a common cradle, with the trunnions set far back from the front of the turret to achieve high angles of fire. Spent rounds are ejected forward with the chutes running parallel to, but below, the guns. The turret is automatic.

Specifications
L/56 twin
Length of barrel: 56 calibres
Muzzle velocity: 900 m/s (2,953 ft/s)
Traverse: 360°
Elevation: −15 to + 85°
Weight of projectile: 6.31 kg (13.9 lb)
Rate of fire: 18 rds/min
Range:
anti-surface: 12 n miles (22 km)
anti-air: 15,000 m (49,000 ft)

37 mm (W-11-M) mountings

There are four twin 37 mm/62.8 cannon in open mountings. The barrels are enclosed in separate water jackets with exposed spring recuperators, and a hydraulic recoil buffer underneath the barrel. The loading mechanism consists of guides for ammunition, which is in five-round clips, the clips being automatically removed on the loading tray. The first round is loaded manually into the breech. The breech block rises and the gun fires when the firing pin strikes the cartridge percussion cap.



Chao Phraya *(455), one of four 'Jianghu' class frigates purchased by Thailand. The YJ-1 (C-801) missiles normally sited abaft the mast are not fitted on this occasion*

Upon recoil the breech block opens and extractor arms propel the case along the loading tray and down an ejection chute. The recoil forces activate the loading mechanism and allow following rounds to be rammed automatically into the breech.

Specifications
W-11-M
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 886 m/s (2,906 ft/s)
Traverse: 360° at 17°/s
Elevation: −10 to +85° at 13°/s
Rate of fire: 80 rds/min
Ammunition (projectile): 0.732 kg (1,61 lb)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,842 ft)
Crew: 3

Ammunition (HE-T)
Projectile Weight: 708 g (25 oz)
Explosive charge: 36 g (1.27 oz) (RDX/aluminium)

ANTI-SUBMARINE MORTARS

RBU 1200 5-tubed fixed launchers

There are two RBU 1200 launchers on the forecastle. This mounting is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm, is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (74.95 lb) warhead and a range of about 0.8 n miles. The RBU 1200 is associated with the old short-range HF (25-30 kHz), 'searchlight' attack sonar which was given the NATO codename Stag Ear and has the Soviet designation Tamir.

DEPTH CHARGES

There are two BMB-2 depth-charge projectors and two depth-charge racks.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Type 923(1) intercept/Type 981(3) jammer

The EW suite is reported to be of Italian design but Chinese manufacture.

DECOYS

Type 945 26-barrelled chaff launchers

There are two Chinese-designed and manufactured Type 945 26-barrelled chaff launchers. Their specifications are not known.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Type ZKJ-3 action data automation

All four ships are reported to be fitted with an action data automation system of Chinese design and manufacture. This may be the same as (or similar to) the system known as the Type 88.

COMMUNICATIONS AND DATALINKS

The communications system is reported to be of German design and Chinese manufacture.

IFF

Type 651.

RADARS

Type 354 (NATO = Eye Shield)

All four Thai ships have a Type 354 (Eye Shield) antenna at the masthead. Also known as MX 902, the Type 354 is an air/surface search equipment which is reported to operate in the E band. This may be a development of the Russian Slim Net radar.

Type 352C (NATO = Square Tie)

Type 352C is an I-band, surface search radar, which also serves as the fire-control radar for the YJ–1 SSMs. The antenna is mounted on a small platform on the forward side of the mainmast.

Type 343 (NATO = Sun Visor)

The Type 343 is an I-band fire-control radar for the 100 mm guns. It is located on the Round House fire director.

Type 341 (NATO = Rice Lamp)

The Rice Lamp fire-control director for the 37 mm guns, operates in the I/J band, and is located aft at the head of a small tower.

Racal-Decca 1290 A/D ARPA

The navigation radar is a Racal-Decca 1290 equipment working in the I band.

SONAR

Type SJD-5A

Type SJD-5A is a hull-mounted, active search and attack, medium-frequency sonar. (It should be noted that a model in a CSSC brochure of a ship very similar to the Thai helicopter-carrying frigate appears to have no hull-mounted dome, but does have a bow dome.)

AVIATION

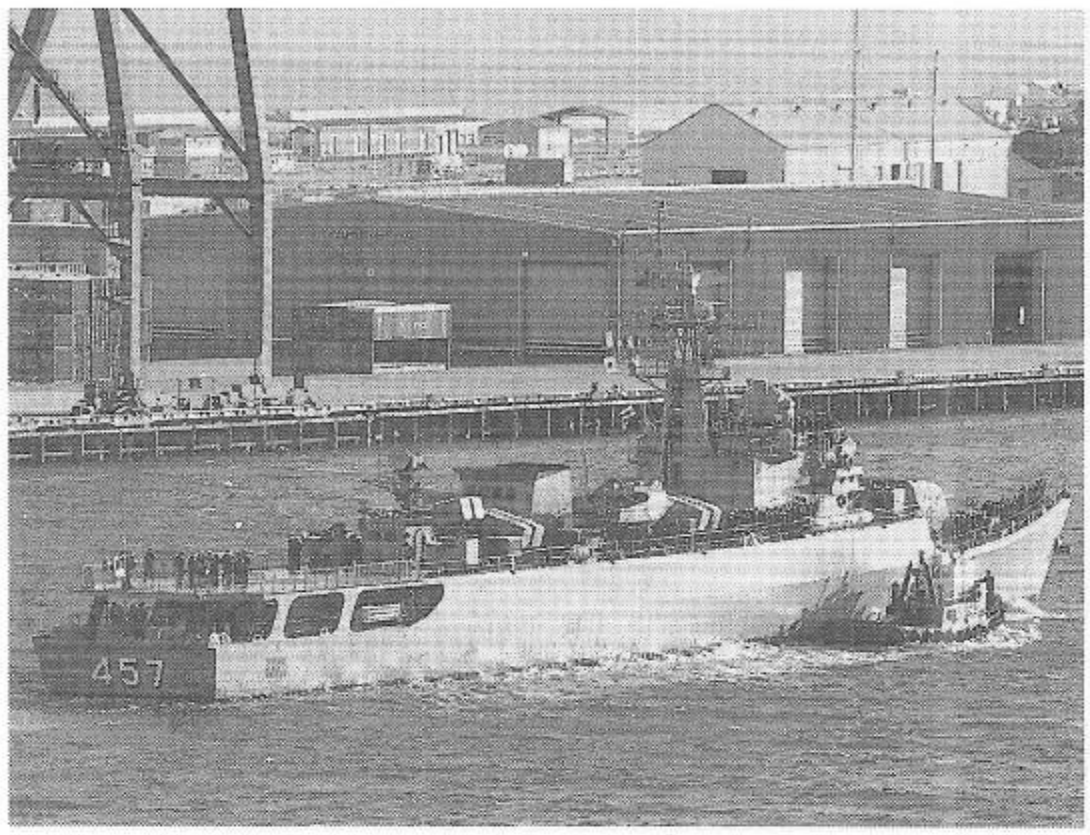
AVIATION FACILITIES

Specifications

Flight deck: *Kraburi* (457) and *Saiburi* (458) only are fitted with a flight deck but there is no hangar .

HELICOPTERS

The RTN operates a number of Bell Model 212 multi-role helicopters and took delivery of its first S-70B7 in late 1996. Either of these types could use the flight deck, although the SH-2Gs, reported to be on order, would appear more suitable. The Thai ships do not, however, currently have the appropriate datalinks and terminal systems necessary to operate the LAMPS I or III systems.



Kraburi *(457) showing the helicopter deck fitted on two of the four Thai ships*
(P. Lewis, RAN)

Kraburi *(457) with Bell 212 helicopter aboard; there is no hangar*

PROPULSION

Specifications

System: Diesel
Main machinery: 4 MTU 20V 1163 TB83 diesels; 21.6 MW (29,440 hp(m)) sustained
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

The contract was signed on 18 July 1988 for the delivery of four modified 'Jianghu' class frigates to be built by the China State Shipbuilding Corporation (CSSC). These were delivered in 1991 and 1992 but, on arrival in Thailand, each ship had to be docked to make good poor shipbuilding standards and to improve the damage control capabilities. It was also planned to build two more Type 053 HT(H) in Thailand in due course, but this plan appears to have been postponed, if not cancelled.

STRUCTURE

Thailand would have preferred only the hulls so that it could outfit the ships themselves, but China insisted on supplying them fully armed. Two of the ships are the Type III variant with 100 mm guns, fore and aft, while the other two are a variation with a helicopter platform replacing the after 100 mm gun.

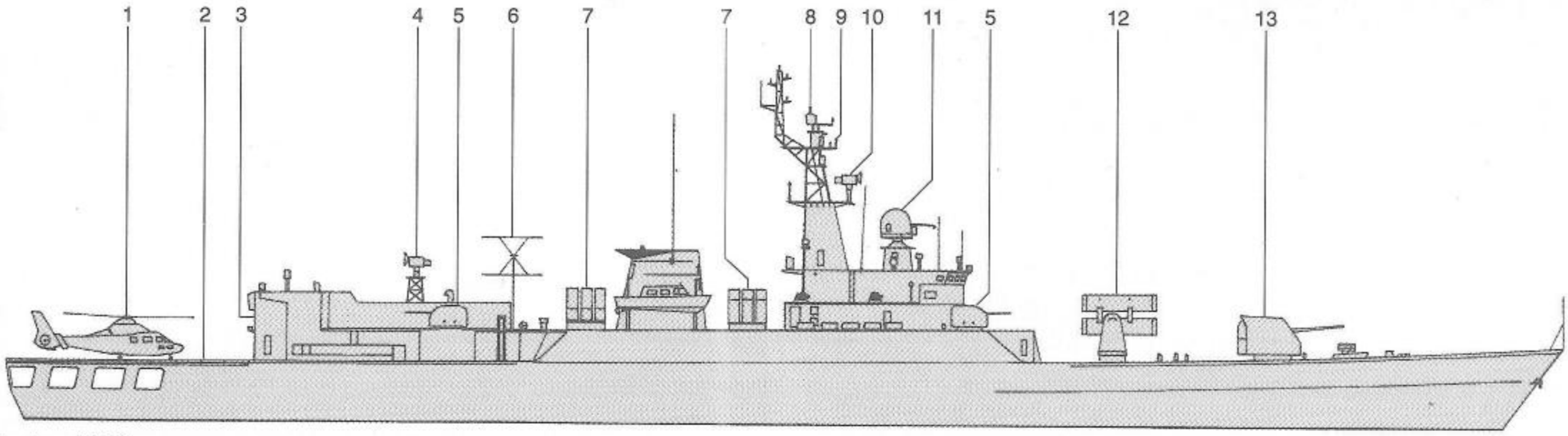
MODERNISATION

It is possible that an HQ-61 launcher for PL-9 will be fitted in due course.

OPERATIONAL

Currently, these ships are mostly used for rotating monthly to the coastguard, and for training.

JIANGWEI



Anqing *(539)*
1 *Harbin Z-9A (licence-built AS 365 Dauphin 2)* **2** *Flight deck* **3** *Hangar* **4** *Rice Lamp fire control (for 37 mm cannon)* **5** *Chinese twin 37 mm/63 (enclosed mounts)* **6** *Knife Rest long-range air search radar* **7** *Triple launchers for YJ-1 (Eagle Strike) anti-ship missiles* **8** *Eye Shield air/surface search radar* **9** *Racal-Decca 1290 navigation radar* **10** *Fog Lamp fire control (for SAM)* **11** *Sun Visor fire-control director* **12** *HQ-61 six-tube launcher for PL-9 SAM* **13** *Chinese twin 100 mm (3.9 in)/56 guns (enclosed mount)*

GENERAL SPECIFICATIONS

Operator: China, People's Republic

Class: JIANGWEI

Built: 4
Active: 4
Building: 2

Displacement:
full load: 2,250 t

Dimensions
Length: 111.7 m (366.5 ft)
Beam: 12.1 m (39.7 ft)
Draught: 4.8 m (15.7 ft)

Speed: 25 kts
Range: 4,000 n miles at 18 kts

Complement: 170

SHIPS

ANQING (539)

Builder	Hudong Shipyard, Shanghai, China
Laid down	1988
Launched	Jul 1991
Completed	Dec 1991

HUAINAN (540)

Builder	Hudong Shipyard, Shanghai, China
Laid down	1989
Launched	Dec 1991
Completed	Dec 1992

HUAIBEI (541)

Builder	Hudong Shipyard, Shanghai, China
Laid down	1990
Launched	Mar 1993
Completed	Aug 1993

TONGLING (542)

Builder	Hudong Shipyard, Shanghai, China
Laid down	1991
Launched	Sep 1993
Completed	Oct 1994

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Builder	Hudong Shipyard, Shanghai, China
Laid down	1993
Launched	1995
Completed	1996

Huainan. *The unique six-tube launcher for PL-9 SAMs is on the foredeck. The system is large and there are no reloads, but it gives the PLA-N a seaborne SAM capability for the first time. Note also the Sun Visor fire-control director on the bridge roof* (H & L van Ginderen Collection)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Ying JI (Eagle Strike) YJ-1 (C-801) missiles

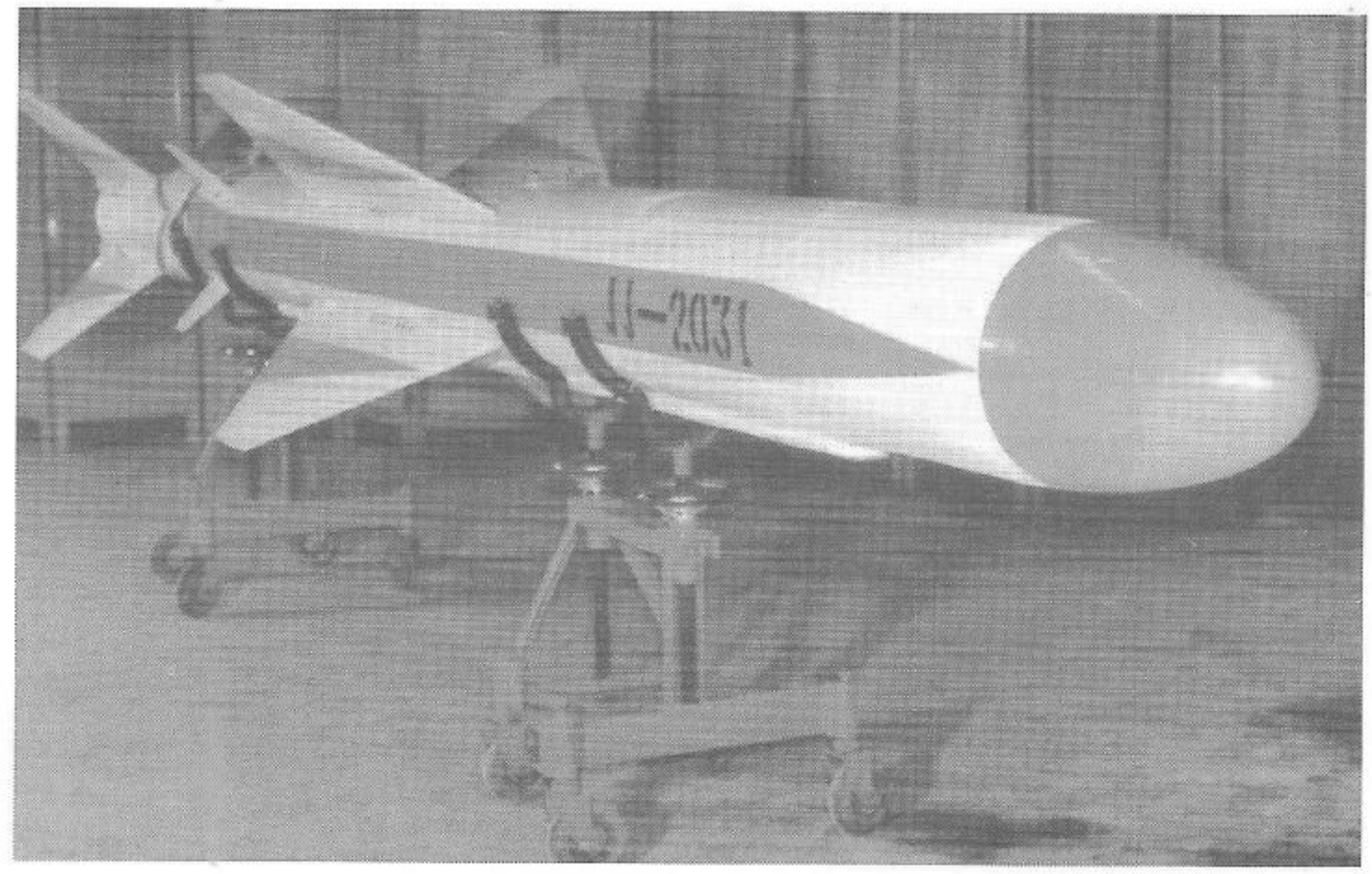
There are six container-launchers for Ying Ji-1 (YJ-1) (export designation = C-801) SSMs in two groups of three before and abaft the stack. The mountings differ from those in the PLA-N's Jianghu IIIs in that they point outwards at 90° to the centreline, as opposed to some 30° in the earlier ships. The YJ-1 is rocket-propelled with a rocket booster, and on launch it climbs to about 50 m (160 ft) then descends to 20-30 m (66-100 ft) until its radar seeker has acquired the target. It then descends to 5-7 m (16-23 ft) using the nose-mounted, monopulse (probably J-band) radar seeker for the terminal approach phase. If the extended range YJ-2 (C-802) is fitted, range is increased to 66 n miles (120 km).

Specifications

Length: 5.81 m (19.06 ft)
Diameter: 36 cm (14.17 in)
Wing span: 1.18 m (3.87 ft)
Propulsion: Rocket motor
Weight: 815 kg (1,797 lb)
Range: 4.5-45.9 n miles (8-85 km)
Speed: Mach 0.9
Guidance: Inertial and active radar
Warhead: 165 kg (363.7 lb) semi-armour-piercing

Manufacturer/Contractor

China Precision Machinery Import and Export Corporation (CPMIEC), Beijing, China.



C-801 anti-ship missile

SURFACE-TO-AIR MISSILES (SAM)

SD-1 (CSA-N-2) point defence system

SD-1, the naval version of the land-based HQ-61, consists of the missile, a launcher-handling system and a radar fire-control system. The missile has cruciform control surfaces and there appears to be at least one command link antenna between the tail surfaces and another may be found on the other side of the body. There is a CW semi-active radar seeker in the nose which is claimed to be extremely accurate and to have an anti-jamming capability. Behind it is an impact/proximity fuze, with a 'chain fragment type' warhead behind the wings. The missile is powered by a solid propellant booster-sustainer rocket motor.

Earlier versions of the missile were launched from a twin-arm launcher, using two massive steel beams, but in the 'Jiangwei' class there is a new launcher with six large cylinders. There appear to be no reloads.

Chinese officials state that a vertical launch version is installed in the 'Jiangwei' class frigates, but there is no evidence of such an installation. However, the missile tubes are raised to nearly 90° for launch and it may be that this is meant rather than a vertical launch system as found in the US Mk 41 GMVLS.

The system apparently uses the 'Fog Lamp' fire-control radar, which is a Chinese development of the Soviet 'Screech' family of fire-control radars. It is an H/I-band system with dish-shaped antenna and illuminating feed support assembly. There appears to be a transmitter-receiver housing behind the antenna, which is probably stabilised. The antenna assembly is mounted at the head of a tall steel plinth. Targets are designated through the air search radar which, in the case of the Jiangwei is the 'Rice Screen' G-band 3D radar.

Specifications

Length: 3.99 m (13.1 ft)
Diameter: 28.6 cm (11.26 in)
Wing span: 99.7 cm (39.25 in)
Launch weight: 320 kg (705 lb)
Speed: Mach 3
Range: 1.4-6.5 n miles (2.5-12 km)
Altitude: 10,000 m (33,000 ft)
Guidance: Command with semi-active radar terminal homing

Manufacturer/Contractor

China Precision Machinery Import and Export Company (CPMIEC), Beijing, China.

GUNS

100 mm L/56 medium-calibre dual-purpose gun

There is a single, twin-gun, automatic turret in 'A' position. The air-cooled B34 barrel is 5.6 m (18.4 ft) long and of monobloc construction with a horizontal sliding breech block and fits into a sleeve. The recoil cylinder is housed under the gun which fires a 15.6 kg (34.4 lb) shell (6.31 kg (14 lb) projectile) and features a pneumatic rammer. The two barrels share a common cradle, with the trunnions set far back from the front of the turret to achieve high angles of fire. Spent rounds are ejected forward with the chutes running parallel to, but below, the guns.

Specifications

L/56 twin
Length of barrel: 56 calibres
Muzzle velocity: 900 m/s (2,953 ft/s)
Traverse: 360°
Elevation: −15 to + 85°
Weight of projectile: 6.31 kg (13.9 lb)
Rate of fire: 18 rds/min
Range:
anti-surface: 12 n miles (22 km)
anti-air: 15,000 m (49,000 ft)

37 mm (W-11-M) mountings

There are four twin 37 mm/62.8 cannon in automatic mountings. The barrels are enclosed in separate water jackets with exposed spring recuperators, and a hydraulic recoil buffer underneath the barrel. The loading mechanism consists of guides for ammunition, which is in five-round clips, the clips being automatically removed on the loading tray. The first round is loaded manually into the breech. The breech block rises and the gun fires when the firing pin strikes the cartridge percussion cap. Upon recoil the breech block opens and extractor arms propel the case along the loading tray and down an ejection chute. The recoil forces activate the loading mechanism and allow following rounds to be rammed automatically into the breech.

Specifications

Calibre: 37 mm
Length of barrel: 63 calibres
Muzzle velocity: 886 m/s (2,906 ft/s)
Traverse: 360° at 17°/s
Elevation: −10 to +85° at 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.61 lb)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,842 ft)
Crew: 3

Ammunition (HE-T)
Projectile Weight: 708 g (25 oz)
Explosive charge: 36 g (1.27 oz) (RDX/aluminium)

ANTI-SUBMARINE MORTARS

RBU 1200 5-tubed fixed launchers

There are two RBU 1200 launchers on the forecastle. This mounting is about 1.5 m high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm, is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (74.95 lb) warhead and a range of about 0.8 n miles. The RBU 1200 is associated with the old short-range HF (25-30 kHz), 'searchlight' attack sonar which was given the NATO codename Stag Ear and has the Soviet designation Tamir.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

RWD-8/NJ81-3

The EW suite consists of an RWD8 radar intercept and warning system, and an NJ81-3 jammer. There are two flat-topped domes on the yard-arm, similar to the Russian Top Hat, which may be the jammer antennas.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are two Mk 36 SRBOC (Super Rapid Bloom Off-board Countermeasures) units.

Specifications

Launcher

Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)

Weight: 173 kg (381.4 lb)

Range: 2.2 n miles (4 km)

Rounds

Diameter: 130 mm (5.1 in)

Length, weight:

Mk 182: 1,209 mm; 22.7 kg

Super Chaffstar: 1,209 mm; 20.9 kg

Super Gemini: 451 mm; 5.5 kg

Super Hiram III: 1,220 mm; 13.6 kg

Super Hiram IV: 467 mm; 3.8 kg

Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.

Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

Type 945 26-barrelled chaff launchers

In addition to the two Mk 36 SRBOC launchers, there are also two Chinese-designed and manufactured Type 945 26-barrelled chaff launchers. Their specifications are not known.

COMMAND AND CONTROL SYSTEMS

RADARS

Type 354 (Eye Shield)

As in the Jianghu frigates, there is a Type 354 (Eye Shield) antenna at the masthead. Also known as MX 902, the Type 354 is an air/surface search equipment which is reported to operate in the E band. This may be a development of the Russian Slim Net radar.

Knife Rest

There is a large open work antenna mounted on a small mast at the forward edge of the hangar. This Chinese Navy array consists of two side by side Yagi antennas and appears to be similar to the Knife Rest found on 1950s-vintage Soviet Navy ships. The (then) Soviet Navy used Knife Rest B, which operated over the 79-93 MHz band, with a peak power of 100 kW, and had an effective range of 100-150 n miles (185-280 km).

Sun Visor

Sun Visor is the I-band, fire-control radar installed on the Round Top gunfire-control director on the bridge roof.

Fog Lamp

The Fog Lamp fire-control radar, a Chinese development of the Soviet 'Screech' family of fire-control radars, is mounted on a platform on the mast (at the top edge of the plating). This is an H/I-band system with a dish-shaped antenna and illuminating feed support assembly. There appears to be a transmitter-receiver housing behind the antenna, which is probably stabilised. Targets are designated through the Eye Shield air search radar.

Type 341 (Rice Lamp)

The Rice Lamp fire-control director for the 37 mm guns operates in the I/J band, and is located aft at the head of a small tower.

Racal-Decca 1290

The Racal-Decca 1290 is an I-band navigation set, with the antenna mounted on a small platform on the mast, below the Eye Shield antenna.

SONAR

Echo Type 5

One sonar set is fitted to all ships: the hull-mounted, active search and attack, Echo Type 5, operating in the medium sonar frequency band.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 17.9 × 12.1 m (58.6 × 40 ft)

HELICOPTERS

One Harbin Zhi-9A Haitun (Dauphin)

Specifications

Dimensions:

main rotor diameter: 11.94 m (39.17 ft)

Fenestron diameter: 1.10 m (3.61 ft)

length, overall: 13.68 m (44.88 ft)

height: 3.99 m (13.09 ft)

Weights:

empty (standard aircraft): 2,262 kg (4,987 lb)

max take-off: 4,250 kg (9,370 lb)

Radius of action:

anti-shipping mission: 4 missiles, 135 n miles (250 km); 2 missiles, 150 n miles (278 km)

search and rescue: 130 n miles (241 km)

Performance:

never exceed speed (VNE): 160 kts (296 km/h)

cruising speed at sea level: 148 kts (274 km/h)

max rate of climb (sea level): 420 m (1,380 ft)/min

hovering ceiling (in ground effect): 2,600 m (8,530 ft)

Power plant: 2 Turbomeca Arriel 1M1 turboshafts, each giving 558 kW (749 shp) for take-off and 487 kW (653 shp) continuously

Accommodation: Pilot, co-pilot. The cabin can hold up to 10 passengers

Huainan. *A stern view of the Chinese frigate showing the flight deck and spacious hangar. On the hangar roof is Rice Lamp fire-control director for the 37 mm guns beside it. Note also the Knife Rest radar array above the after YJ-1 SSM launchers* (H & L van Ginderen Collection)

PROPULSION

Specifications
System: Diesel
Main machinery: 4 MTU 20V1163 TB83 diesels
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The design of this class started in the early 1980s and the first of class was laid down in 1988, launched in 1991 and started running trials later that year. Four were then completed at a rate of one per year, but there appears to have been a break in the programme, with the fifth and sixth ships not entering service in 1995 and 1996, as expected.

DESIGN

The Jiangwei hull is slightly larger all round than that of the Jianghu, and displacement has increased by 326 t. The Jiangwei represents a steady evolution with full aviation facilities, including both a flight deck and a hangar, as trialled in the sole Jianghu II. The one totally new equipment is the SD-1 SAM system, although this underwent a very protracted development in the abortive 'Jiangdong' class frigates.

The SD-1 (CSA-N-2) finally gives the PLA-N an at-sea air defence capability, although with only six missiles per ship (there are no reloads) it is still limited in scope.

There is a possibility that CY-1 anti-submarine missiles may also be launched from the YJ-1 launchers as in Luda III.

Huainan (H & L van Ginderen Collection)

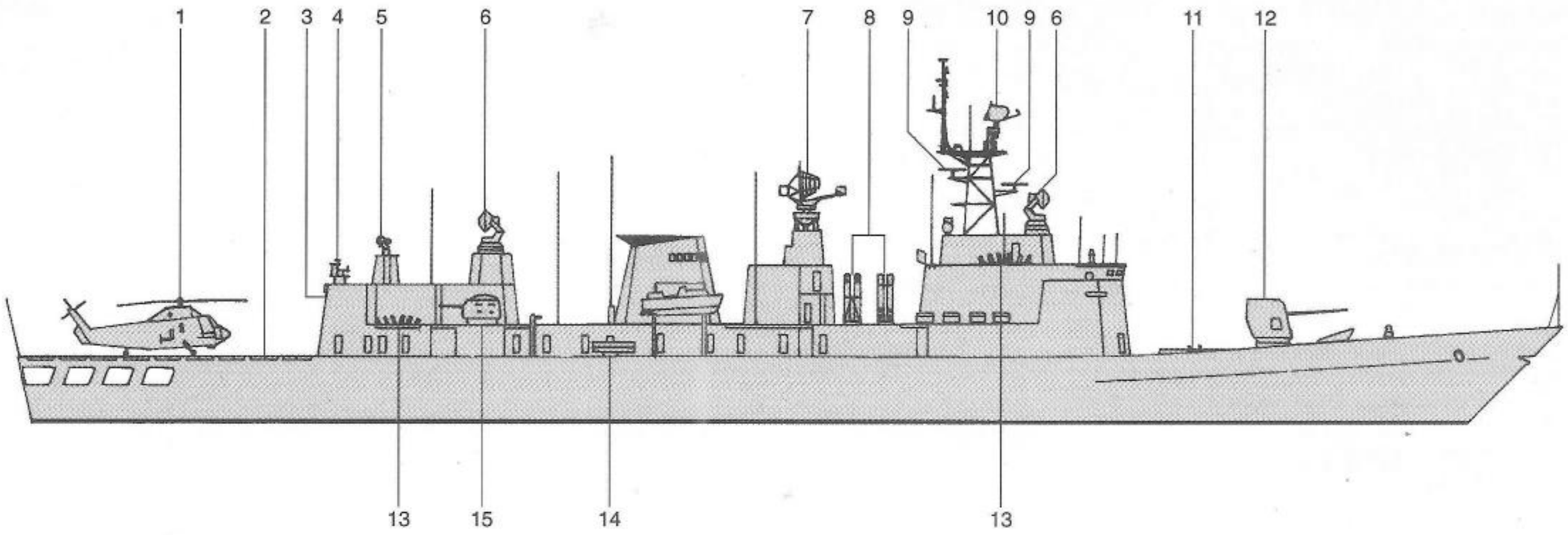
PROPULSION

It was originally estimated that these ships were powered by two Chinese Type 12E diesels. However, the export version of this ship (described in brochures as 'Guided Missile Frigate Version 2') has four MTU diesels on two shafts and it is believed that this is the more likely power plant.

DEPLOYMENT

All are currently based in the East Sea Fleet.

NARESUAN



Naresuan (Ian Sturton)
1 *Kaman SH-2F Seasprite ASW helicopter* **2** *Flight deck* **3** *Hangar* **4** *Model JM-83H optical director* **5** *Model 374G fire control (for 37 mm)* **6** *Signaal STIR fire control (for SSM and 122 mm gun)* **7** *Signaal LW08 air search radar* **8** *McDonnell Douglas Harpoon (two four-tube launchers)* **9** *Raytheon SPS-64(V)5 navigation radar* **10** *Type 360 surface search radar* **11** *FMC Mk 41 LHCR vertical launcher for Sea Sparrow SAM* **12** *United Defense 127 mm (5 in)/54 Mk 45 Mod 2 gun* **13** *Type 945 GPT 26-tube chaff/IR launcher* **14** *Triple US/Mk 32 Mod 5—324 mm torpedo tubes* **15** *Twin 37 mm/76 H/PJ 76A (Note: Unless a foreign manufacturer is specifically mentioned the equipment is of Chinese design and manufacture)*

GENERAL SPECIFICATIONS

Country of origin: China, People's Republic
Operator: Thailand
Type: 25T

Class: NARESUAN

Building: 2
Active: 2

Displacement:
standard: 2,500 t
full load: 2,980 t

Dimensions
Length: 120 m (393.7 ft)
Beam: 13 m (42.7 ft)
Draught: 3.8 m (12.5 ft)

Speed: 32 kts
Range: 4,000 n miles at 18 kts

Complement: 150

SHIPS

NARESUAN (421)

Builder	Zhonghua Shipyard, Shanghai, China
Laid down	1991
Launched	24 Jul 1993
Commissioned	15 Dec 1995

TAKSIN (422)

Builder	Zhonghua Shipyard, Shanghai, China
Laid down	1991
Launched	14 May 1994
Commissioned	28 Sep 1995

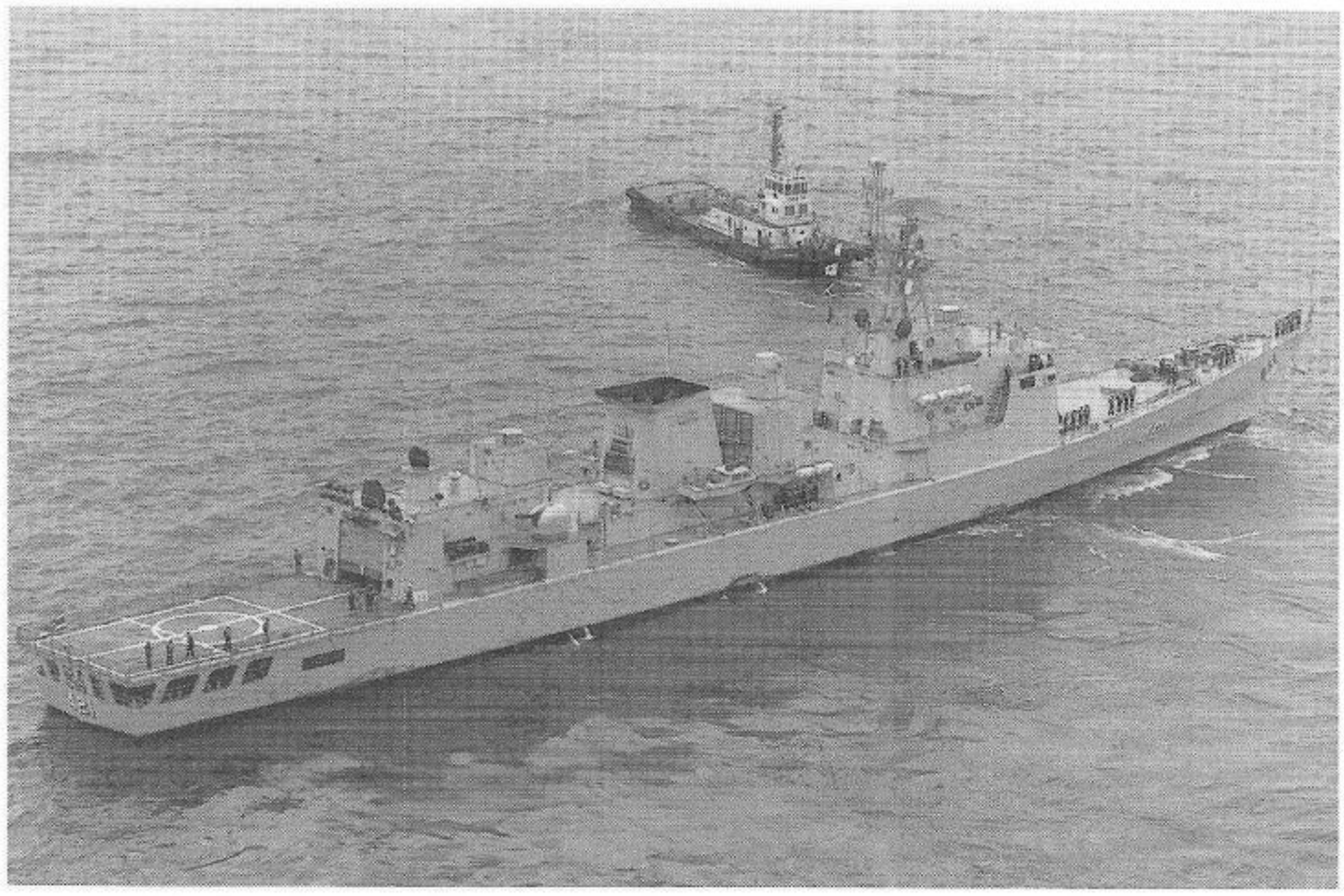
Naresuan *in 1996. These ships were built in China, have US missiles and launchers; US 127 mm gun; Italian anti-aircraft guns made under licence in China; Italian ESM/ECM equipment; a mixture of Dutch, Chinese and US radars; and a CODOG propulsion system with US gas turbines and German diesels* (Royal Thai Navy)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas UGM-84B Harpoon

Eight Harpoon anti-ship missile canisters are mounted in the gap immediately abaft the bridge structure. There are two groups of four launchers each, with one group pointing to either beam. The missiles are either Block 1B or Block 1C versions, the latter having a similar performance to the Block 1B but with certain additional options, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.



Naresuan *in 1995. At this stage the 127 mm gun, Mk 41 VLS and Signaal radars had not been fitted. The anti-aircraft guns either side of the hangar are reported to be OTOBREDA 40 mm guns made under licence in China, firing Chinese 37 mm ammunition and controlled by a Chinese version of the Dardo system* (Dr Giorgio Arra)

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

Mk 41 GMVLS
There is a Lockheed Martin Mk 41 Guided Missile Vertical Launch System (GMVLS), with one eight-cell module located under the foredeck. Firing rate is reported to be about 1 missile per second.

Raytheon Sea Sparrow point defence missile system
The ships carry eight Sea Sparrow point defence missiles.

The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85 lb) blast fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications
RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

TORPEDOES

324 mm Mk 32 Mod 5 triple torpedo launchers
Two triple Mk 32 Mod 5 torpedo launchers are mounted, one on either beam, on the main deck abreast the stack.

Specifications
Mk 46 Mod 5
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts
Range: 6 n miles (11.2 km)
Homing: Active/passive acoustic homing
Warhead: Mk 103 Mod 1; 44 kg; PBXN-103
Motor: 5-cylinder liquid mono-propellant (Otto) motor

Manufacturer/Contractor
Loral Defense Systems, Akron, Ohio, USA.

GUNS

Mk 45 Mod 2 single 127 mm (5 in) L/54 gun mounting
One United Defense single 127 mm (5 in) Mk 45 Mod 2 gun is mounted forward, firing semi-fixed ammunition with point detonating, proximity (variable time or infrared), mechanical time and electronically set fuzes. The theoretical rate of fire is 20 rounds per minute and a gun crew of six is required, all below decks, of which four are ammunition handlers.

Specifications
Calibre: 127 mm (5 in)
Length of barrel: 54 calibres
Muzzle velocity: 807 m/s (2,646 ft/s) (new barrel), 762 m/s (2,500 ft/s) (mid-life)
Crew: 6 (1 mount captain, 1 panel operator, 4 ammunition handlers)
Traverse: 340° at 30°/s
Elevation: −15 to +65° at 20°/s
Range:
anti-surface: 12.39 n miles (23 km)
anti-air: 15,000 m (49,000 ft)
Rate of fire: 16-20 rds/min
Ammunition weight: 31.75 kg (70 lb) (projectile)

Manufacturer/Contractor
United Defense, Armament Systems Division, Minneapolis, Minnesota, USA.

37 mm/63 Model 76 mountings
There are two twin 37 mm/62.8 cannon in automatic mountings, mounted either side of the forward end of the hangar. The barrels are enclosed in separate water jackets with exposed spring recuperators, and a hydraulic recoil buffer underneath the barrel. The loading mechanism consists of guides for ammunition, which is in five-round clips, the clips being automatically removed on the loading tray. The first round is loaded manually into the breech. The breech block rises and the gun fires when the firing pin strikes the cartridge percussion cap. Upon recoil the breech block opens and extractor arms propel the case along the loading tray and down an ejection chute. The recoil forces activate the loading mechanism and allow following rounds to be rammed automatically into the breech.

Specifications
Calibre: 37 mm
Length of barrel: 63 calibres
Muzzle velocity: 886 m/s (2,906 ft/s)
Traverse: 360° at 17°/s
Elevation: −10 to +85° at 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.61 lb)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,842 ft)
Crew: 3

Ammunition (HE-T)
Projectile Weight: 708 g (25 oz)
Explosive charge: 36 g (1.27 oz) (RDX/aluminium)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Newton-Beta EW suite
Both ships are fitted with an Elettronica Newton-Beta system consisting of an ESM section and an ECM section, with the related antennas, controlled from an operator console. The ESM section provides 100 per cent intercept probability, passive surveillance, automatic instantaneous warning of programmed threat, automatic analysis of threat parameters, automatic identification and tracking of threats, a synthetic data display, instantaneous DF, and broad frequency coverage. The ECM section provides self-protection by noise jamming using an Elettronica jammer.

Manufacturer/Contractor
Elettronica SpA, Rome, Italy.

DECOYS

Type 945 GPJ 26-barrelled chaff launchers
There are two Chinese-designed and manufactured Type 945 26-barrelled chaff launchers. Their specifications are not known.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

JM-83H optical director

There is one JM-83H optical director mounted at the after end of the hangar roof.

SONAR

SJD-7

SJD-7 is a Chinese-manufactured, hull-mounted, active search and attack sonar, operating at medium frequencies.

RADARS

Set	LW 08	Type 360	AN/SPS-64(V)5 (two sets)	STIR 1.8 (two sets)	Type 374G
Company	HSA	—	Raytheon	HSA	—
Role	Air search	Surface search	Navigation	Fire control (SSM and 127 mm gun)	Fire control (for 37 mm guns)
Band	D	E/F	I/J	I/J/K	
Range	145 n miles for 2 m^2 target at 85,000 ft		18.3 m-118.5 km	76 n miles (140 km)	
Beam	2.2 × csc^2 to 40°		1.25 × 20°	1.4°	
Peak power	150 kW		10/25/50 kW	220 kW	
Gain	30 dB		—	—	
Pulsewidth	35/69 µs		0.06/0.5/1 µs	0.29 µs	
PRF	1,000/500 pps		3,600/1,800/900 pps	1,800/3,600 pps	
Scan rate	7.5/15 rpm		28 dB	—	

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 23 × 13 m (76 × 43 ft)

HELICOPTERS

The Royal Thai Navy intends to operate one Kaman SH-2F Seasprite from these ships.

Specifications

Main rotor:
diameter: 13.51 m (44.33 ft)
disc area: 143.41 m^2 (1,543.66 sq ft)

Tail rotor:
diameter: 2.46 m (8.15 ft)
disc area: 4.77 m^2 (51.32 sq ft)
Length overall (both rotors turning): 16.08 m (52.75 ft)
Fuselage length: 12.19 m (40.00 ft)
Height to rotor head: 4.58 m (15.00 ft)
Weights:
empty: 3,447 kg (7,600 lb)
max take-off: 6,124 kg (13,500 lb)
Max level speed at sea level: 138 kts (256 km/h)
Typical cruising speed: 120 kts (222 km/h)
Service ceiling: 7,285 m (23,900 ft)
Range with max standard fuel: 478 n miles (885 km)
Power plant: 2—1,285 kW (1,723 shp) General Electric T700-GE-401 turboshafts

Accommodation: crew of 3 in ASW role (pilot, co-pilot/tactical co-ordinator, sensor operator
Weapons: 1/2 Mk 46 or Mk 50 torpedoes; 8 Mk 25 marine smoke markers. provision for pintle-mounted 7.62 mm MG in both doorways

PROPULSION

Specifications

System: combined diesel or gas turbine (CODOG)
Main machinery: 2 General Electric LM-2500 gas turbines, 41 MW (55,000 hp) sustained; 2 MTU 20 V 1163 TB83 diesels, 10.84 MW (14,730 hp(m)) sustained
Shafts: 2
Propellers: cp

FURTHER INFORMATION

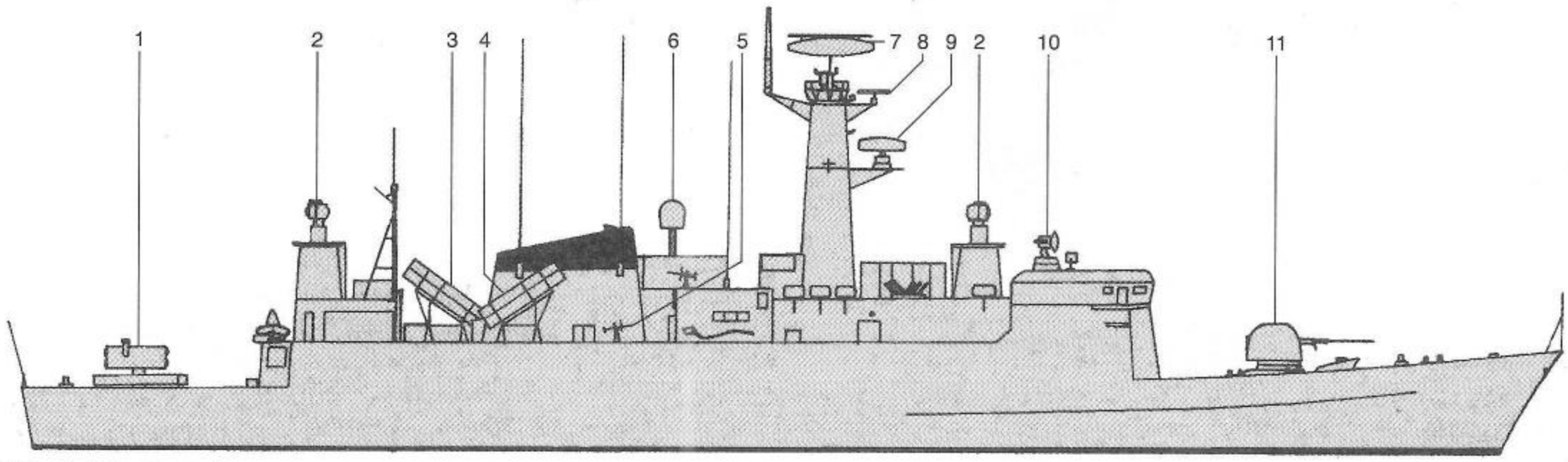
PROGRAMME

Despite its not entirely satisfactory experiences with the 'Chao Phraya' class frigates, the Royal Thai Navy signed a contract on 21 September 1989 for two frigates to a new design. These were to be built by the China State Shipbuilding Corporation (CSSC) with delivery in 1994, following which US and European weapon systems would be fitted in Thailand. By early 1993 the programme had slipped by 12 months and the first ship eventually sailed for Bangkok without most of its weapon systems in January 1995. A series of photographs of the ship was issued in 1993, but it later transpired that most of the systems shown were wooden mock-ups and, as late as 1995, both ships were to be seen without their 127 mm guns, Harpoon missiles and most of their sensors.

STRUCTURE

These ships were jointly designed by the Royal Thai Navy and the China State Shipbuilding Corporation (CSSC) and the design incorporates a considerable amount of Western machinery and equipment, providing enhanced capabilities in comparison with the earlier Type 053 ships. The anti-aircraft guns are OTO-BREDA 40 mm with 37 mm ammunition and they are controlled by a Chinese-manufactured RTN-20 Dardo tracker.

NIELS JUEL



Niels Juel (Ian Sturton)
1 *Mk 29 eight-cell launcher for NATO Sea Sparrow* **2** *Mk 95 tracked illuminator (for SAM)* **3** *Four Harpoon anti-ship missiles (port side, facing aft)* **4** *Four Harpoon anti-ship missiles (starboard side, facing forward)* **5** *20 mm Oerlikon* **6** *Satcom* **7** *Plessey AWS-5 (being replaced by DASA TRS-3D)* **8** *Terma Scanter navigation radar* **9** *CelsiusTech 9GR 600* **10** *CelsiusTech 9LV 200* **11** *OTOBREDA 76 mm/62 Compact*

GENERAL SPECIFICATIONS

Operator: Denmark
Type: KV72

Class: NIELS JUEL (FFG)

Built: 3
Active: 3

Displacement:
standard: 1,190 t
full load: 1,320 t

Dimensions
Length: 84 m (275.5 ft)(oa) 80.0 m (262.5 ft)(wl)
Beam: 10.3 m (33.8 ft)
Draught: 3.1 m (10.2 ft)

Speed: Gas turbines – 29 kts; diesels – 20 kts
Range: 2,500 n miles at 18 kts

Complement: 98 (18 officers)

SHIPS

NIELS JUEL (F 354)
Builder Aalborg Vaerft, Aalborg, Denmark
Laid down 20 Oct 1976
Launched 17 Feb 1978
Commissioned 26 Aug 1980

OLFERT FISCHER (F 355)
Builder Aalborg Vaerft, Aalborg, Denmark
Laid down 6 Dec 1978
Launched 10 May 1979
Commissioned 16 Oct 1981

PETER TORDENSKIOLD (F 356)
Builder Aalborg Vaerft, Aalborg, Denmark
Laid down 3 Dec 1979
Launched 30 Apr 1980
Commissioned 2 Apr 1982

Peter Tordenskiold *(F 356) is one of three 'Niels Juel' class frigates of the Royal Danish Navy. They entered service between 1980 and 1982 and are undergoing mid-life refits between 1997 and 1999 which will enable them to serve well into the 21st century* (Royal Danish Navy via Hans Harboe-Hansen)

WEAPONS SYSTEMS

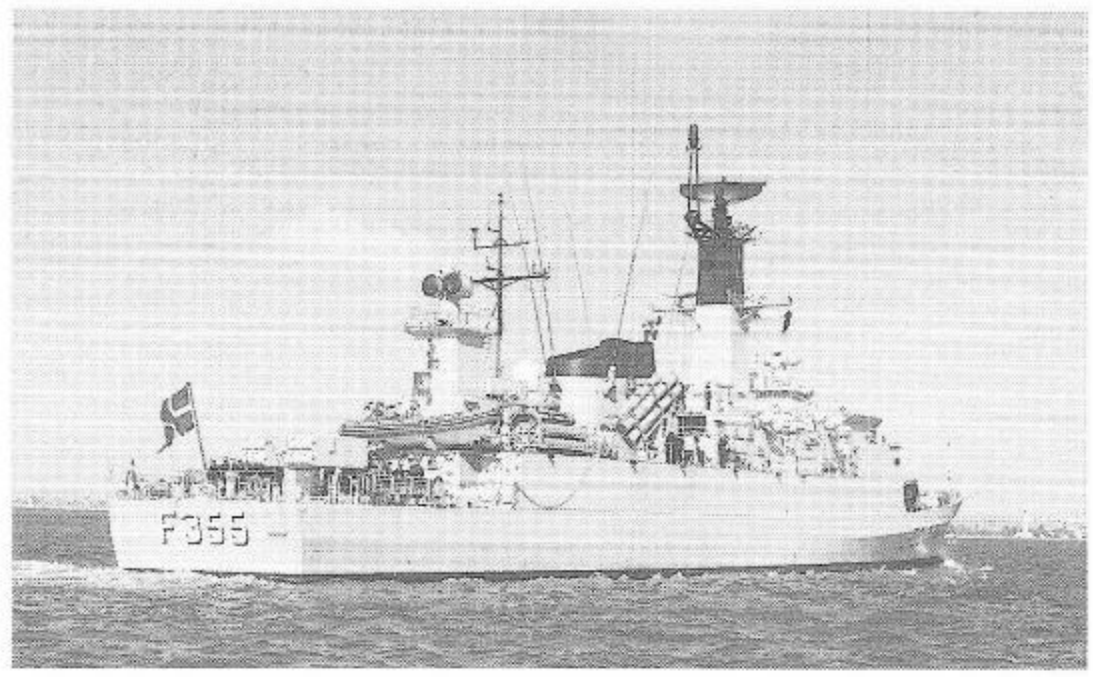
SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84B Harpoon

Eight Harpoon anti-ship missile canisters are mounted either side of the stack, but in an unusual arrangement, with the starboard group of four pointing forwards and the port set pointing aft. The missiles are the Block 1C version with additional options, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).



Olfert Fischer *(F 355). These ships are very well armed for their size and carry eight Harpoon anti-ship missiles. As seen here, however, their arrangement is unique, with the four starboard Harpoons pointing forwards while the four port tubes point aft* (H & L van Ginderen Collection)

SURFACE-TO-AIR MISSILES (SAM)

Raytheon Sea Sparrow point-defence missile system

There is a single Mk 29 octuple launcher for the Sea Sparrow system, which is located aft on the quarterdeck. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast fragmentation warhead and a dual-purpose proximity-impact fuze. The RIM-7M missiles originally carried are being replaced by RIM-7P during the current mid-life refits, the new installation including improved electronics and a computer with significantly increased capacity. There are no reloads.

Specifications

RIM-7P
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors

Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

GUNS

OTOBREDA 76 mm (3 in)/62 Compact

There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air-defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications

Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

Oerlikon 20 mm

Four single Oerlikon 20 mm guns are mounted in a very close group amidships. There is one immediately ahead of each of the two Harpoon launchers, and one on each corner of the deckhouse abaft the mast.

Specifications

Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°

DEPTH CHARGES

There is one rack for depth charges on the stern.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Cutlass B1 ESM system

Cutlass B1 is designed for operation in very dense signal environments, receiving signals in the 1 to 18 GHz frequency range, measuring their parameters, comparing these with those in the radar library which contains the parameters of 2,000 radars, and displaying the information — all within one second. The EW operator is presented with a tabular display for threat identity and threat evaluation, and a tactical display giving a pictorial representation of the RF environment. Selected digital outputs can be sent to other local systems, and hard copy printout of the intercepted radar is also available. The tabular display can indicate 150 intercepts, in the order of priority. Cutlass is wide open in both bearing and frequency: that is, it does not employ sweep techniques, giving a very high intercept probability (nearly 100 per cent). Cutlass B1 uses the Cutlass processor and an Instantaneous Frequency Measurement (IFM) receiver. It has a 32-element array antenna to provide bearing measurement by phase analysis techniques. This antenna also provides RF for the IFM. In both systems the processor is provided with fast and accurate information on incoming pulses.

Specifications

Frequency coverage: 2-18 GHz (Cutlass B1); 0.6-18 GHz (Cutlass Type 242)

Cutlass B1
Accuracy: 2° RMS in bearing
Coverage: 360° azimuth; +40 to −10° elevation
Pulse density capability: 500,000/s
Radar store capacity: 2000 modes

Cutlass Type 242
Accuracy: 3.5° RMS
Sensitivity: −60 dBm
Dynamic range: 60 dB
Coverage: 360° azimuth, +30 to −10° elevation
Pulse density capability: 1 Mpps
Radar store capacity: 2000 modes

Manufacturer/Contractor

Racal Radar Defence Systems Ltd, Chessington, Surrey, UK.

DECOYS

NATO Sea Gnat

There are two six-barrel launchers for Sea Gnat, NATO's new long-range chaff/infra-red (IR) decoy launching system. It consists of a control unit, a launcher with 130 mm tubes and munitions. The control unit provides for the launching of the most effective combination of rounds for distraction and centroid/seduction given the type, speed and direction of the threat, the ship's speed and heading as well as wind direction and speed. There are three types of round:

Mk 214 RF seduction
Mk 216 RF distraction
Mk 245 IR seduction

Manufacturers/Contractors

Thorn EMI/AB Precision Ltd, UK (control unit).
Chemring Ltd, UK (munitions).

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

CelsiusTech CEPLO (Computerised Electronic Plotting System)

CEPLO (Computerised Electronic Plotting System) provides target detection, identification and tracking facilities together with movement prediction, threat evaluation, weapon co-ordination and unit deployment. There is an optional torpedo fire-control element and the CCIS has built-in facilities for simulation and training. The system features a mainframe architecture using two Censor 932E 32-bit, 512 k memory computers, one of which provides redundancy. Peripherals include an input/output device, data recorder and either a printer or a plotter. Software is written in the Assembler language and involves some 240,000 lines of code.

The system is linked through a single or duplicated CCIS bus to the display system, up to four radars

(through a plot extractor), weapon control systems, navigation and communications systems. A datalink terminal may be incorporated in the system.

The modular display system features three monochrome or colour display units; horizontal or vertical Local Operations Consoles (LOC) and a vertical General Operations Plot (GOP) all with CRT PPI screens. These consoles present a raw radar picture with track symbols, labels and bearing-vector lines. They are primarily for compiling the tactical situation as well as for target allocation to weapon systems. They can also be used for weapon co-ordination and control. The MMI allows the selection of one of four radars and one of the three video channels. It consists of a rollerball, 11 function keys (each of which may have 12 functions), together with page select, mode select, display select and alphanumeric keys.

The GOP, which is intended to assist command and control, features a 40.64 cm (16 in) or 58.42 cm (23 in) circular screen upon which is presented synthetic radar data, map and chart data together with bearing-vector lines. An alphanumeric display may be integrated into the screen or alternatively presented in a separate plasma display. The GOP may be controlled either through a dedicated MMI or by another operator's MMI. Generally, there are two LOCs and a GOP in larger warships, of corvette size and above, while a single vertical LOC is used in fast attack craft. In CEPLO there are two 61 cm (24 in) vertical and three 40.64 cm (16 in) horizontal displays.

A previous plan to replace the CEPLO by the Philips 9LV Mk 3 during the forthcoming mid-life update has been dropped.

Manufacturer/Contractor

CelsiusTech AB, Sweden.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11

Satcom: Satcoms can be fitted forward or aft of the stack and were installed during the Gulf deployments.

WEAPONS CONTROL

9LV 200 Mk 1 (RAKEL) fire-control system

The basic 9LV 200 system is an air defence (LV = Luftvarn anti-aircraft), surface fire and torpedo fire-control system, which is known in the Danish Navy as RAKEL *(RAdar KanonenELdledning)*. It can direct one or more guns against one or more targets simultaneously and includes a CelsiusTech 9GR600 radar. The 9LV 200 has a mainframe architecture, using Philips P800 minicomputers with a memory of 128 k which may be expanded to 512 k.

The normal configuration includes a tactical display and missile control console together with gun control consoles (usually one for surface engagements and one for air engagements) and optional torpedo control console. The tactical display and missile control unit is a three-man console (tactical picture compiler, principal warfare officer and the commanding officer) with 40.64 cm (16 in) tactical displays and two alphanumeric displays for surveillance, target acquisition and target designation. There is automatic track-while-scan of up to 16 air and surface targets with weapon systems exchanging target data. Also available is an external VHF/UHF voice channel and short burst transmission for exchanging target data with other ships. The principal warfare officer designates surface targets to either guns or missiles but also launches missiles either from integrated controls or a nearby missile firing panel. Surface targets to be engaged by gunfire are transferred to the appropriate gun console depending upon whether or not the target is to be tracked by the director or by track-while-scan, if the search radar is used.

The gun control consoles feature a 30.48 cm (12 in) PPI and there is optional pulse Doppler processing for MTI and track-while-scan facilities. The console is used to control the air defence function against either aircraft or missiles. Once the decision is taken to engage the target then target acquisition, tracking and ballistic calculations are conducted automatically. The guns are fired by a pedal beneath the console. For simultaneous engagement of two independent targets a surface gun console manned by the assistant gunnery officer may be included. This is similar to the gun control console but has no alphanumeric display. Its prime role is to engage surface targets using track-while-scan but it has a secondary role of assisting in the air search.

The basic electro-optic sensor is a Si-Vidicon TV camera with a field of view of 32 × 42 mrad and 300 mm lens. The camera produces a 625-line picture which is refreshed at 25 frame/s. The TV camera can be augmented by an 8-12 µm FLIR with CCIR-standard output and a 10 Hz Nd:YAG laser rangefinder.

A typical 9LV 200 installation features a tactical display, two gun control consoles (with primary air defence and surface engagement roles respectively), two optical target designators and a wind sensor.

The Mk 1 system is for warships of 80 tonnes or more and features an analogue version of the P800 processor. This directs 40-120 mm dual-purpose guns and anti-ship weapons including missiles and wire-guided torpedoes. It receives data from the surveillance and tracking radars, although there is also provision for inputs from a D-band air warning radar with integrated Mk 10 IFF.

Manufacturer/Contractor

CelsiusTech AB, Linkoping, Sweden.

Mk 91 Mod 1 air defence fire-control system

The Mk 91 fire-control system operates in either automatic or semi-automatic modes from target acquisition to interception. It is a mainframe system using an NFT (*Norsk Forsvarsteknologi*) Mk 157 digital computer which performs all necessary calculations, stores data and is responsible for data distribution. There are two Mk 91 Mod 3 directors — one is on the bridge roof, the other atop a small tower aft — using the Mk 95 radar.

Because of its I-band frequency the Mk 91 will detect sea-skimming missiles sooner than lower-frequency search radars; the system can thus be fully autonomous, conducting search, detection and engagement automatically. It can also accept outside designations from radar, EW or optic sources. Radar data from the director is passed to the signal data processor to provide range and angle tracking data. This data is passed to the firing officer's console from where prelaunch data and firing commands are relayed to the Mk 29 trainable launcher and missile. The launcher then trains in azimuth to the intercept point and in superelevation to optimum angle to maximise missile kinetic energy. Should the correct azimuth be blocked by the ship's superstructure, the launcher trains to the nearest clear azimuth and commands the missile to 'fly around the corner' to the direct path to the intercept. On launch, the missile flies a proportional navigation path (lead angle intercept) directly to the intercept point in a lofted trajectory which maximises energy and minimises image effects.

Manufacturer/Contractor

Raytheon Company, Equipment Division (prime).

AN/SWG-1A Harpoon Launch Control System (LCS)

SWG-1A is the Harpoon weapons control system, which activates the missile, selects the flight pattern and sets seeker search modes (with small-, medium- or large-acquisition windows), as well as providing target range and bearing data. Alternatively, the missile can simply be launched along the bearing of the target, with the seeker activated early to scan a 90° sector; if, after a set time, no target has been acquired the missile commences a preset search pattern. SWG-1A takes account of other ships in the general target area and generates indirect flight plans for the missile, including waypoints to optimise angles of approach which will achieve the highest possibility of success while minimising the chances of the missile being destroyed by hostile fire. It can also be used to compute flight plans in a multiple attack so that several missiles, from either the same or different ships, arrive on target simultaneously, thus swamping the defences.

RADARS

DASA TRS-3D/16

TRS-3D/16 is a multimode acquisition radar for surveillance and weapon assignment. The most recent member of the C-band radar family performs Automatic Detection and Tracking (ADT) of surface and air targets even in heavy clutter and under severe ECM conditions. The highly stable coherent transmitter has a solid-state driver stage and a TWT output stage. A number of preset frequencies can be set from pulse to pulse. It is claimed to be highly resistant to ECCM. The modes of operation are:

- self-defence mode — combined long- and short-range scanning with high-elevation coverage. May be used in sea and ground clutter environment and in light rain; scan time is 2 seconds
- self-defence/clutter mode — offers an adapted waveform for severe clutter or chaff conditions; scan time is 3.5 seconds
- surveillance mode — provides 92 km instrumented range with 17 km altitude coverage. It is useful up to medium-clutter conditions, scan time is 6 seconds
- long-range mode — gives an instrumented range of 180 km for duct conditions with a scan time of 6 seconds.

The antenna group comprises a primary G/H-band planar phased-array antenna, an IFF antenna and an optional I-band navigation radar antenna. The G/H-band radar incorporates a full pulse-to-pulse polarisation agility. Scanning in elevation is performed with a single agile pencil beam; the antenna is scanned in bearing mechanically using a fully stabilised platform rotating at 30 rpm. With the use of MTD Doppler processing, small targets (such as sea-skimmers and diving missiles) can be detected and target data determined. There are separate air and surface target channels, each with adaptive detection thresholds and a jamming detector. Helicopter classification is also provided, as is a quick reaction technique to detect pop-up targets.

Manufacturer/Contractor

Daimler-Benz Aerospace AG, Sensor Systems Division, Ulm, Germany.

CelsiusTech 9GR600

The 9GR600 D/I/J-band (8-18 GHz) is the radar element of the 9LV 200 fire-control system. It features two stabilised parabolic antennas: the 2,700 × 700 mm 9GA218 for search; and the monopulse cassegrain 9GA209 on the director for fire control. Both can be used in broadband frequency agility mode or in a fixed frequency mode for MTI operations. The director has an elevation of −25 to +85° and an angular speed of 85°/s in both azimuth and elevation.

The search element operates in D-band (1.01-1.11, 1.25-1.35 GHz) and I-band (8.5-9.6 GHz) with a pulse peak power of 200 kW and a frequency agility of 450 MHz. Horizontal beamwidths are 6-8° in D-band and 1° at I-band while vertical beamwidths are 20-25° at D-band and 3° at I-band. The antenna rotates at 30 or 60 rpm. The radar can conduct track-while-scan upon 16 surface targets simultaneously.

The fire-control element operates in J-band (15.9-17.1 GHz) at a pulse peak power of 65 kW and a frequency agility of 670 MHz. The horizontal beamwidth is 1.1° and the vertical one is 7°. The antenna rotates at up to 60 rpm.

Mk 95 tracker-illuminator

There are two Mk 95 tracker-illuminators: one is on the bridge roof, the other atop a small tower at the after end of the superstructure. Mk 95 consists of a Mk 78 radar director with separate transmitting and receiving antennas, a director controller (Mk 106) and a low-light TV camera (Mk 6) with 2.4 × 2.4° and 10 × 10° fields of view. The I-band radar directs the Sea Sparrow missile to fly a lead angle course to the intercept point enabling the ship to protect both itself and other ships in company. Inboard equipment includes a Mk 73 continuous wave illuminator transmitter, a signal data processor (Mk 17), a signal data converter (Mk 80) and a director controller (Mk 106). There is a radar set console (Mk 83), with Bell Aerospace low-light television monitor and a firing officer's console (Mk 86).

Terma Skanter Mil 009

The navigation radar is the Terma Skanter Mil 009. This set operates in the I/J-band and there are two horizontal slotted waveguide antennas on the yard-arms.

Specifications

Antenna: 4 m (13 ft) (I/J-band)
Polarisation: Horizontal
Horizontal beamwidth: <2.0°
Vertical beamwidth: 20° ±1°
Gain: >28.5 dB
Scanner rotation
(1 or 2 speed): Up to 30 rpm

Receiver/Transmitter unit
Transmitter frequency: 9,375 ±30 MHz (I/J-band)
PRF
Short pulse: Max 4,400 Hz
Long pulse: Max 2,200 Hz
Pulse length: 0.06 ±0.01/µs, or 0.6 ±0.1/µs
Peak power: 20 kW I/J-band; 25 kW E/F-band

Manufacturer/Contractor

Terma Elektronik, Lystrup, Denmark.

SONAR

GEC-Marconi PMS-26 hull-mounted passive sonar

PMS 26 is a self-contained system providing 360° coverage in four steps of 90° and may be manually controlled to cover a particular sector, or set to carry out automatic search procedure. It incorporates a 'maintenance of close contact' (MCC) facility for tracking close or deep targets. The single operator controls the sonar through a special console and is provided with three sources of sonar information: audio, visual Doppler, and visual sector.

The Doppler facility provides increased initial detection range and improved classification capabilities compared with conventional small ship sonars. The PMS 26 transducer array is mounted within a hull outfit with a retractable glass-reinforced plastic dome.

PMS-26 was designed specifically for use in smaller warships. Operating frequencies are 9.5, 10 and 10.5 kHz and effective range is of the order of 4-5 km.

Manufacturer/Contractor

GEC-Marconi Naval Systems, Sonar Systems Division, Templecombe, Somerset, UK

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 General Electric LM-2500 gas turbine; 18.35 MW (24,600 hp) sustained; 1 MTU 20 V 956 TB82 diesel; 3.83 MW ((5,210 hp(m)) sustained
Shafts: 2
Propellers: 2 SMM, five-bladed, cp
Auxiliary power: 2 Frichs/van Kaich 500 kW diesel generators; plus 1–5 kW diesel generator for emergency power

FURTHER INFORMATION

PROGRAMME

These ships could be classified as corvettes, but are classified by the Danish Navy as frigates and have 'F' pennant numbers. The contract for three ships was signed on 5 December 1975 and the ships entered service between 1979 and 1981.

DESIGN

The design was prepared under contract by Y-ARD (Yarrow - Admiralty Research Department) an independent consultancy based in Scotstoun, near Glasgow, in Scotland. The design was prepared against overriding time, cost and displacement constraints. Among the requirements were the ability to operate in all weather conditions, including specified icing in close conjunction with other Danish and NATO warships, and also to serve as task group flagship, if required. Operational characteristics required included a maximum continuous speed of 30 knots, and the ability to use all weapons, in a Force 6 wind. Other requirements included a cruise speed of 20 knots, a roll not exceeding 15°, an endurance of seven days, and the ability to operate and maintain speed in shallow waters.

There were three additional programme restraints. First, the lead ship had to be handed over by December 1978; second, the cost (including weapons) was not to exceed Kr150 million per ship at 1973 prices; and the displacement was not to exceed 1,300 tonnes. Finally, provision was to be made for future weapons and equipment to increase the displacement by 5 per cent.

Not surprisingly, the initial design study failed to meet this very ambitious requirement, exceeding the design displacement by some 300 tonnes. A rigorous re-examination resulted in reducing the main propulsion system to one gas turbine and one diesel on a single-shaft propulsion system, reducing the auxiliary power system from four to three diesel generators and reducing length and beam. Yet further study showed that the single-shaft configuration could cause excessive vibration, with a consequent influence on the stern-mounted SAM launcher, so the twin shaft arrangement was reinstated and the weight penalty accepted.

The result is a very small ship, with a 1,320 tonne full load displacement, but which nevertheless manages to accommodate a considerable number of weapons and sensor systems.

MODERNISATION

Having entered service between 1980 and 1982, these three ships have undergone periodic in-service improvements. The seaboat was replaced by a rigid inflatable in 1989 and the new NATO Sea Gnat launchers have also been installed. All three ships are about to undergo a mid-life update, with *Peter Tordenskiold* (F 356) due to complete in 1997, *Olfert Fischer* (F 355) in 1998; and *Niels Juel* (F 354) in 1999. The work will include installing the TST TRS-3D air search radar to replace the Plessey AWS-5 and other new communications equipment.

Various other plans have been shelved. It was planned from the start to fit ASW torpedo tubes (presumably, either US pattern Mk 33 or British STWS-1) but this has never happened. It was also intended to fit two ten-missile RAM launchers and a 9LV Mk 3 combat data system, but this, too, has been shelved.

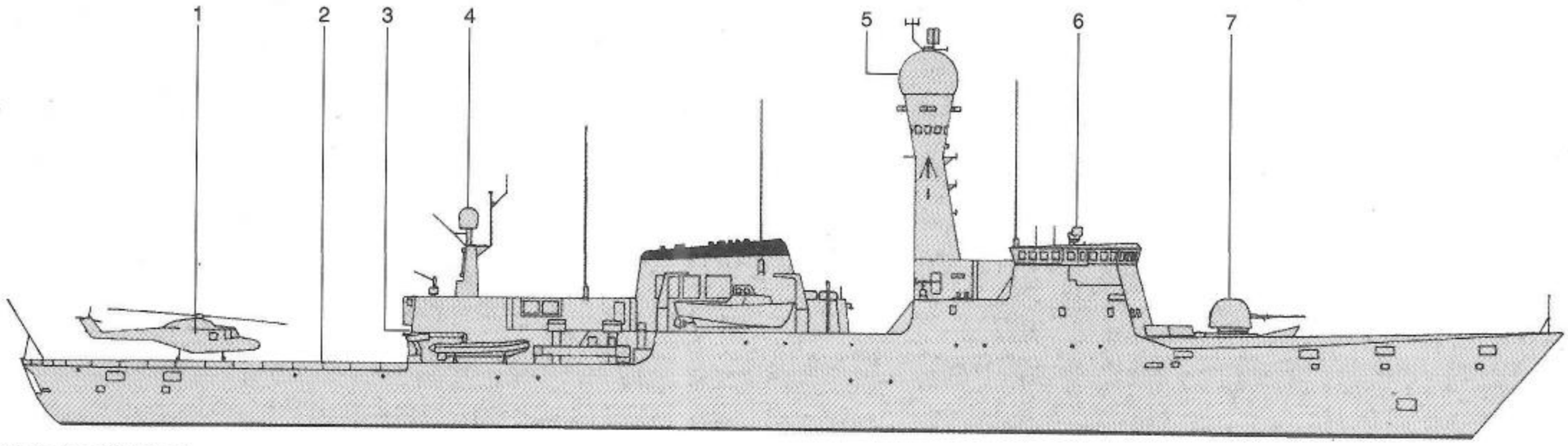
The capability of these ships is constrained by their relatively small size. They mount a surprisingly wide variety of weaponry including a 76 mm gun, eight Harpoon SSMs, a Sea Sparrow SAM launcher and four 20 mm Oerlikons but, there are no reloads for the Sea Sparrow SAM system and ASW armament is limited to one depth-charge rack.

DEPLOYMENT

Olfert Fischer (F 355) took part in the Gulf operation in 1990-91.

Peter Tordenskiold *(F 356)* (R Dan N via Hans Harboe-Hansen)

THETIS



Thetis (Ian Sturton)
1 *Westland Lynx Mk 91* **2** *Flight deck* **3** *Hangar* **4** *Satcom antenna* **5** *Plessey AWS-6* **6** *Terma Scanter navigation radar* **7** *OTOBREDA 76 mm (3 in)/62 Super Rapid gun*

GENERAL SPECIFICATIONS

Operator: Denmark

Class: THETIS

Built: 4
Active: 4

Displacement:
standard: 2,600 t
full load: 3,500 t

Dimensions
Length: 112.5 m (369.0 ft) (oa); 99.8 m (327.4 ft) (wl)
Beam: 14.4 m (47.2 ft)
Draught: 6.0 m (19.7 ft)

Speed: 20 kts; 8 kts on thrusters
Range: 8,500 n miles at 15.5 kts

Endurance: 124 days
Complement: 61 (11 officers) plus 12 spare berths

SHIPS

THETIS (F 357)
Builder Svenborg Skibsvaerft, Svenborg, Denmark
Laid down 10 Oct 1988
Launched 14 Jul 1989
Commissioned 1 Jul 1991

TRITON (F 358)
Builder Svenborg Skibsvaerft, Svenborg, Denmark
Laid down 27 Jun 1989
Launched 16 Mar 1990
Commissioned 2 Dec 1991

VAEDDEREN (F 359)
Builder Svenborg Skibsvaerft, Svenborg, Denmark
Laid down 19 Mar 1990
Launched 21 Dec 1990
Commissioned 9 Jun 1992

HVIDBJØRNEN (F 360)
Builder Svenborg Skibsvaerft, Svenborg, Denmark
Laid down 2 Jan 1991
Launched 11 Oct 1991
Commissioned 30 Nov 1992

WEAPONS SYSTEMS

GUNS

OTOBREDA 76 mm (3 in)/62 Super Rapid

There is one OTOBREDA 76 mm (3 in)/62 calibre Super Rapid gun in a single turret immediately forward of the bridge.

Specifications
Elevation: −15 to +85°
Training speed: 60°/s
Elevation speed: 35°/s
Muzzle velocity: 925 m/s (3,034 ft/s)
Rate of fire: 120 rds/min
Weight of shell: 6 kg (13.23 lb)
Range: 8.5 n miles (15.75 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Oerlikon 20 mm

One or two single Oerlikon 20 mm guns may be mounted.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)

Hvidbjørnen *(F 360), one of four Danish frigates/patrol ships. Gun armament is one 76 mm and consideration is being given to Harpoon and Sea Sparrow missiles* (Royal Danish Navy via Hans Harboe-Hansen)

Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°

DEPTH CHARGES

There are two rails in a stern compartment which can launch depth charges through a door in the transom.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Cutlass B1 ESM system

Cutlass B1 is designed for operation in very dense signal environments, receiving signals in the 1 to 18 GHz frequency range, measuring their parameters, comparing these with those in the radar library which contains the parameters of 2,000 radars, and displaying the information — all within one second. The EW operator is presented with a tabular display for threat identity and threat evaluation, and a tactical display giving a pictorial representation of the RF environment. Selected digital outputs can be sent to other local systems, and hard copy printout of the intercepted radar is also available. The tabular display can indicate 150 intercepts, in the order of priority. Cutlass is wide open in both bearing and frequency: that is, it does not employ sweep techniques, giving a very high intercept probability (nearly 100 per cent). Cutlass B1 uses the Cutlass processor and an Instantaneous Frequency Measurement (IFM) receiver. It has a 32-element array antenna to provide bearing measurement by phase analysis techniques. This antenna also provides RF for the IFM. In both systems the processor is provided with fast and accurate information on incoming pulses.

Specifications

Frequency coverage: 2-18 GHz (Cutlass B1); 0.6-18 GHz (Cutlass Type 242)

Cutlass B1
Accuracy: 2° RMS in bearing
Coverage: 360° azimuth; +40 to −10° elevation
Pulse density capability: 500,000/s
Radar store capacity: 2,000 modes

Cutlass Type 242
Accuracy: 3.5° RMS
Sensitivity: −60 dBm
Dynamic range: 60 dB
Coverage: 360° azimuth, +30 to −10° elevation
Pulse density capability: 1 Mpps
Radar store capacity: 2,000 modes

Manufacturer/Contractor

Racal Radar Defence Systems Ltd, Chessington, Surrey, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Terma TDS

The Terma Tactical Data System (TDS) is designed to meet the requirements of combat information systems for small and medium-sized surface warships. Its functions include: picture compilation, situation assessment, tactical manoeuvre calculations and weapons deployment. It provides a standard tactical datalink to exchange track and ESM information as well as plain text messages, utilising existing onboard radio equipment, but may also be supplied with NATO Link 11 or other customer-specified datalink. The system incorporates a Bofors 9LV 200 Mk 3 electro-optic director.

Manufacturer/Contractor

Terma Elektronik, Lystrup. Denmark.

SONAR

Thomson-CSF TSM 2643 (Salmon)

TSM 2643 (Salmon) sonar consists of an acoustic array of 24 staves housed in a streamlined fish, a towing winch, a transmitter and a receiver unit, and an operator console equipped with a multicolour display. Embedded facilities include passive listening, sound ray tracer, integrated onboard simulator, and an acoustic propagation prediction for the day and a recording system. There is also a hull-mounted transducer.

Specifications

Acoustic array: 24 identical staves of 7 transducers
Frequency: 19 kHz (approx)

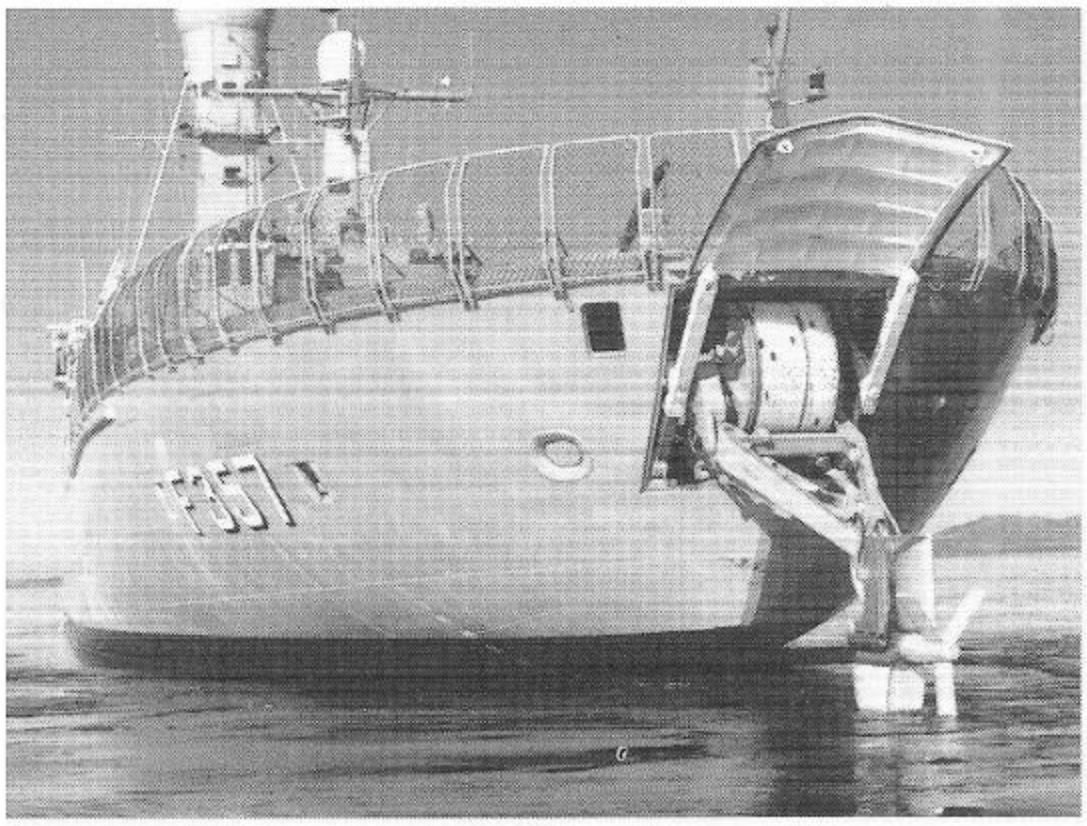
RADARS

Set	AWS-6	Scanter Mil	FR1505DA	9LV Mk 3
Company	Plessey	Terma	Furuno	CelsiusTech
Role	Air/surface search	Surface search	Navigation	Fire control
Band	G	I	I	I/J
Range	48 n miles (88 km)	—	—	
Beam	1.5°	1°		
Peak power	49 kW	20 kW		
Gain	29 dB	30 dB		
Pulsewidth	0.1/4.3 µs	0.06/0.6 µs		
PRF		4,400/2,200 pps		
Scan rate	30/30 rpm	24/48 rpm		

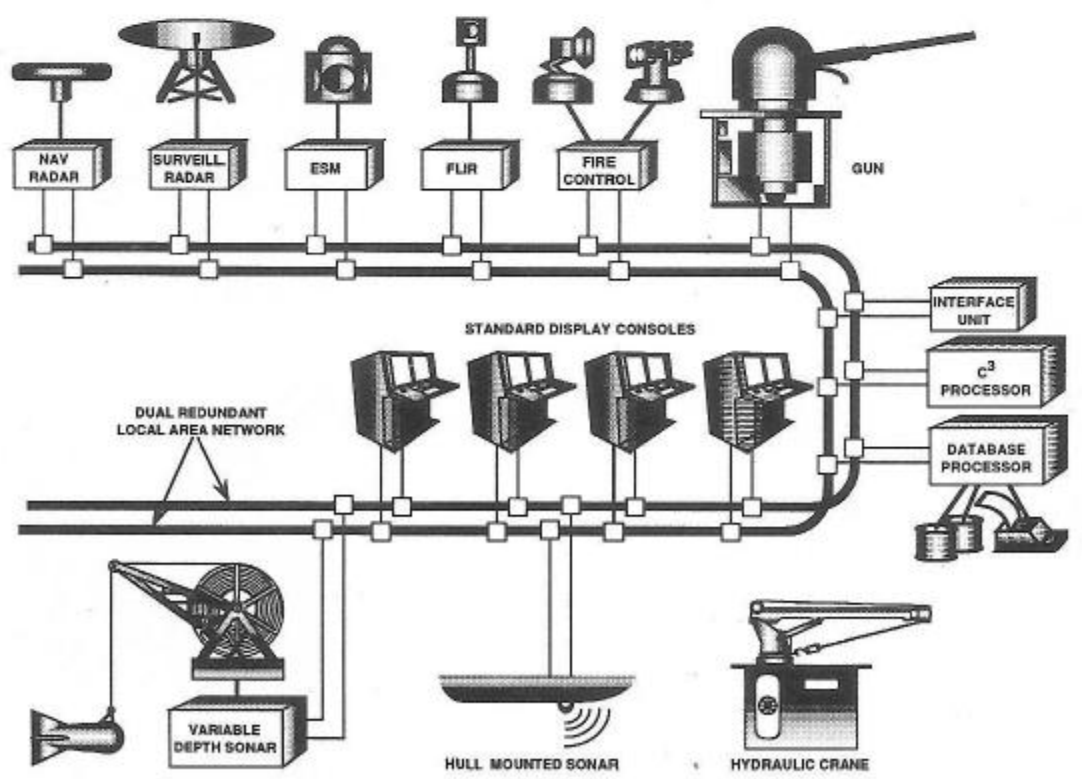
Transmitter: Omnidirectional transmission in CW or FM modes
Receiver: 36 preformed beams
Video processing: Data processing in FM and CW modes: automatic detection and tracking; simultaneous multitrack extraction (up to 64); target analysis (apparent length, Doppler measurement)
Display: 2 high-resolution flicker-free colour TV monitors

Manufacturer/Contractor

Thomson Sintra Activités Sous-Marines, Sophia Antipolis Cedex, France.



The Thomson-CSF Salmon VDS fish and drum aboard Thetis *(F 357)* (Royal Danish Navy)



A schematic view of the Terma TDS installed in the 'Thetis' class. There are dual redundent Ethernet (IEEE 802.3) databuses with a series of intelligent nodes. Programming language is Ada (Royal Danish Navy)

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 28 × 14 m (92 × 46 ft). The flight deck is strengthened to take helicopters up to Sea King or Merlin size
Helicopter: 1 Westland Lynx Mk 91

Westland Lynx Mk 19 aboard Hvidbjørnen *(F 360)* (H M Steele)

PROPULSION

Specifications
System: Diesel
Main machinery: 3 MAN/Burmeister & Wain Alpha 12V 28/32A diesels; 7.94 MW (10,800 hp(m)) sustained
Shafts: 1
Propellers: 1 KaMeWa cp
Thrusters: Brunvoll bow thruster, 647 kW (880 hp(m)); Brunvoll azimuth thruster, 800 kW (1,100 hp(m))
Ship services: 3 GM Detroit diesel/Volund generator sets, each 480 kW; one 127 kW emergency generator

FURTHER INFORMATION

PROGRAMME

The Royal Danish Navy has developed a particular type of vessel which is part patrol ship and part warship. The patrolling function stems from the Danish territories in Greenland and the Faroes, which involves fishery protection and EEZ surveillance, under extremely adverse conditions. The warship function requires a ship that can be used in keeping the narrow waters of the Baltic clear in times of crisis or war.

The four strong 'Hvidbjørnen' class was constructed between 1961 and 1963. These 'inspection vessels' displaced 1,650 tonnes and were armed with one 76 mm (3 in) gun, a depth-charge rack and an ASW helicopter (originally an Alouette, later a Lynx). The ships also had a radar suite and a sonar.

These were followed by *Beskytteren* (F 340), which was slightly larger and designated 'Modified Hvidbjørnen' class. It is still in service.

The 'Thetis' class was built to replace the 'Hvidbjørnen' class and a preliminary study by Y-ARD in 1986 led to Dwinger Marine Consultants being awarded the contract for a detailed design, which was completed in mid-1987. An order for all four was then placed in October 1987 and they were completed between 1991 and 1992.

The hull has an ice-breaking bow and is capable of proceeding through 80 cm (31 in) of ice. The smooth upper surfaces and rounded corners are designed to resist the formation of ice, although the total amount of ice allowed is 375 tonnes (Royal Danish Navy via Hans Harboe-Hansen)

DESIGN

The hull is some 30 m (98.43 ft) longer than the 'Hvidbjørnen' class to improve sea-keeping qualities and allow considerable extra space for additional armament. As with the contemporary Stanflex 300 design ('Flyvefisken' class) considerable use is made of containerisation, enabling equipment to be shipped depending on role.

The hull is ice strengthened to enable penetration of 1 m (3.28 ft) thick ice and there is a double skin up to 2 m (6.5 ft) above the waterline which is subdivided by ten watertight bulkheads. *Thetis* is regularly employed in seismological surveys off the Greenland coast and for this role a 4,000 m (13,124 ft) towed array has been installed in the stern. This is used to receive signals generated by pneumatic noise guns towed 800 m (2,625 ft) astern. The mast is of unusual design, with a very large radome for the Plessey AWS-6 and an elaborate lookout position. The bridge and operations room are combined.

Anchor equipment, bollards and winches are stowed below the upper deck, the sides are angled and corners rounded-off to minimise ice formation, but this also has 'stealth' benefits.

WEAPONS FIT

The design has built-in flexibility and weight allowances to enable it to be developed into a fully armed frigate in due course. The following systems have been considered: Harpoon, VLS Sea Sparrow, triple torpedo tubes, RAM, PDMS, SRBOC or Sea Gnat decoys, Nixie, fire-control radars and a passive sonar towed array.

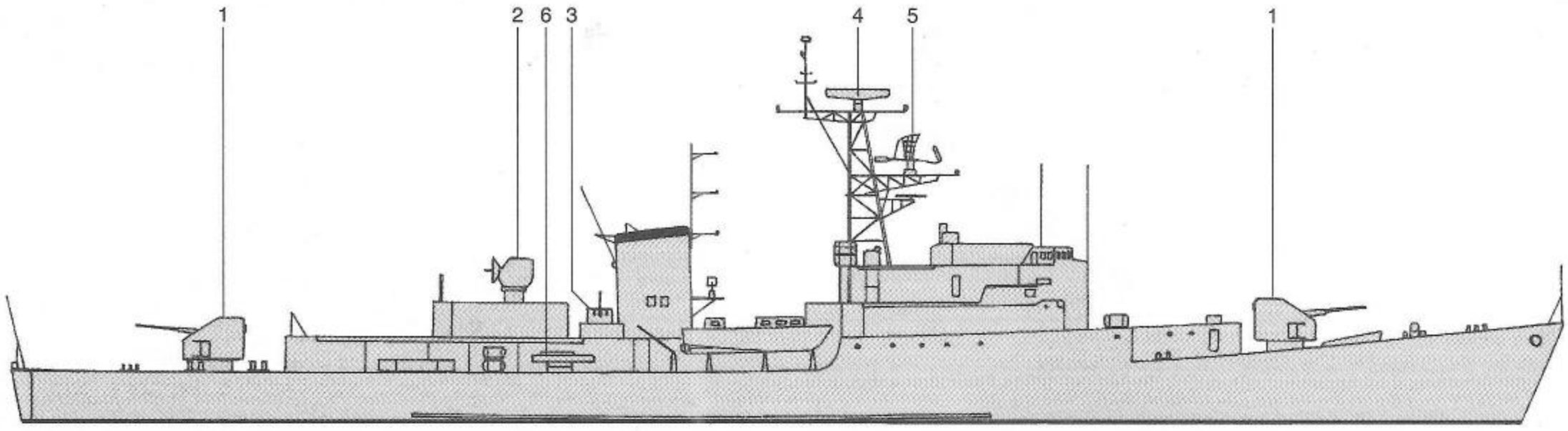
DEPLOYMENT

The primary role for all four ships in peacetime is fishery protection. In addition, *Thetis* is employed for some three to four months in each year doing seismological surveys in the Greenland EEZ.

MODIFIED HVIDBJOERNEN

Beskytteren, the sole surviving 'Modified Hvidbjørnen' class ship is now used solely for patrol and fishery protection duties and will be included in the 'Patrol Ship' section.

COMANDANTE JOÃO BELO



Comandante Hermenegildo Capelo (Ian Sturton)
1 *DCN single 100 mm (3.9in)/55 Modèle 1953 automatic gun* **2** *Thomson-CSF DRBC-32C fire control* **3** *Bofors 40 mm/60 anti-air cannon* **4** *Thomson-CSF DRBV-50 surface search radar* **5** *Thomson-CSF DRBV-22A air search radar* **6** *US Navy triple Mk 32 324 mm torpedo tubes (six)*

GENERAL SPECIFICATIONS

Country of origin: France
Operator: Portugal

Class: COMANDANTE JOÃO BELO

Built: 4
Active: 3 (F 482 is now employed on non-military duties)

Displacement:
standard: 1,750 t
full load: 2,250 t

Dimensions
Length: 102.7 m (336.9 ft)
Beam: 11.7 m (38.4 ft)
Draught: 4.4 m (14.4 ft)

Speed: 25 kts
Range: 7,500 n miles at 15 kts

Complement: 201 (15 officers)

SHIPS

COMANDANTE JOÃO BELO (F 480)

Builder	Atelier et Chantiers de Nantes, Nantes, France
Laid down	6 Sep 1965
Launched	22 Mar 1966
Commissioned	1 Jul 1967

COMANDANTE HERMENEGILDO CAPELO (F 481)

Builder	Atelier et Chantiers de Nantes, Nantes, France
Laid down	13 May 1966
Launched	29 Nov 1966
Commissioned	26 Apr 1968

COMANDANTE SACADURA CABRAL (F 483)

Builder	Atelier et Chantiers de Nantes, Nantes, France
Laid down	18 Aug 1967
Launched	15 Mar 1968
Commissioned	25 Jul 1969

WEAPONS SYSTEMS

TUBES

Following the mid-1990s modernisation these ships now have two triple 324 mm US Mk 32 torpedo tubes located in the waist, with one set on either beam.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

Manufacturer/Contractor
GEC-Marconi Naval Systems, UK.

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

100 mm Modèle 1953 multipurpose gun

As built, the ships had three 100 mm Modèle 1953 mountings in 'A,' 'X' and 'Y' positions. F 482 is being converted for non-military roles, but F 480, F 481 and F 483 have had 'X' turret removed. The remaining guns are all original Modèle 1953, a design which has been in service since 1959 and is normally operated in the fully automatic remote mode, although it can be operated manually in an emergency. The magazine is below the deck, the replenishment system consisting of a 10-cell loader drum feeding rounds directly to a hydraulically operated hoist, which lifts the round into the turret through a curved chute finally bringing it into a horizontal position; handling speed is 35 rds/min. The round is then transferred to a 10-round, hydraulically driven intermediate magazine which remains parallel to the elevating mass. Once the fuze has been set, the shell is transferred to a horizontal curved chute from where it is rammed into the open breech. After the gun has fired the expended cartridge is ejected downwards and through the front of the turret, while fresh water is automatically sprayed into the barrel together with a jet of compressed air. The total mounting capacity is 30 rounds; 10 in the loading drum, two in the hoist and 18 within the turret loading system.

Specifications
Calibre: 100 mm
Length of barrel: 55 calibres
Muzzle velocity: 1,870 m/s (6,133 ft/s)
Traverse: 360° at 40°/s
Elevation: −15 to +80° at 25°/s
Mounting weight: 21 t
Crew: 2 (optional) and 2 loaders
Range:
anti-surface: 9.15 n miles (17 km)
anti-air: 8,000 m (26,240 ft)
Rate of fire: 60 rds/min
Ammunition: 13.5 kg (30 lb) (multipurpose projectile); 9.7 kg (21.4 lb) (charge)

Manufacturers/Contractors
Direction des Constructions Navales (prime).
Mécanique Creusot-Loire, Marine Products (mounting).
DCN Ruelle (gun).
CSEE Défense (servo equipment).

Bofors 40 mm/60

Two Bofors 40 mm guns are mounted in single mounts abreast the stack.

Specifications
Gun
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity:
new barrel: 881 m/s (2,890 ft/s)
mid-life: 850 m/s (2,788 ft/s)
Rate of fire: 120 rds/min (cyclic)
Max range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,630 ft)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

ANTI-SUBMARINE MORTARS

The original 305 mm Mortier anti-submarine mortar which was mounted in 'B' position has been removed during modernisation.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Argo 700

An Argo 700 system has been installed during modernisation. This provides surveillance, radar warning and targeting information over the 2-18 GHz band.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units which have been fitted during modernisation.

Specifications

Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

AN/SLQ-25 Nixie noisemaker

One AN/SLQ-25 Nixie, solid-state, modular design electroacoustic countermeasures decoy system has been installed to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm long (3.10 ft), 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor

Aerojet ElectroSystems, Sacramento, California, USA.

Comandante Roberto Ivens *(F 482) in the mid-1980s showing the pre-modernisation weapons and sensors of the 'Comandante João Belo' class. Note the gun-like turret of the 304 mm ASW mortar in 'B' position* (Portuguese Navy)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SEWACO FD command and fire-control system

SEWACO FD (FD = Fully Distributed) is an automatic threat evaluation, weapon assignment and sensor allocation system, which can also be used as a planning aid through inputs of intelligence data and decision support facilities. SEWACO FD has been developed from the SEWACO system, with distributed processing power replacing the centralised computer complexes. The processing power is formed by SIGMA (SIGnaal Modular Architecture) nodes, one of which is built into every MOC (Multifunction Operator Console) and Bus Terminal Server (BTS). These SIGMA nodes consist of a number of SUN-1S type processor boards each with 16 Mbyte RAM and capable of 12.5 Mips. These nodes are housed in both Multifunction Operator Consoles (MOCs) and Bus Terminal Servers (BTS).

The software package is written in Ada but includes SPLICE (Subscription Paradigm for the Logical Interconnection of Concurrent Engines) distributed database and data communication modules, which operate alongside Unix. The hardware is linked through a dual Ethernet (IEEE 802.3) standard LAN (local area network), with subsystems either linked directly to the LAN through a digital data interface bustap, or through a BTSs interface. These BTS also have spare processing power which they bring into use automatically to compensate for failures in standard processor nodes.

Manufacturers/Contractors

Thomson-CSF, Systèmes Défense et Controle, France.
Hollandse Signaalapparaten BV, Netherlands.

COMMUNICATIONS AND DATALINKS

Link 11

Link 11 has been fitted during the recent refits.

WEAPONS CONTROL

CTA

CTA *(Conduit de Tir Analogue)* was the first of the French computer-based fire-control systems to enter service and it controls the ship's 100 mm guns in operations against air, surface and shore targets. These are designated by the ship's search radar through the combat information centre. CTA uses an analogue computer with CS-1 software language and a single four-axis optical director. The CTA is supported by DRBV-22 I-band monopulse radar, which can track a 0.1 m² target at 8 n miles (15 km). Presumably there is a digital/analogue interface to enable CTA and SEWACO FD to interoperate.

Manufacturer/Contractor

DCN International, Paris, France.

SAGEM DMAa optical secondary director

DMAa is an optical-only director for use in air defence operations.

Manufacturer/Contractor

SAGEM, France.

RADARS

Type	DRBV 22A	DRBV 50	KH 1007	DRBC 31D
Company	Thomson-CSF	Thomson-CSF	Kelvin Hughes	Thomson-CSF
Role	Air/surface search/target designation	Surface search	Navigation	Fire control for 100 mm guns
Band	D	G	I	I
Beam	2.5 × 50°		1.0 × 18°	
Peak power	2 MW		25 kW	
Gain	28 dB		31 dB	
Pulsewidth	2.5 µs		0.08/0.3/0.8 µs	
PRF	450 pps		1,600/800/400 pps	
Scan rate	7.5/15 rpm		26 rpm	

SONARS

AN/SQS-510(V) sonar

The Computing Devices of Canada (CDC) AN/SQS-510(V) is being installed in these three ships during their refits and will achieve commonality with the Portuguese Navy's 'Vasco da Gama' (MEKO) class frigates, which already have this sonar. AN/SQS-510(V) is a development of the Canadian Westinghouse AN/SQS-505 sonar, combined with the AN/SQR-501 towed array. The hull-mounted element is a 7 kHz medium-size search and attack sonar, which can be used in direct communication with a digital computer, either for the transfer of range and bearing information, or it can give assistance to the operator in detection and tracking. It is a deep water, omnidirectional, surveillance system, but is also able to operate in a directional mode that can maintain search ability while tracking defined targets. Three selectable frequencies are available so that several ships can survey an area in close proximity without cross-talk. The 'wet end' is AN/SQR-501 (also known as the Canadian Towed Sonar Array (CANTASS), which is itself a combination of a US Navy AN/SQR-19 array and a Computing Devices of Canada signal processor.

Specifications

AN/SQS-501
Coverage: 360° (azimuth)
Range: 183-3,000 m (200-3,200 yd)
Doppler range: ±40 kts (7.2 kHz)
Displays:
range: A Scan
bearing: B Scan
Doppler frequencies: 6.4, 7.2 and 8.0 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT
Power level: High and low (10 dB reduction)

Manufacturers/Contractors

Computing Devices, Ottawa, Canada (prime and software).
Westinghouse Canada Inc, Burlington, Ontario, Canada (sonars).

PROPULSION

Specifications

System: Diesel
Main machinery: 4 SEMT-Pielstick 12 PC2.2 V 400 diesels; 11.8 MW (16,000 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These were the first French-designed ships to be acquired by the Portuguese Navy and were generally similar to the French 'Commandant Rivière' class, but with additional emphasis on the requirements of tropical service. The four ships were built in French yards between 1965 and 1969. There was a plan to give all the ships a major mid-life modernisation in the mid-1980s, but this was shelved for economic reasons, although some work was done. A new plan has, however, been agreed and the ships were modernised in the mid-1990s.

Comandante Roberto Ivens has been converted to become a non-combatant ship for employment on training and SAR roles. The other three will remain front-line units.

MODERNISATION

Although the major work for the 1980s modernisation was cancelled, the modernisation of external communications, sensors and electronics was undertaken between 1987 and 1990, which included fitting Mk 36 SRBOC.

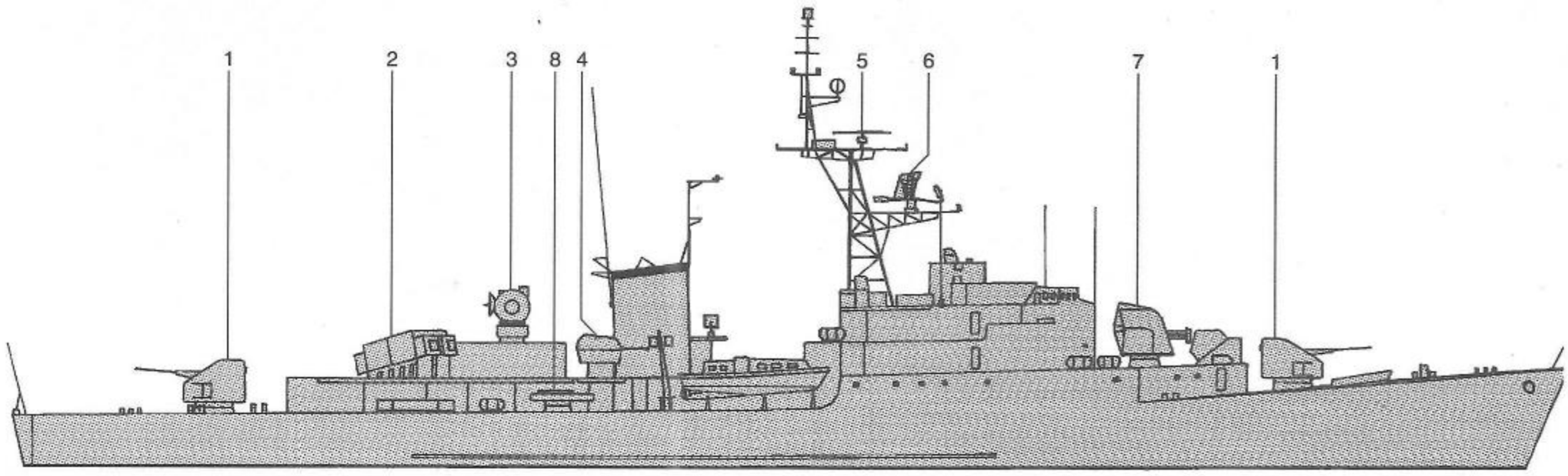
Further work was undertaken between 1993 and 1996 which included replacing the hull sonar and torpedo tubes, removing the anti-submarine mortar, and fitting the Nixie torpedo decoy system. The ESM equipment was also updated.

In 1996/97 further work is being undertaken on the three front-line units, but not *Comandante Roberto Ivens.* This work is generally aimed at improving their ASW capability and includes installing a combat data system and Link 11 data communications enabling the ships to interoperate with the destroyers of the 'Vasco da Gama' class.

At least one ship, *Comandante Hermenegildo Capelo,* has had both 'B' and 'X' 100 mm mountings removed, and 'X' mounting is also scheduled to be removed in the other two. These steps will considerably reduce topweight, but a plan to remove both after 100 mm guns and replace them with either a flight deck and hangar for a helicopter or by SSM has been shelved.

Comandante João Belo, *name ship of the class of four in the Portuguese Navy* (D + B Teague)

URUGUAY (COMMANDANT RIVIÉRE)



Uruguay (Ian Sturton)
1 *DCN single 100 mm (3.9 in)/55 Modèle 1953 automatic gun* **2** *Twin Aerospatiale MM 38 Exocet anti-ship missile launchers (four missiles)* **3** *Thomson-CSF DRBC-32C fire control* **4** *Hispano-Suiza 30 mm/70* **5** *Racal-Decca Type 1226 navigation radar* **6** *Thomson-CSF DRBV-22A air/surface search radar* **7** *Mortier 305 mm four-barrelled ASW mortar* **8** *Triple 550 mm (21.7 in) torpedo tubes (total 6 tubes)*

GENERAL SPECIFICATIONS

Country of origin: France
Operator: Uruguay
Type: Commandant Riviére (FFG)

Class: URUGUAY

Acquired: 3
Active: 3

Displacement:
standard: 1,750 t
full load: 2,250 t

Dimensions
Length: 102.7 m (336.9 ft)
Beam: 11.7 m (38.4 ft)
Draught: 4.3 m (14.1 ft)

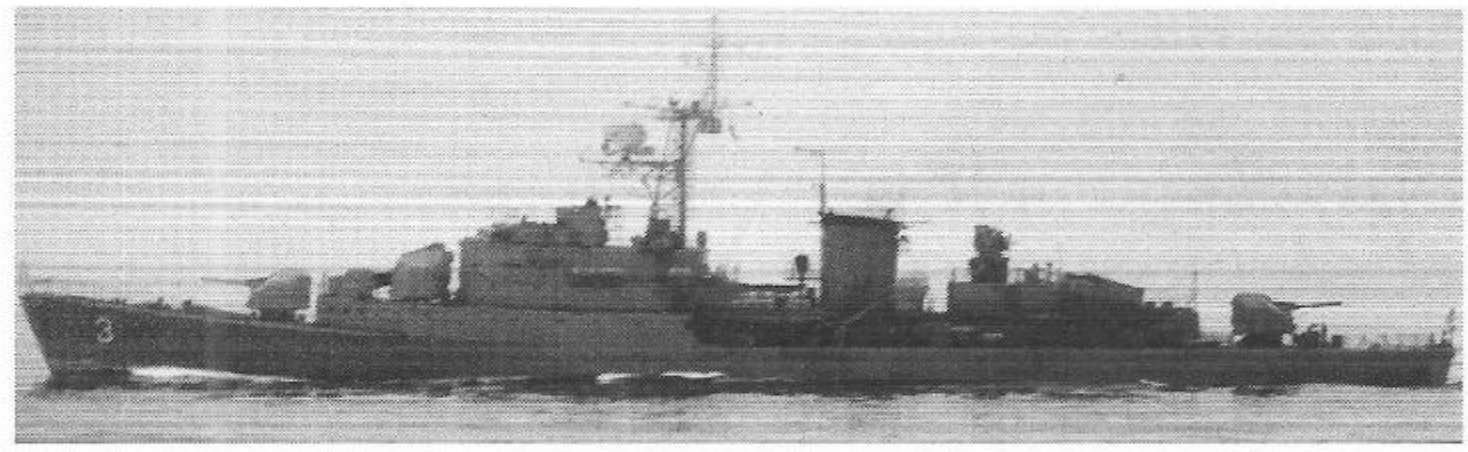
SHIPS

URURUGUAY (1)

Builder	Arsenal de Lorient, Lorient, France
Laid down	Apr 1959
Launched	15 Apr 1961
Commissioned (France)	10 Mar 1962 (*Commandant Bourdais* (740))
Purchased by Uruguay	14 Mar 1990
Recommissioned (Uruguay)	20 Aug 1990 (Uruguay (1))

GENERAL ARTIGAS (2)

Builder	Arsenal de Lorient, Lorient, France
Laid down	Oct 1957
Launched	11 Oct 1958
Commissioned (France)	15 Oct 1962 (*Victor Schoelcher* (F 725))
Purchased by Uruguay	30 Sep 1988
Recommissioned (Uruguay)	9 Jan 1989 (*General Artigas* (2))



Montevideo *(3)*

MONTEVIDEO (3)*

Builder	Arsenal de Lorient, Lorient, France
Laid down	Nov 1958
Launched	12 Mar 1960
Commissioned (France)	14 Dec 1962 (*Amiral Charner* (F 727))
Purchased by Uruguay	14 Mar 1990
Recommissioned (Uruguay)	28 Jan 1991 (*Montevideo* (4))*

***Note**
On first commissioning in the Uruguayan Navy *Montevideo* had the pennant number '4' but this has subsequently been changed to '3'.

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 38 medium-range anti-ship missile

The original Exocet missile launchers were removed in France prior to the transfer to Uruguay. Four ITS *(Installation de Tir Standard)* launchers per ship for MM 38 missiles were, however, reinstalled in 1992. These launcher-containers point outwards and are inclined at an angle of 12° to the horizontal. Targets are acquired by the ship's DRBV-22A radar and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence. This involves turning on the thermal battery, releasing the mechanical safety locks, igniting the booster, and, finally, breaking the umbilical cord; the total process takes some 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change of course during its flight. The attack consists of three phases: cruise, approach and terminal. A salvo may be fired in 12-20 seconds.

Specifications
MM 38
Length: 5.21 m (17 ft)
Diameter: 35 cm (13.8 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s
Booster: 100 kg (220 lb) SNPE Epervier boost motor, burn time of 2.4 s.
Warhead: Luchaire 165 kg (364 lb) fragmentation warhead
Fuzes: delayed impact fuze and autopilot-controlled proximity fuze

Manufacturer/Contractor
Aerospatiale Tactical Missiles, Chatillon Cedex, France.

TUBES

There are two triple sets of 550 mm (21.6 in) tubes.

TORPEDOES

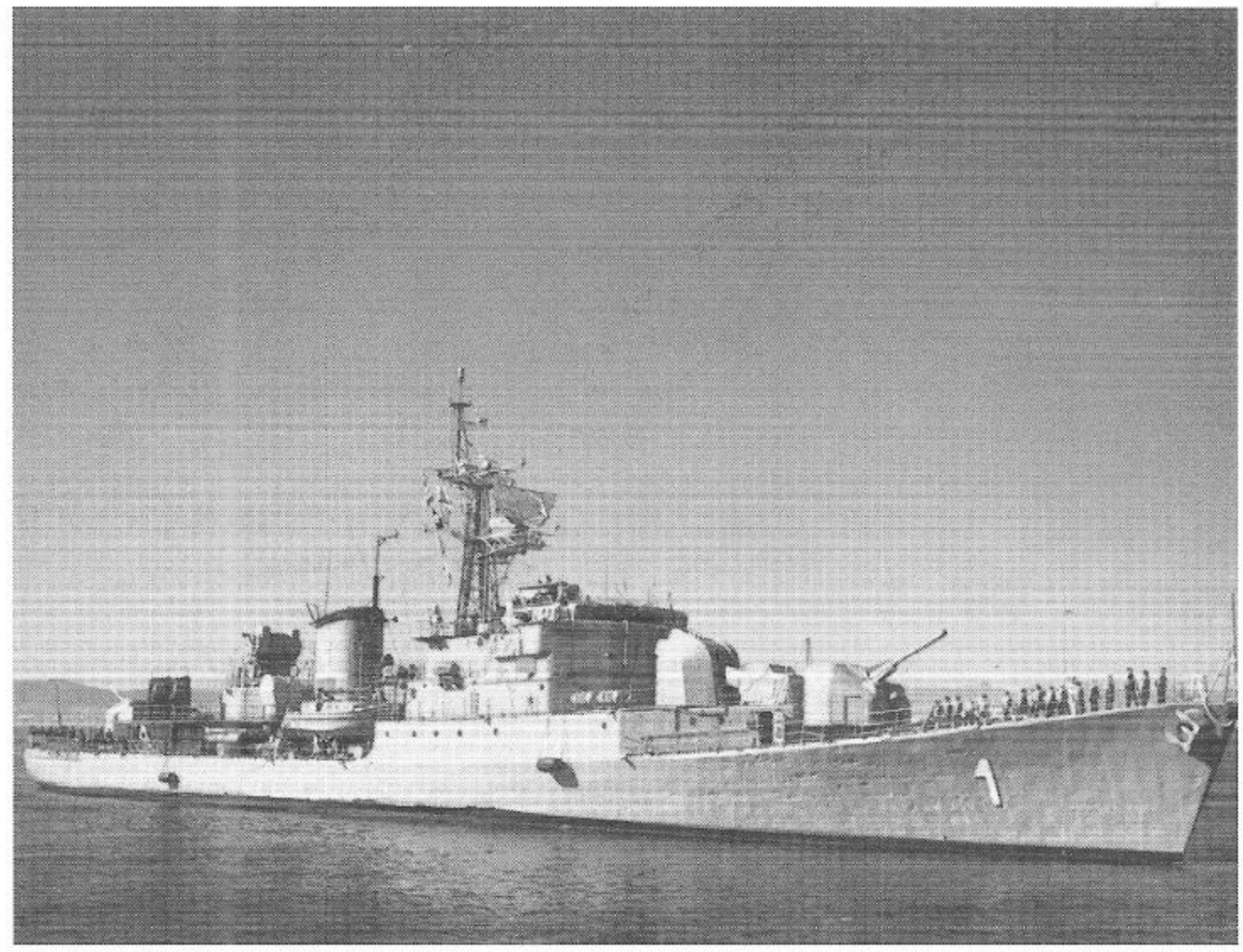
L3 heavyweight anti-submarine torpedo

These Uruguayan ships are among the last to use the French 550 mm (21.6 in) torpedoes. The L3 guidance system uses an active sonar seeker with a range of approximately 600 m (1,968 ft), behind which is the warhead with a 200 kg (441 lb) charge of Tolite A1 with

an impact fuze. The weapon can attack submarines moving at speeds up to 20 kts at a maximum depth of 300 m (984 lb). Distance and track data are provided by the fire-control system before discharge and upon leaving the tube the automatic pilot provides the appropriate heading and depth. Using this data the weapon travels some 2 n miles (4 km) as the onboard guidance system is warmed up, the latter being completed about 350 m (1,148 ft) before this phase is complete. The torpedo then begins the search phase adopting a zig-zag approach at an approach heading of 20° and the safety and arming mechanism is activated. The zig-zag approach is used so the seeker may cover a greater area. When the target is acquired, the onboard guidance system calculates the most effective ballistic course with the fuze detonating the warhead 3.5 seconds after the seeker has ensured the target is within 20 m (65.6 ft).

Specifications
Length: 4.3 m (14.1 ft)
Diameter: 550 mm (21.6 in)
Weight: 910 kg (2,006 lb)
Speed: 25 kts
Range: 3 n miles (5.5 km)
Depth: 300 m (984 ft)

Manufacturer/Contractor
DCN International, Paris, France.



Uruguay *(1), the former French* Commandant Bourdais, *is now the lead ship in a class of three in the Uruguayan Navy. The weapons and sensors are virtually the same as when in French service* (Peter Humphries)

GUNS

100 mm Modèle 1953 multipurpose gun
As built, the ships had three 100 mm Modèle 1953 mountings in the customary 'A,' 'X' and 'Y' positions, but the 'X' turret was subsequently removed to create space for the MM 38 launchers. The two guns in these three ships are both original Modèle 1953, a design which has been in service since 1959 and is normally operated in the fully automatic remote mode, although it can be operated manually in an emergency. The magazine is below the deck, the replenishment system consisting of a 10-cell loader drum feeding rounds directly to a hydraulically operated hoist, which lifts the round into the turret through a curved chute finally bringing it into a horizontal position; handling speed is 35 rds/min. The round is then transferred to a 10-round, hydraulically driven intermediate magazine which remains parallel to the elevating mass. Once the fuze has been set, the shell is transferred to a horizontal curved chute from where it is rammed into the open breech. After the gun has fired, the expended cartridge is ejected downwards and through the front of the turret, while fresh water is automatically sprayed into the barrel together with a jet of compressed air. The total mounting capacity is 30 rounds; 10 in the loading drum, two in the hoist and 18 within the turret loading system.

Specifications
Calibre: 100 mm
Length of barrel: 55 calibres
Muzzle velocity: 1,870 m/s (6,134 ft/s)
Traverse: 360° at 40°/s
Elevation: −15 to +80° at 25°/s
Mounting weight: 21 t
Crew: 2 (optional) and 2 loaders
Range:
anti-surface: 9.15 n miles (17 km)
anti-air: 8,000 m (26,240 ft)
Rate of fire: 60 rds/min
Ammunition: 13.5 kg (29.8 lb) (multipurpose projectile); 9.7 kg (21.4 lb) (charge)

Manufacturers/Contractors
Direction des Constructions Navales (prime).
Mécanique Creusot-Loire, Marine Products (mountings).
DCN Ruelle (gun).
CSEE Défense (servo equipment).

Hispano Suiza 30 mm/70
Each of these ships is armed with two single 30 mm/70 in power-operated, turreted mountings. These would appear to be CAS 62 mountings which were produced in the 1960s and installed in the 'Commandant Riviére' class as built but removed in the late 1970s and replaced by 40 mm mountings in all except *Victor Schoelcher* (F 725), *Balny* (F 729), *Protet* (F 748) and *Enseigne de Vaisseau Henry* (F 749).

Specifications
Calibre: 30 mm
Barrel length: 70 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Rate of fire: 600 rds/min
Range
max: 8,500 m (9,300 yd)
effective: 2,800 m (3,100 yd)
Elevation: −18 to +83° at 40°/s
Training: 360° at 50°/s

ANTI-SUBMARINE MORTARS

Mortier 305 mm ASW mortar
As built, all the Commandant Riviére and Comandante Joao Belo ships included a Mortier 305 mm ASW mortar in their armament, but this weapon has now been removed from all except for the four ships sold to Uruguay. The French Mortier is a 304 mm weapon and should not be confused with the contemporary 375 mm rocket launcher, which is also found on French ships of this period, and was built by Creusot-Loire under licence from Bofors.

The Mortier weapon is mounted in a turret, which in these ships is in 'B' position, and which, from a distance appears to be another gun turret. The weapon itself has four tubes and fires two types of bomb. The ASW bomb weighs 230 kg (507 lb) and has a range bracket of 400 to 2,750 m (1,312 to 9,020 ft), while that used for shore bombardment weighs 100 kg (220 lb) and has a maximum range of 6,000 m (19,680 ft). One salvo can be fired every 25 seconds, with the four tubes firing one second apart.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

ARBR 16 radar warning receiver
ARBR 16 is an analysis receiver associated with the Dagaie chaff system. It detects radio frequency signals (pulse, continuous wave and frequency hoppers) and compares them with a 1,000-signal library, giving an audio signal where analysis indicates that jamming is necessary. There is a single omnidirectional antenna plus six direction-finding antennas

Manufacturer/Contractor
Thomson-CSF, Paris Cedex, France.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

CTA
CTA *(Conduit de Tir Analogue)* was the first of the French computer-based fire-control systems to enter service and it controls the ship's 100 mm guns in operations against air, surface and shore targets. These are designated by the ship's search radar through the combat information centre. CTA uses an analogue computer with CS-1 software language and a single four-axis optical director. The CTA is supported by DRBC 32C I-band monopulse radar, which can track a 0.1 m^2 target at 8 n miles (15 km).

Manufacturer/Contractor
DCN International.

SAGEM DMAa optical secondary director
DMAa is an optical-only director for use in air defence operations.

Manufacturer/Contractor
SAGEM, France.

RADARS

Type	DRBV 22A	Type 1226	DRBC 32C
Company	Thomson-CSF	Racal-Decca	Thomson-CSF
Role	Air/surface search/target designation for MM 38	Surface search	Fire control for 100 mm guns
Band	D	I	I
Beam	2.5 × 50°	1.2°	2.3°
Peak power	2 MW	25 kW	30 kW
Gain	28 dB	30 dB	
Pulsewidth	2.5 µs	0.05/0.25/1 µs	4 µs
PRF	450 pps	—	
Scan rate	7.5/15 rpm	28 rpm	

SONARS

EDO AN/SQS-17

The AN/SQS-17 is a 1950s-vintage sonar, which was designed by EDO and built under licence in France. It is a hull-mounted, active search set, working at 12, 13 and 14 kHz, using a 24-stave 50 cm diameter array.

Thomson-CSF DUBA-3

The DUBA-3 is a searchlight, high-frequency, active attack sonar, which is used to control the Bofors ASW mortar. It occupies the same dome as the AN/SQS-17.

Manufacturer/Contractor
Thomson-CSF, Paris, Cedex, France.

PROPULSION

Specifications
System: 4 SEMT-Pielstick 12 PC series diesels; 11.8 MW; (16,000 hp(m))
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These are the largest warships ever operated by the Uruguayan Navy. The first one was bought from France through SOFMA on 30 September 1988, followed by the other two on 14 March 1990. All were refitted before transfer.

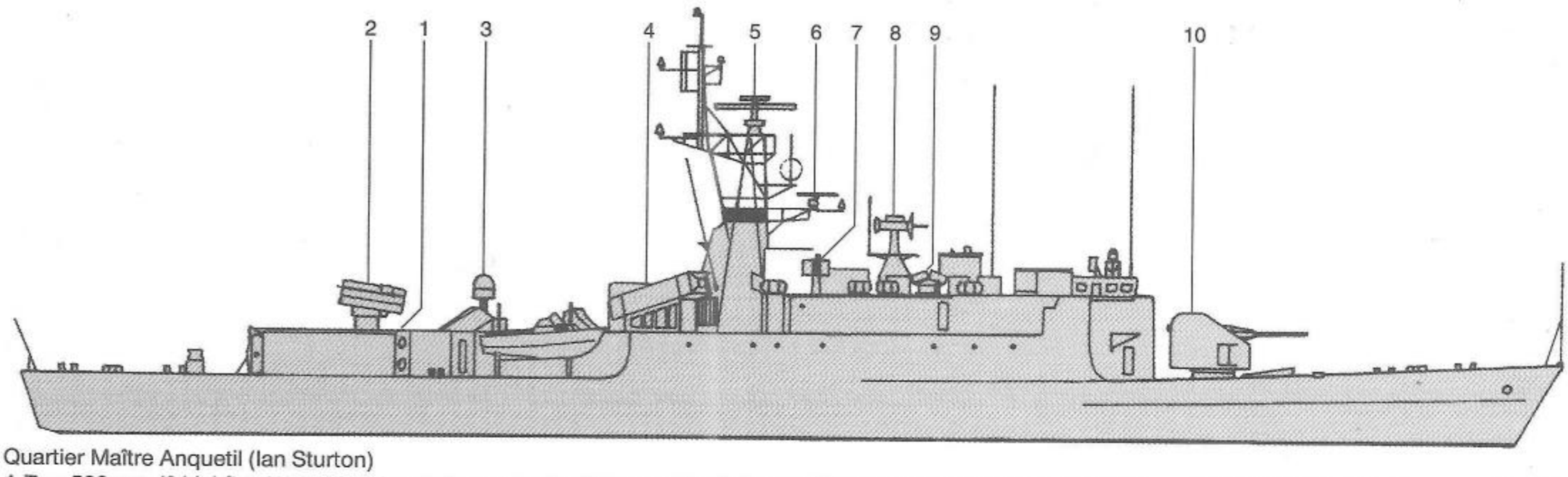
NAMES

The three ships have patriotic names of the country, the capital city and the hero of the war of independence. *Montevideo* was originally given the pennant number '4' but this was later changed to '3'.

STRUCTURE

Exocet and Dagaie were removed before transfer but the SSM casings were retained. Both systems were restored in 1991/92.

D'ESTIENNE D'ORVES (TYPE A 69)



Quartier Maître Anquetil (Ian Sturton)
1 *Two 533 mm (21 in) fixed torpedo tubes* **2** *Creusot-Loire 375 mm Mk 54 six-tube ASW mortar* **3** *Satcom* **4** *MM 40 Exocet* **5** *DRBV-51A air/surface search radar* **6** *Racal-Decca 1226 radar* **7** *20 mm cannon* **8** *DRBC-32E* **9** *Dagaie chaff/IR launcher* **10** *Single 100 mm (3.9 in)/55 Mod 68 CADAM gun*

GENERAL SPECIFICATIONS

Operator: France
Type: A 69

Class: D'ESTIENNE D'ORVES

Built: 17
Active: 17

Displacement:
standard: 1,175 t
full load: 1,250 t (1,330 t, later ships)

Dimensions:
Length: 80.5 m (264.1 ft)
Beam: 10.3 m (33.8 ft)
Draught: 5.5 m (18 ft) (sonar)

Speed: 23 kts
Range: 4,500 n miles at 15 kts

Endurance: 30 days
Complement: 90 (7 officers) plus 9 marines (in some)

SHIPS

D'ESTIENNE D'ORVES (F 781)
Builder Arsenal de Lorient, Lorient, France
Laid down 1 Sep 1972
Launched 1 Jun 1973
Commissioned 10 Sep 1976

AMYOT D'INVILLE (F 782)
Builder Arsenal de Lorient, Lorient, France
Laid down 2 Jul 1973
Launched 30 Nov 1974
Commissioned 13 Oct 1976

DROGOU (F 783)
Builder Arsenal de Lorient, Lorient, France
Laid down 16 Oct 1973
Launched 30 Nov 1974
Commissioned 1 Oct 1976

DETROYAT (F 784)
Builder Arsenal de Lorient, Lorient, France
Laid down 15 Dec 1974
Launched 31 Jan 1976
Commissioned 4 May 1977

JEAN MOULIN (F 785)
Builder Arsenal de Lorient, Lorient, France
Laid down 15 Jan 1975
Launched 31 Jan 1976
Commissioned 11 May 1977

QUARTIER MÂITRE ANQUETIL (F 786)
Builder Arsenal de Lorient, Lorient, France
Laid down 1 Aug 1975
Launched 7 Aug 1976
Commissioned 4 Feb 1978

COMMANDANT DE PIMODAN (F 787)
Builder Arsenal de Lorient, Lorient, France
Laid down 15 Jul 1975
Launched 7 Aug 1976
Commissioned 20 May 1978

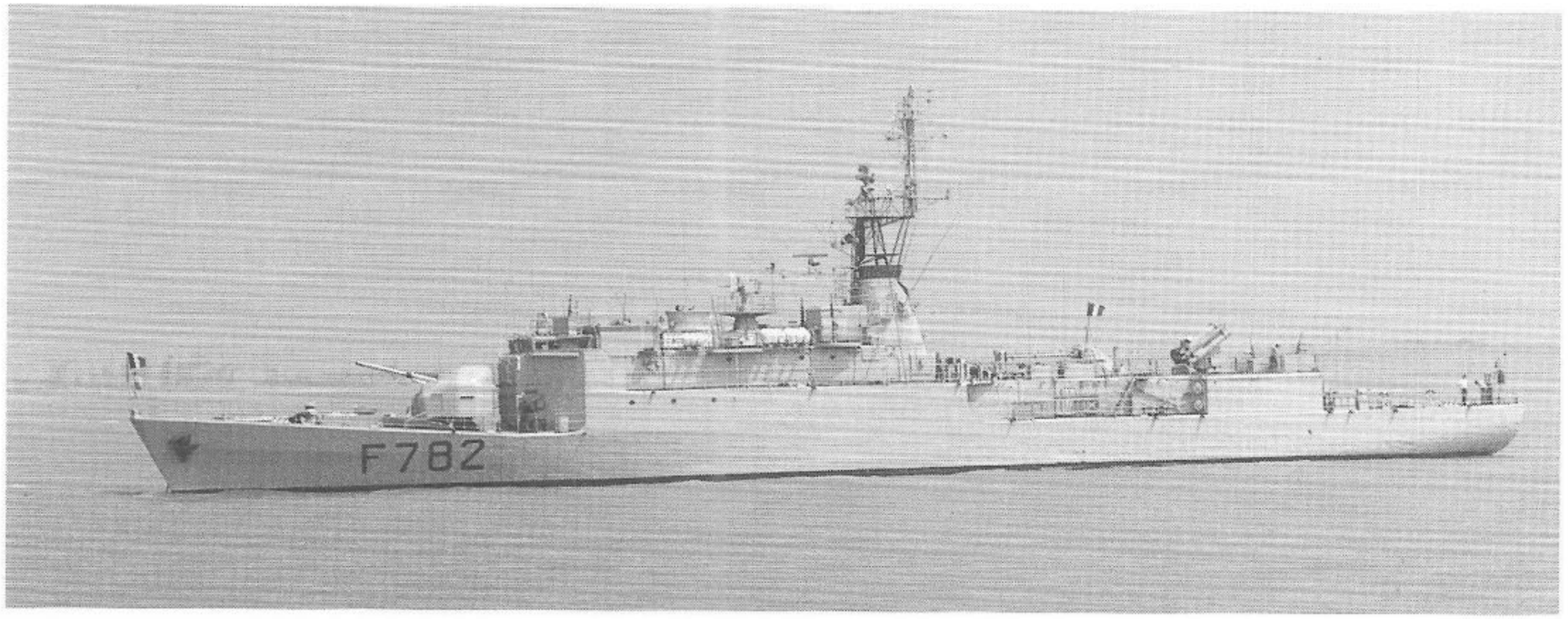
SECOND MÂITRE LE BIHAN (F 788)
Builder Arsenal de Lorient, Lorient, France
Laid down 1 Nov 1976
Launched 13 Aug 1977
Commissioned 7 Jul 1979

LIEUTENANT DE VAISSEAU LE HÉNAFF (F 789)
Builder Arsenal de Lorient, Lorient, France
Laid down 21 Mar 1977
Launched 16 Sep 1978
Commissioned 13 Feb 1980

LIEUTENANT DE VAISSEAU LAVALLÉE (F 790)
Builder Arsenal de Lorient, Lorient, France
Laid down 30 Nov 1977
Launched 11 May 1979
Commissioned 8 Oct 1980

COMMANDANT L'HERMINIER (F 791)
Builder Arsenal de Lorient, Lorient, France
Laid down 29 May 1979
Launched 7 Mar 1981
Commissioned 19 Jan 1986

PREMIER MÂITRE L'HER (F 792)
Builder Arsenal de Lorient, Lorient, France
Laid down 24 Jul 1979
Launched 28 Jun 1980
Commissioned 5 Dec 1981



Amyot d'Inville *(F 782)* (H & L van Ginderen Collection)

COMMANDANT BLAISON (F 793)
Builder: Arsenal de Lorient, Lorient, France
Laid down 15 Nov 1979
Launched 7 Mar 1981
Commissioned 26 Apr 1982

ENSEIGNE DE VAISSEAU JACOUBET (F 794)
Builder Arsenal de Lorient, Lorient, France
Laid down Jun 1980
Launched 28 Sep 1981
Commissioned 23 Oct 1982

COMMANDANT DUCUING (F 795)
Builder Arsenal de Lorient, Lorient, France
Laid down 1 Oct 1980
Launched 28 Sep 1981
Commissioned 17 Mar 1983

COMMANDANT BIROT (F 796)
Builder Arsenal de Lorient, Lorient, France
Laid down 23 Mar 1981
Launched 22 May 1982
Commissioned 14 Mar 1984

COMMANDANT BOUAN (F 797)
Builder Arsenal de Lorient, Lorient, France
Laid down 12 Oct 1981
Launched 23 Apr 1983
Commissioned 1 Nov 1984

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 38/40 medium-range anti-ship missile

As built, the ships were fitted for, but not with, Exocet, with the requisite base-plates mounted on the decks. Initially, two MM 38 Exocets were installed in a few ships, but the position now is that all carry either two MM 38 in metal ITS *(Installation de Tir Standard)* launchers or four MM 40 in glass-fibre ITL *(Installation de Tir Légère)* launchers.

TUBES

There are four fixed KU-64A torpedo tubes mounted at the forward end of the after deckhouse. There are no reloads.

TORPEDOES

ECAN L5 Mod 4 533 mm (21 in) torpedoes

L5 is an ASW torpedo, which can be used for direct or indirect attacks. The weapon is of conventional design with a light alloy body, four fins and twin contrarotating propellers, and a blunt nose made of a laminated material. The torpedo is electrically propelled using silver/zinc batteries. They have passive/active seekers which have various operating modes including direct attack or programmed search.

Specifications
Mod 4
Length: 4.4 m (14.43 ft)
Diameter: 533.4 mm (21 in)
Weight: 935 kg (2,061 lb)
Speed: 35 kts
Range: 5 n miles (9.54 km)
Depth: 555 m (1,820 ft)
Warhead: 150 kg (331 lb)

Manufacturers/Contractors
DCN International (prime).
ECAN, Saint Tropez, France.

GUNS

100 mm/55 Modèle 1968 CADAM

There is one single 100 mm/55 Modèle 1968-II CADAM dual-purpose mounting located on the foredeck. This is normally operated in the fully automatic remote mode with an unmanned turret, although there is a fall-back manual mode, which requires two men in the turret. The turrets have been taken from an old ship and upgraded to CADAM (CADence AMéliorée) standard with improved recoil and feed systems, raising the firing rate from 60 rds/min to 78 rds/min.

Specifications
Calibre: 100 mm
Length of barrel: 55 calibres
Muzzle velocity: 870 m/s (2,854 ft/s)
Traverse: 360° at 40°/s
Elevation: −15 to +80° at 25°/s
Crew: 2 (optional) and 2 loaders
Range:
anti-surface: 9.15 n miles (17 km)
anti-air: 8,000 m (26,000 ft)

Specifications

	MM 38	MM 40 Block 1	MM 40 Block 2
Length	5.21 m (17 ft)	5.78 m (19 ft)	5.80 m (19 ft)
Diameter	35 cm (13.8 in)	35 cm (13.8 in)	35 cm (13.8 in)
Wing span	1.00 m (3.28 ft)	1.13 m (3.7 ft)	1.13 m (3.7 ft)
Weight	735 kg (1,620 lb)	855 kg (1,885 lb)	870 kg (1,918 lb)
Speed	Mach 0.9	Mach 0.9	Mach 0.9
Range	2-22.5 n miles (4-42 km)	2-38 n miles (4-70 km)	2-40.5 n miles (4-75 km)
Warhead	165 kg (364 lb) HE frag	165 kg (364 lb) HE frag	155 kg (342 lb) HE frag
Fuze	Delayed impact/ proximity (autopilot-controlled)	Delayed impact/ proximity	Impact/proximity
Guidance	Inertial and active radar	Inertial and active radar	Inertial and active radar

Rate of fire: 78 rds/min
Ammunition: 13.5 kg (28 lb) (multipurpose projectile); 9.7 kg (21.4 lb) (charge)

Manufacturers/Contractors
Direction des Constructions Navales (DCN) (prime).
Mécanique Creusot-Loire, Marine Products (mountings).
DCN Ruelle (gun).
CSEE Défense (servo equipment).

GIAT 20 mm F2 Type A (M 693) multipurpose cannon

There are two manually operated 20 mm cannon either side of the deckhouse immediately before the mack.

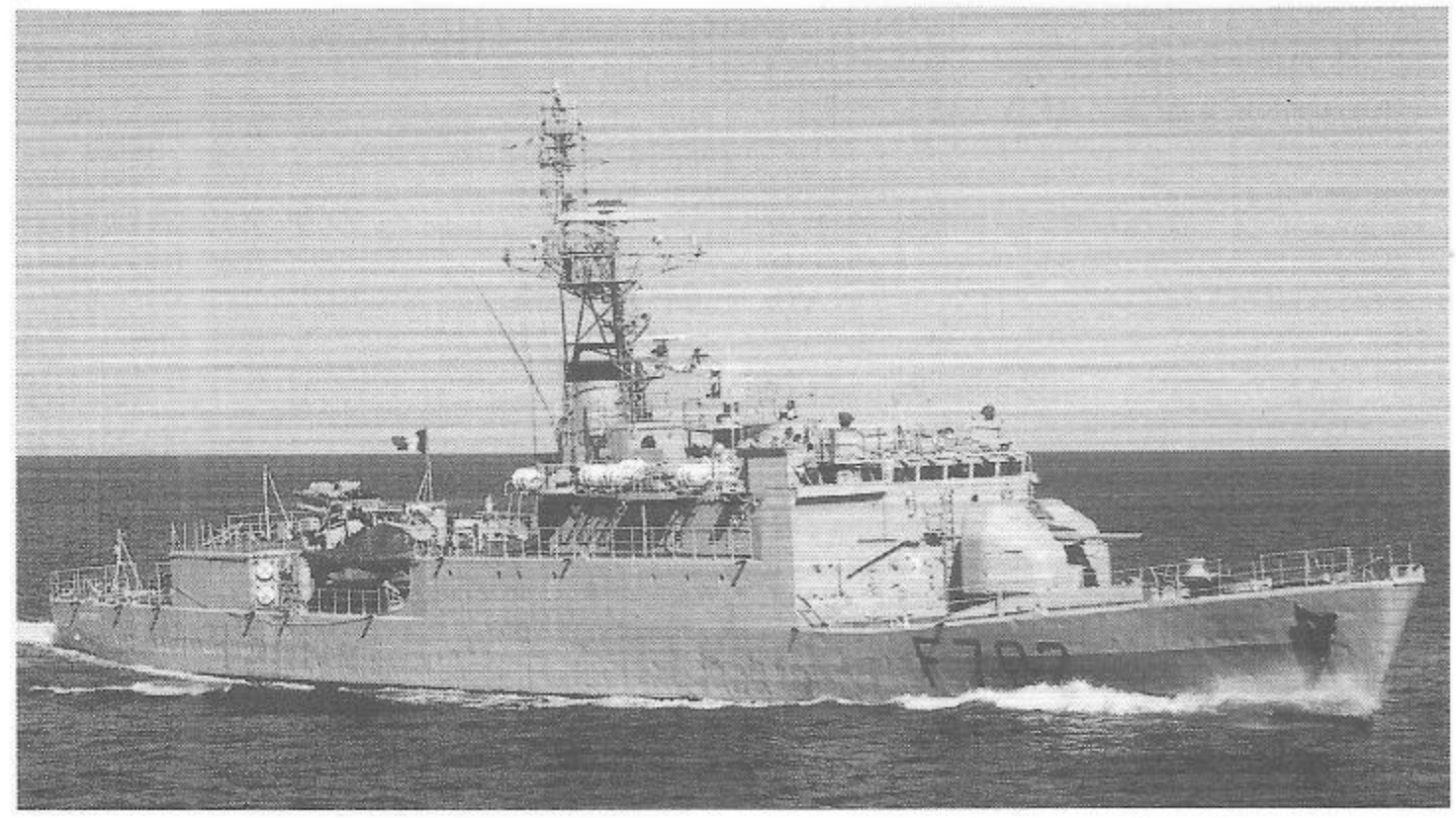
Specifications
Calibre: 20 mm
Length of barrel: 90 calibres
Rate of fire: 720 rds/min
Muzzle velocity: 1,050-1,250 m/s (3,445-4,100 ft/s)
Traverse: 325°
Elevation: −15 to +80°
Weight of shell: 0.25 kg (0.55 lb)
Crew: 2
Range: 3.5-5.5 n miles (6.75-10 km)

Manufacturer/Contractor
Giat, France.

M2HB 12.7 mm machine guns

There are four Creusot-Loire P127A mounts for M2HB 12.7 mm machine guns. The mounting is a simple, adjustable pintle type on top of a steel tube with four braces at its base, which are bolted to the deck.

Specifications
Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rds/min



Amyot d'Inville *(F 782). These ships are well armed for their size, including a 100 mm gun on the foredeck, 375 mm ASW mortar aft and four 533 mm torpedo tubes (two at each forward corner of the after deckhouse)* (French Navy)

Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-airborne: 1,380 m (4,500 ft)

ANTI-SUBMARINE MORTARS

Creusot Loire 375 mm Modèle 54 6-tubed ASW mortar

There is a single, six-tube Type 71 ASW rocket launcher mounted on the roof of the after deck house. This has, however, already been removed from F 792, F 793, F 794 and will be removed from the others in due course. The Creusot Loire Modèle 54 is a licence-produced adaptation of the Bofors 375 mm rocket system. The system consists of a rocket launcher, a handling system, the ship sonar and a fire-control system.

The Modèle 54 has six launch tubes mounted in an arc with the hydraulic laying machinery underneath and a flame deflector in the rear. Each system features an automatic electrohydraulic handling system. The 72 rounds are stored vertically in a magazine two decks under the mounting and selected by an operator. A grab on a roof-mounted rail picks up the round by the nose and transfers it to the loading table. A hoist brings the rounds up a hoist, passing vertically through the torpedo compartment, and then through the deck hatch to where the launch tubes have been elevated to their loading position. The rounds are then inserted through the rear of the launch tube. The magazine holds 72 rounds and reload time is three minutes, each tube being loaded separately. The rate of fire is one round a second and rockets may be fired singly or in salvos. There are two types of rocket, both with Hexotonal filling. The Type E (Erika) rocket has Stidar time and impact fuzes, while the Type N (Nelli) uses the Zambo proximity and impact fuzes.

Specifications

Launcher
Tubes: 4
Traverse: 260° at 18°/s
Elevation: −15 to +90° at 18°/s
Crew: 4

Rockets

	Type E	Type N
Weight	250 kg (551 lb)	230 kg (507 lb)
Muzzle velocity	130 m/s (427 ft/s)	205 m/s (673 ft/s)
Explosive weight	107 kg (236 lb)	80 kg (176 lb)
Range	0.35-0.87 n miles (0.65-1.63 km)	0.85-2.11 n miles (1.58-3.62 km)
Sinking speed	10.7 m/s (35.1 ft/s)	9.2 m/s (30.2 ft/s)

Manufacturer/Contractor

Mécanique Creusot-Loire, France.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

ARBR 16 radar warning receiver

ARBR 16 is an analysis receiver associated with the Dagaie chaff system (see above). It detects radio frequency signals (pulse, continuous wave and frequency hoppers) and compares them with a 1,000-signal library, giving an audio signal where analysis indicates that jamming is necessary. There is a single omnidirectional antenna plus six direction-finding antennas

Manufacturer/Contractor

Thomson-CSF, Paris Cedex, France.

ELECTRONIC COUNTERMEASURES (ECM)

DAGAIE countermeasures system

There are two DAGAIE ten-barrelled, trainable launchers mounted on top of the bridge structure, just forward of the DRBC-32E director, which can be loaded with either IR or chaff rockets. The firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, windspeed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either 3-5 and 8-14 µm IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised fibreglass chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 µm bands.

Specifications

Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)

Manufacturer/Contractor

CSEE Défense, Paris, France.

DECOYS

AN/SLQ-25 Nixie noisemaker

All ships carry one AN/SLQ-25 Nixie solid-state, modular design electroacoustic countermeasures decoy system, which is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom or in a partially or totally enclosed location on the main deck. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm long (3.10 ft), 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor

Aerojet ElectroSystems, Sacramento, California, USA.

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

Syracuse II Satcom

Three ships — *Commandant Blaison* (F 793), *Enseigne de Vaisseau Jacoubet* (F 794) and *Premier Maitre l'Her* (F 792) — have had the Creusot-Loire Modèle 54 ASW mortar removed and replaced by a large pedestal mount for a SYRACUSE II Satcom antenna.

Inmarsat

Several ships have been observed (for example, *Drogou* (F 783)) with a small Inmarsat radome, immediately before (but not in place of) the Modèle 54 ASW mortar.

WEAPONS CONTROL

Thomson-CSF VEGA command and weapon control system

The Vega command and weapon control system uses the DRBV 51A search and the DRBC 32E fire-control radars to provide versatility and resistance to enemy ECM through the use of different frequency bands, with both radars featuring linear digital filtering for improved performance and reliability. DRBV 51A (also known as Triton II) is used for air/surface search, target designation and navigation (although there is also a DRBN 32 (Decca 1226)), with a roll-stabilised antenna. It is claimed to detect a 2 m² air target at distances of 16 n miles (30 km) and altitudes of 6,000 m, while 10 m² surface targets can be detected at 24.25 n miles (45 km). The DRBV-51A can be used for fire-control purposes, but this task is normally allocated to the DRBC 32E. Reaction time is 6 seconds in automatic mode and 12 seconds in semi-automatic mode. However, the track-while-scan capability is limited to two targets.

Manufacturer/Contractor

Thomson-CSF.

DLT-4D torpedo fire-control system

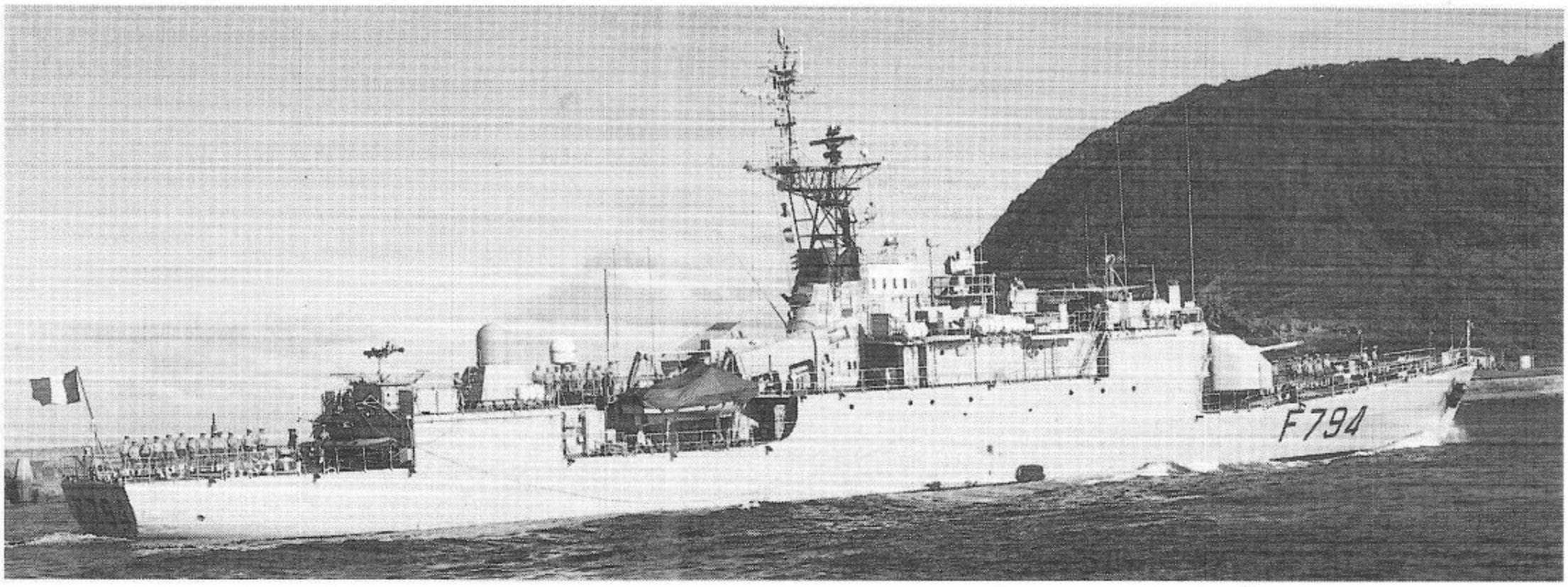
DLT-4D *(Direction de Lancement de Torpilles)* torpedo fire-control systems are installed in all ships of the class. This consists of a torpedo launch control station in the combat information centre and interface boxes which provide the electrical supply and control links to the mechanical elements. The control console has a single display. Sonar data is received in the launch control station where it is processed. The most suitable tube or tubes are then selected and ballistic data is calculated before being transmitted to the weapon. The data provided includes gyro-deflection angle, time of trajectory and target depth.

Manufacturer/Contractor

Thomson-CSF, Paris Cedex, France.

CSEE Panda Mk 2 optical director

These ships are fitted with Panda Mk 2 autonomous deck-mounted optical directors for use in air defence operations. Panda rotates through a nominal 360° and consists of the binocular optical unit with auxiliary sight, gyrometric units, bearing and elevation electrical units, servo controls, a ballistics computer, and control and communications units. The optical sensor offers ×8 and ×2.5 magnification with fields of view of 19° and 6° respectively and operates in two modes: surveillance/



Enseigne de Vaisseau Jacoubet *(F 794). Note that this ship has a large radome for the Syracuse French national satellite system on the roof of the after deckhouse, displacing the 375 mm ASW mortar normally carried. The usual Inmarsat radome is, however, retained as well* (H & L van Ginderen Collection)

target tracking and fire control. In the former the target may be designated by the ship's radar and the director slews to face it. The target is acquired visually, identified and then tracked by the operator who moves the director with a joystick. In fire-control mode the operator selects air or surface engagement and inserts target range data. The relevant guns are then slaved to the director whose operator then conducts the engagement. Panda Mk 2 is a development of Panda Mk 1, in which the Mk 1's purely optical system is supplemented by a low-light television camera.

Specifications
Panda
Height: 1.35 m (4.43 ft)
Width: 1.5 m (4.92 ft)
Weight: 480 kg (1,058 lb)
Elevation: −25 to +65°
Max velocity
traverse: 60°/s
elevation: 60°/s

Manufacturer/Contractor
CSEE Défense, France.

RADARS

Type	DRBV 51A*	Decca 1226	DRBC 32E
Company	Thomson-CSF	Racal-Decca	Thomson-CSF
Role	Air/surface search/target designation for MM 38/40	Surface search	Fire control for 100 mm guns
Band	G	X	X
Beam		1.2°	2.3°
Peak power	200 kW	25 kW	30 kW
Gain		30 dB	
Pulsewidth	0.6/1.7 µs	0.05/0.25/1 µs	4 µs
PRF	Various	—	
Scan rate	24 rpm	28 rpm	

Note
*Includes UPX12 IFF

SONARS

DUBA 25 hull-mounted active panoramic sonar system
The DUBA 25 Tarpon (TSM-2400) hull-mounted, medium-frequency, active, attack sonar is fitted only in this class of ships. It provides them with all-round surveillance, acquisition and attack facilities for ASW operations. The power employed is sufficient for operating ranges of several kilometres. The transducer array consists of 36 staves arranged to form a cylinder 115 cm (45 in) in diameter and provided with roll stabilisation. The array is housed in a fixed keel dome which is located just forward of amidships. Operating frequencies are 8 kHz, 9 kHz and 10 kHz and the system was designed specifically for use in depths of less than 200 m (656 ft).

Manufacturer/Contractor
Thomson Sintra Activités Sous-Marines, Sophia Antipolis Cedex, France.

PROPULSION

Specifications
System: Diesel
Main machinery:
all except F 791: 2 SEMT-Pielstick 12 PC2 V 400 diesels; 8.82 MW (12,000 hp(m)); 2 shafts; cp props
***Commandant L'Herminier* (F-791):** 2 SEMT-Pielstick 12 PA6 V 280 BTC diesels; 10.6 MW (14,400 hp(m)) sustained
Auxiliary power: 2–320 kW diesel alternators; 1–200 kW alternator
Shafts: 2
Propellers: cp

Commandant L'Herminier *(F 791). Alone in the class, this ship is powered by two SEMT-Pielstick 12PA6 BTC diesels* (French Navy)

FURTHER INFORMATION

PROGRAMME

This class was the fourth in a series of designs known in the French Navy as 'Avisos.' It was originally intended that there should be two types with a common hull: Type A 69 for coastal ASW, and the Type A 70 for surface operations, with a heavier anti-ship missile armament. An eventual total of 35 ships was planned which would have replaced the 'Le Corse' (E 50), 'Le Normand' (E 52) and 'Commandant Riviére' classes. In the event, only the Type A 69 was built.

The initial order was for 14 Type A 69, which was followed by an order for another three. The South African Navy then ordered two and, in order to achieve a prompt delivery, two ships already under construction for the French Navy, *Le Henaff* and *L'Herminiere,* were allocated. This order was, however, cancelled by the French Government to comply with the UN embargo and the two ships were subsequently sold to Argentina (see next entry). Meanwhile, two further hulls had been laid down to complete the French Navy's order for 17, and these were given the same names and hull numbers as those originally held by the two sold overseas.

TYPE

The designation 'aviso' is unique to the French Navy and is derived from the Spanish term *'barca de aviso,'* which translates literally as 'boat of notice'. Historically, these were small, fast vessels used to carry messages overseas and the term developed in French usage into a small vessel used for overseas missions and escort duties. The type is approximately equivalent to the British 'sloop' which displaced some 1,000-2,000 tonnes and was intended as a general purpose unit for use in colonial territories.

DESIGN

The Type A 69 is designed to undertake anti-submarine warfare in coastal waters (inside the 200 m line) and lengthy patrols in colonial waters. They are also required to be used in sea training. The emphasis in the operational requirement is endurance rather than speed. The result is a maximum speed of 23 kts, but a range of 4,500 n miles at 15 kts and an endurance of 30 days.

Everything about the ships emphasises simplicity, ruggedness and reliability, all of which are of especial importance for their deployments in distant waters, where the ships must be self-reliant for long periods.

Problems were experienced with the exhaust gases in the first four ships which led to the raising of the stack in *Jean Moulin* (F 785) and subsequent ships. This proved successful and the modification was later retrofitted to the earlier ships, as well.

At one stage there was a proposal to install a flight deck and hangar for a Dauphin helicopter in *Commandant Blaison* (F 793) and *Enseigne de Vaisseau Jacoubet* (F 794). Adaptable as these small ships are, it appears that this would have stretched them beyond their limits, and the plan was shelved.

TROOP ACCOMMODATION

Part of the duties of an 'aviso' is the ability, in distant water, to deploy a small party of troops to deal with minor colonial troubles. It was thus intended that there should be accommodation for a landing party of one officer and 17 soldiers, but this appears not to have been implemented, as in the 1990s a modification was made to introduce accommodation for nine soldiers in some of the class.

PROPULSION TRIALS

As two ships already laid down for the French order were diverted to meet foreign sales (see above) two more ships had to be laid down for the French Navy. It was decided to take this unexpected opportunity to use the second of these, *Commandant L'Herminier* (F 791), to test the new engines which were to be fitted in the 'Cassard' (C 70AA) class. Thus, this ship alone among the 'avisos' is powered by two SEMT-Pielstick 12 PA 6 BTC diesels, with infra-red suppressors. It will be noted in the 'Ships' section above that this ship took no less than five years between launching and commissioning, compared with 1-2 years for the remainder, and this was primarily due to problems experienced with the engine installation.

MODERNISATION

The class underwent a mid-life modernisation during the late 1980s. The work included fitting facilities for MM38/40 Exocet, upgrading the 100 mm guns to CADAM standard and installing AN/ALQ-25 Nixie.

DEPLOYMENT

Ten are normally assigned to GASM, the remainder to Commander Mediterranean Flotilla or abroad.

SALES

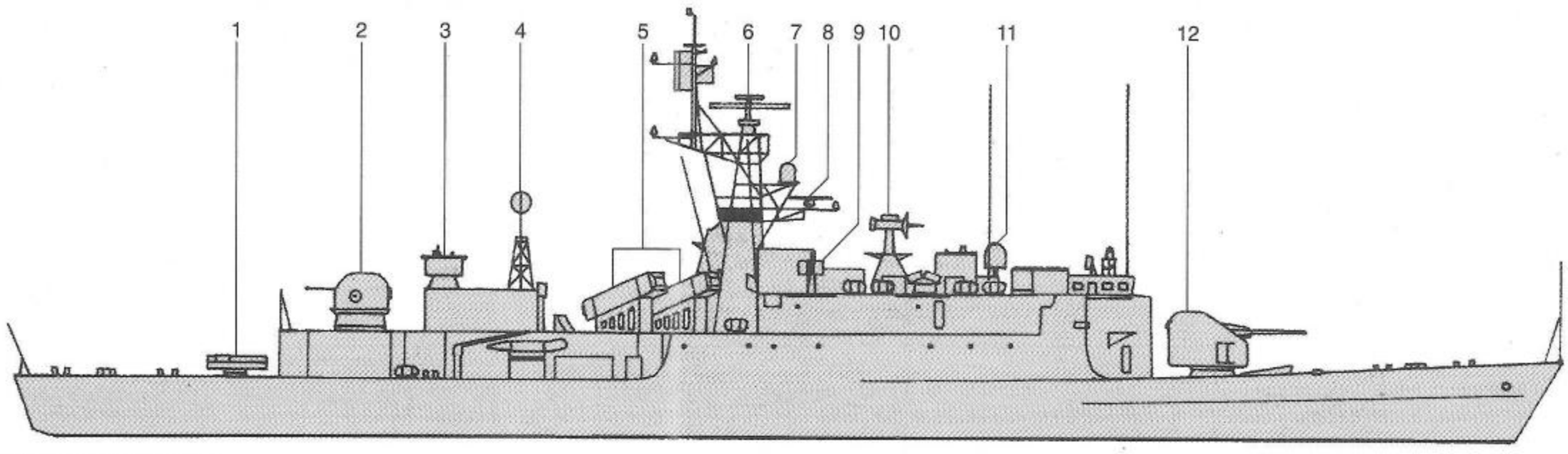
Two were originally sold to South Africa, but were eventually sold to Argentina, together with a third — see Guerrico.

FUTURE

The service lives of these ships has been extended to 2000 and beyond.

A French Navy Alouette III carrying out a VERTREP (vertical replenishment) on the quarterdeck of Amyot d'Inville *(F 782)* (French Navy)

DRUMMOND (TYPE A 69)



Granville (Ian Sturton)

1 *US Mk 32 324 mm torpedo tube* **2** *40 mm L/70 Compact twin mounting* **3** *Panda Mk 2 optical director* **4** *Direction-finding array* **5** *MM 38 Exocet* **6** *DRBV-51A air/surface search radar with VPX-12 IFF* **7** *Alligator jammer* **8** *Racal-Decca 1226 navigation radar* **9** *20 mm cannon* **10** *DRBC-32E fire-control director* **11** *Inmarsat Satcom* **12** *Single 100 mm/55 Modèle 1953 gun*

GENERAL SPECIFICATIONS

Operator: Argentina

Class: DRUMMOND (TYPE A 69) (FFG)

Purchased: 3
Active: 3

Displacement:
standard: 950 t
full load: 1,170 t

Dimensions
Length: 80 m (262.5 ft)
Beam: 10.3 m (33.8 ft)
Draught: 3 m (9.8 ft); 5.5 m (19 ft) (sonar)

Speed: 23 kts
Range: 4,500 n miles at 15 kts; 3,000 n miles at 18 kts

Endurance: 15 days
Complement: 93 (10 officers)

SHIPS

DRUMMOND (31)

Builder	Arsenal de Lorient, Lorient, France
Laid down	12 Mar 1976 (*Lieutenant de Vaisseau le Henaff* (F 789))
Launched	5 Mar 1977
Completed	Mar 1978
Purchased by Argentina	25 Sep 1978
Completed	Oct 1978

GUERRICO (32)

Builder	Arsenal de Lorient, Lorient, France
Laid down	1 Oct 1976 (*Commandant l'Herminier* (F 791))
Launched	13 Sep 1977
Purchased by Argentina	25 Sep 1978
Completed	Oct 1978

GRANVILLE (33)

Builder	Arsenal de Lorient, Lorient, France
Laid down	1 Dec 1978
Launched	28 Jun 1980
Completed	22 Jun 1981

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 38 medium-range anti-ship missile

There are four Aerospatiale MM 38 Exocets in two sets of twin launchers immediately abaft the mack in individual ITS *(Installation de Tir Standard)* launcher-containers. Two launchers point to port, two to starboard. Targets are acquired by the ship's DRBV-15A search radar and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence. This involves turning on the thermal battery, releasing the mechanical safety locks, igniting the booster, and, finally, breaking the umbilical cord; the total process takes some 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change of course during its flight.

The attack consists of three phases:

Cruise phase. The cruise phase starts as the missile clears the container and the missile, powered by the sustainer motor, flies towards the general location of the target at a height of about 100 m which is low enough to reduce the chance of detection but adequate for target acquisition. This phase can be as long as 22 km and ends when the seeker acquires the target. This seeker is a Dassault Electronique ADAC (Auto Directeur Anti-Clutter) active monopulse radar, working in the I-band (8-10 GHz), which has a typical range of 13 n miles (24 km) against FACs.

Approach phase. On detecting the target the missile descends to 9-15 m (30-50 ft) in the approach phase.

Terminal phase. During this final phase the missile descends to 8 m (26 ft) (2-5 m (6-6.16 ft) in a calm sea) for a sea-skimming run in to the target.

A salvo may be fired in 12-20 seconds.

Specifications

MM 38
Length: 5.21 m (17.1 ft)
Diameter: 35 cm (13.8 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s
Booster: SNPE Epervier boost motor, weight 100 kg, burn time of 2.4 s
Warhead: Luchaire 165 kg (364 lb) fragmentation warhead
Fuzes: Delayed impact fuze and autopilot-controlled proximity fuze

Manufacturer/Contractor

Aerospatiale Tactical Missiles, Chatillon Cedex, France.

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited on the quarterdeck.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

A244/S lightweight air-/surface-launched anti-submarine weapon

The Whitehead A244/S torpedo has an Alenia CIACIO-S seeker, capable of active, passive or mixed modes, which can discriminate between decoys and real targets in the presence of heavy reverberations, using specially emitted pulses and signal processing. It has a series of programmable search patterns and tactical manoeuvres (including re-attack procedures). The seeker has a large search volume covered by multiple preformed beams following a number of self-adaptive search patterns and is reported capable of target detection at −5 dB in good acoustic conditions. The computerised homing system also provides for presettable combinations of signal processing, spatial filtering and tactical torpedo manoeuvring. The software can be reprogrammed to meet new tactical conditions. Upon launching the A244/S initially steers a straight course and, if the target is not detected, it starts searching using either a spiral pattern between preselected depths or a helix.

Specifications
Length: 2.7 m (8.86 ft)
Diameter: 324 mm (12.75 in)
Weight: 215 kg (474 lb) (warshot version)
Warhead: 34 kg (75 lb) shaped charge HBX-3 HE
Propulsion: Electric; silver/zinc batteries
Range: 3.5 n miles (6 km)
Speed: 30 kts
Guidance: Active/passive sonar, self-adaptive programmed patterns

Manufacturer/Contractor
Whitehead SpA, Salviano, Italy.

GUNS

100 mm/55 Modèle 1968
There is one single Creusot-Loire 100 mm (3.9 in) Modèle 1968 dual-purpose gun located on the foredeck which is normally operated in the fully automatic remote mode with an unmanned turret, although there is a fall-back manual mode, requiring two men in the turret.

Specifications
Calibre: 100 mm
Length of barrel: 55 calibres
Muzzle velocity: 870 m/s (2,854 ft/s)
Traverse: 360° at 40°/s
Elevation: −15 to +80° at 25°/s
Crew: 2 (optional) and 2 loaders
Range:
anti-surface: 9.15 n miles (17 km)
anti-air: 8,000 m (26,000 ft)
Rate of fire: 60-78 rds/min
Ammunition: 13.5 kg (29.77 lb) (multipurpose projectile); 9.7 kg (21.4 lb) (charge)

Manufacturers/Contractors
Direction des Constructions Navales (DCN) (prime).
Mécanique Creusot-Loire, Marine Products (mountings).
DCN Ruelle (gun).
CSEE Défense (servo equipment).

OTOBREDA 40 mm L/70 Compact (Type 70) twin mounting
A single twin 40 mm turret is mounted aft in 'C' position.

It is not known whether this is a Type A mount, which would have 736 rounds, or a Type B (444 rounds).

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 600 rds/min
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Oerlikon 20 mm cannon
There are two single Oerlikon 20 mm cannon, one either side of the superstructure, just forward of the mack.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km (1,640 yd)
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g (8.5 oz)
Projectile: 122 g (4.3 oz)
Elevation: −15 to +90°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

DR 2000 ESM receiver/Dalia 500 threat analyser
Thomson-CSF's DR 2000 ESM system detects pulse and continuous wave (CW) signals, and when coupled with the Dalia analyser is used as a basic ESM suite, under the company designation TMV 434. There are six DF antennas and one omnidirectional antenna and a processing control/display console in the combat information centre. It provides a virtual 100 per cent probability of detection over the complete 360° of azimuth and gives instantaneous audio and video alerts. In the Argentine ships DR 2000 works in conjunction with the Dalia 500 analyser which holds a library of radar modes and parameters and is easily reprogrammable (the figure 500 gives the number of threat modes held in the library).

Manufacturer/Contractor
Thomson-CSF, RCM, Elancourt, France.

DECOYS

DAGAIE countermeasures system
There are two DAGAIE launchers which can be loaded with either IR or chaff rockets. The firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, windspeed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises: (a) two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either 3-5 and 8-14 μm IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised fibreglass chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 μm bands.

Specifications
Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)
Container weight: 54 kg (119 lb)

Manufacturer/Contractor
CSEE Défense, Paris, France.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Thomson-CSF Vega command and weapon control system
The Vega command weapon control system uses the DRBV 51A search and the DRBC 32E fire-control radars to provide versatility and resistance to enemy ECM through the use of different frequency bands, with both radars featuring linear digital filtering for improved performance and reliability. DRBV 51A (also known as Triton II) is used for air/surface search, target designation and navigation (although there is also a Decca 1226). It is claimed to detect a 2 m² air target at distances of 16 n miles (30 km) and altitudes of 6,000 m, while 10 m² surface targets can be detected at 24.25 n miles (45 km). The DRBV-51A can be used for fire-control purposes, but this task is normally allocated to the DRBC 32E.

The manufacturer claims that the system will detect surface targets at ranges of 28-32 km and low-level Mach 1 strike aircraft at 26 km in the most unfavourable cases. Against aircraft, the system's reaction time was six seconds in automatic mode and 12 seconds in semi-automatic mode. However, the track-while-scan capability was limited to two targets.

Manufacturer/Contractor
Thomson-CSF.

RADARS

Type	DRBV 51A*	1226	DRBC 32E
Company	Thomson-CSF	Racal-Decca	Thomson-CSF
Role	Air/surface search/target designation for MM 38	Surface search	Fire control for 100 mm guns
Band	G	I	I
Beam		1.2°	2.3°
Peak power	200 kW	25 kW	30 kW
Gain		30 dB	
Pulsewidth	0.6/1.7 μs	0.05/0.25/1μs	4 μs
PRF	Various	—	
Scan rate	24 rpm	28 rpm	

Notes
*Includes UPX12 IFF

CSEE Panda Mk 2 optical director

These ships are fitted with Panda Mk 2 autonomous deck-mounted optical directors for use in air defence operations. Panda rotates through a nominal 360° and consists of the binocular optical unit with auxiliary sight, gyrometric units, bearing and elevation electrical units, servo controls, a ballistics computer, and control and communications units. The optical sensor offers ×8 and ×2.5 magnification with fields of view of 19° and 6° respectively and operates in two modes: surveillance/target tracking and fire control. In the former the target may be designated by the ship's radar and the director slews to face it. The target is acquired visually, identified and then tracked by the operator who moves the director with a joystick. In fire-control mode the operator selects air or surface engagement and inserts target range data. The relevant guns are then slaved to the director whose operator then conducts the engagement. Panda Mk 2 is a development of Panda Mk 1, in which the Mk 1's purely optical system is supplemented by a low-light television camera.

Specifications

Panda
Height: 1.35 m (4.43 ft)
Width: 1.5 m (4.92 ft)
Weight: 480 kg (1,058 lb)
Elevation: −25 to +65°
Max velocity
traverse: 60°/s
elevation: 60°/s

Manufacturer/Contractor

CSEE Défense, France.

SONARS

Thomson Sintra Diodon hull-mounted sonar

Diodon is a panoramic medium-frequency sonar. Embedded facilities include passive listening, sound ray tracer, an acoustic propagation prediction for the day and a recording system that can be used for debriefing and training.

Specifications

Acoustic array: 24 identical staves
Frequencies: 11 kHz, 12 kHz, 13 kHz
Transmitter: Omnidirectional transmission in CW and FM modes
Receiver: 36 preformed beams; advanced processing with replica correlator in FM and spectrum analysis (FFT) in CW
Video processing:
Data processing in FM and CW modes: Automatic detection and tracking; simultaneous multitrack extraction (up to 64); target analysis (apparent length, Doppler measurement).
Range scales: 15,000 m max
Display: High-resolution flicker-free colour TV monitors
Total weight: 1,500 kg (3,307 lb)

Manufacturer/Contractor

Thomson CSF, Sophia Antipolis Cedex, France.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 SEMT-Pielstick 12 PC2.2 V 400 diesels; 8.82 MW (12,000 hp(m))
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

The first two ships were originally laid down in 1976 for the French Navy as *Lieutenant de Vaisseau le Henaff* (F 789) and *Commandant l'Herminier* (F 791). Whilst still under construction they were sold to the South African Navy, where they would have been named *Good Hope* and *Transvaal*, respectively. The UN embargo on sales of defence equipment prevented that sale and they were purchased by Argentina in September 1978 and given the names *Drummond* (31) and *Guerrico* (32); they arrived in Argentina on 2 November 1978. The third ship, *Granville* (33), was ordered as a new build, being laid down on 1 December 1978 and commissioned on 22 June 1981.

MODERNISATION

Drummond has had her armament updated to the same standard as the other two, replacing the Bofors 40/60.

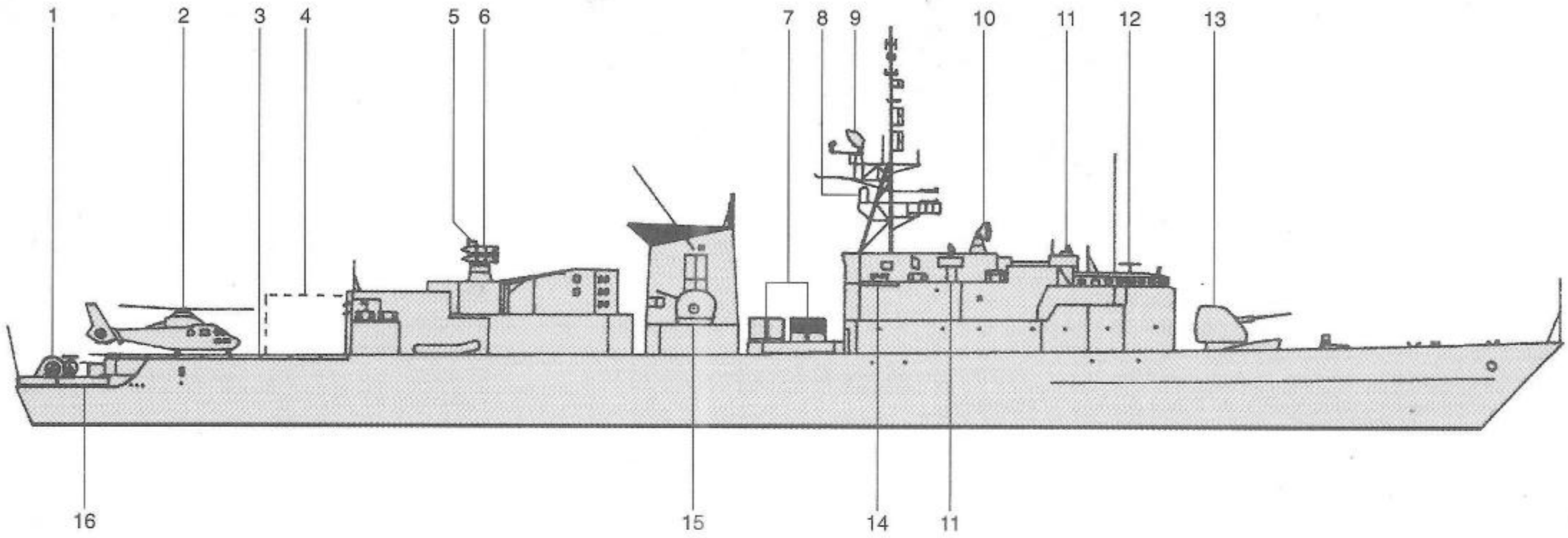
OPERATIONAL

These ships are very economical to operate, with particularly good fuel consumption and have proved very popular ships in the Argentine Navy. All three played very active parts in the Falklands (Malvinas) war in 1992. *Guerrico* took part in the operations off the island of South Georgia in April 1982 and, on venturing too close to the shore, was damaged by land-based troops during the taking of Grytviken, being hit by a rocket from a Carl Gustav rocket launcher and machine-gun fire. The damage was not severe and *Guerrico* returned to Argentina unaided and was repaired within three days. *Drummond* and *Granville* supported the main landings on the Falkland Islands.

Recently, at least one of these ships took part in the operations off Haiti in 1994.

Granville *(33) one of the three A 69 Avisos bought from France in the late 1970s* (Maritime Photograhic)

MADINA



Madina (Ian Sturton)
1 *Thomson-CSF TSM 263O VDS* **2** *Aerospatiale SA 365F Dauphin 2* **3** *Flight deck* **4** *Telescopic hangar* **5** *Thomson-CSF DRBC 32 fire-control radar* **6** *Thomson-CSF Crotale naval eight-tube launcher* **7** *Matra/OTOBREDA Otomat Mk 2 (eight)* **8** *Thomson-CSF DR 4000 ESM* **9***Thomson-CSF DRBV 15 (Sea Tiger) air/surface search radar (including IFF)* **10** *Thomson-CSF Castor IIB fire-control radar* **11** *CSEE Défence Naja electro-optic director* **12** *Racal-Decca TM1226 navigation radar* **13** *Creusot-Loire 100 mm (3.9 in)/55 Compact gun* **14** *CSEE Défense Dagaie chaff/IR launcher* **15** *OTOBREDA twin 40 mm/70 cannon* **16** *533 mm (21 in) torpedo tubes (four, aft-facing)*

GENERAL SPECIFICATIONS

Country of origin: France
Operator: Saudi Arabia
Type: TYPE F 2000S

Class: MADINA

Purchased: 4
Active: 4

Displacement:
standard: 2,000 t
full load: 2,870 t

Dimensions
Length: 115.0 (377.30 ft) (oa); 106.5 m (349.41 ft) (wl)
Beam: 12.5 m (41.01 ft)
Draught: 4.9 m (16.08 ft) (sonar)

Speed: 30 kts
Range: 8,000 n miles at 15 kts; 6,500 n miles at 18 kts

Complement: 179 (15 officers)

SHIPS

MADINA (702)
Builder Lorient Naval Dockyard, Lorient, France
Laid down 15 Oct 1981
Launched 23 Apr 1983
Commissioned 4 Jan 1985

HOFOUF (704)
Builder CNIM, Seyne-sur-Mer, Toulon, France
Laid down 14 Jun 1982
Launched 24 Jun 1983
Commissioned 31 Oct 1985

ABHA (706)
Builder CNIM, Seyne-sur-Mer, Toulon, France
Laid down 7 Dec 1982
Launched 23 Dec 1983
Commissioned 4 Apr 1986

TAIF (708)
Builder CNIM, Seyne-sur-Mer, Toulon, France
Laid down 1 Mar 1983
Launched 25 May 1984
Commissioned 29 Aug 1986

Madina *(702) lead ship of a class of four, built in France for the Royal Saudi Navy, and commissioned in 1985-86* (DCNI/Jean Biaugeaud)

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Thomson-CSF Crotale EDIR octuple launcher

The single octuple Thomson-CSF Crotale launcher is mounted on the forward end of the hangar roof. The system comprises a combined director and missile-launching mounting, a fire-control room with supporting electronics and a supervising console in the combat information centre. There is also a missile handling and storage system. The system obtains search information from the Thomson-CSF Sea Tiger radar, while the director's own sensors are a two-axis stabilised Castor IIC radar antenna, a missile guidance antenna, an infrared localiser and a TV for low-level tracking.

The VT-1 missile attains a speed of Mach 3-plus some 2.5 seconds after launch, can manoeuvre at up to 25 *g* in each axis. System reaction time from target acquisition to launch is a minimum of 4.5 seconds and an average of 6 seconds. Maximum range is about 10 km. The system is capable of intercepting four separate targets simultaneously and there are two types of fuze: infra-red (V3N) and RF (V3S). The J-band monopulse radar has a peak power of 80 kW to give it a range in excess of 8.5 n miles (16 km) and has an accuracy of 0.3 mrad in tracking and 0.1 m in missile-to-target differential deviation measurement. The RIC has a deviation measurement accuracy of 1 mrad and is designed to gather the Crotale missile for the command link.

The second ship onwards were fitted with Crotale EDIR 'as built', but the system was retrofitted into *Madina* in Saudi Arabia.

Specifications

Missile VT-1
Length: 2.34 m (7.68 ft)
Diameter: 16.5 cm (6.5 in)
Wing span: n/k
Weight: 73 kg (161 lb)
Speed: Mach 3.5
Warhead: 14 kg (30.9 lb)
Lethal radius: 8 m (26.25 ft)
Range: 10 km (11,000 yd)
Altitude: 4,000 m (13,120 ft)

Manufacturer/Contractor

Thomson-CSF, Division Systèmes Electroniques, Paris, France.

ANTI-SHIP MISSILES (ASM)

OTOBREDA/Matra Otomat Mk 2 ERATO

Eight Otomat Mk 2 launchers are mounted in two sets of four in the waist; four point to port, four to starboard at 90° to the ship's centreline. The Otomat missile has folding wings and is powered by a turbojet with solid fuel rocket boosters. The warhead is a semi-armour-piercing type, which is claimed to penetrate up to 8 cm of nickel-chromium armour.

The target may be acquired by the ship's radar, by the radars of friendly ships or by helicopter radars. Data on the target's location are transmitted to the missile's autopilot and the turbojet is started. Once it has reached full power the boosters are ignited and the missile is launched, but as the missile can turn through angles of up to ±200° the warship does not have to be facing the target during the launch phase. Once launched, the missile climbs to 150 m (492 ft) accelerated by the boosters which burn for 4 seconds until reaching cruising speed at a distance of some 2.15 n miles (4 km) from the launch point, where the boosters are jettisoned. If OTH targeting is not being used, the missile then descends to a cruising altitude of 15-20 m (49.2-65.6 ft), a compromise between ensuring good communications with the mothership and making detection by the target difficult. The missile continues towards the target with mid-course guidance correction until the radar seeker is activated at a predetermined point and scans a 40° sector, acquiring the target at a range of about 6.5 n miles (12 km).

The French Mk 2 system, known as ERATO (ERATO = Extended Range Automatic Targeting of Otomat), is designed for over-the-horizon targeting using a co-operating helicopter, and, while generally similar to the Italian Teseo system, has several important differences. The launching sequence is similar to that for Teseo, but for engaging a target at ranges of over 35 n miles (65 km) the missile cruises at an altitude of 900 m (2,952 ft), but it only drops to a height of 15 m (49.2 ft) for the sea-skimming final approach after receiving mid-course guidance from the SA 365F helicopter with its Agrion 15 I/J-band radar. In the terminal phase the French missile seeker operates in both azimuth and elevation, and a dive-attack capability is added. In this case the missile approaches to within 4 n miles (7 km) of the target and then 'pops-up' to a height of about 2,000 m before diving at an angle of about 7°. The ERATO system can launch up to four missiles in a salvo and can control six missiles in flight.

Specifications

Length: 4.46 m (14.6 ft)
Diameter: 46 cm (18 in)
Wing span: 1.36 m (4.5 ft)
Weight:
  without boosters: 762 kg (1,680 lb)
  with boosters: 770 kg (1,698 lb)
Range: 86 n miles (160 km)
Speed: Mach 0.9
Guidance: Inertial and active radar homing
Propulsion: Turbomeca TR 281 Arbizon III turbojet; 400 kg (882 lb) st
Boosters: 2 SNPE solid-propellant boosters; 3,500 kg (7,716 lb) st each
Warhead: Semi-armour-piercing; 210 kg (463 lb); HE 65 kg (143 lb)
Fuzes: Impact, proximity

Manufacturer/Contractor

OTOBREDA, Italy.

TUBES

There are four single 533 mm (21 in) torpedo tubes mounted on the quarterdeck and launching the torpedoes over the transom which is a relatively unusual arrangement. The only other ship to employ such a technique is the Italian 'Maestrale' class frigate.

TORPEDOES

ECAN F17P torpedo

F 17P (P = *polvelope*) can be used against surface and submarine targets and is normally wire-guided during the early part of its run and is given commands on course and depth to be achieved at the end of the wire-guided operation. It can also, however, be launched in the 'free-running' mode. During the terminal phase the torpedo uses passive search only throughout attacks against surface ships, but against submarine targets the passive mode is used until the terminal phase when the seeker goes active. The F 17P has a maximum operating depth in excess of 500 m (1,640 ft) and a search depth of 6 to 20 m (19.6 to 65.6 ft).

Specifications

F17 P1
Length: 5.91 m (19.3 ft)
Diameter: 533.4 mm (can be increased to 550 mm if required)
Weight: 1,428 kg (3,148 lb)
Warhead: 250 kg (551 lb) HBX3
Propulsion: Electric
Speed: 35 kts
Range: 10 n miles (18.5 km)
Guidance: Wire and automatic homing

Manufacturer/Contractor

DCN International, Paris, France.

GUNS

100 mm/55 Modèle 1968

There is one single 100 mm/55 Modèle 1968 dual-purpose mounting located on the foredeck in 'A' position. This is normally operated in the fully automatic remote mode with an unmanned turret, although there is a fall-back manual mode, which requires two men in each turret.

Specifications

Calibre: 100 mm
Length of barrel: 55 calibres
Muzzle velocity: 870 m/s (2,853 ft/s)
Traverse: 360° at 40°/s
Elevation: −15 to +80° at 25°/s
Mounting weight: 21 t
Crew: 2 (optional) and 2 loaders
Range:
  anti-surface: 9.15 n miles (17 km)
  anti-air: 8,000 m (26,000 ft)
Rate of fire: 78 rds/min
Ammunition: 13.5 kg (29.7 lb) (multipurpose projectile); 9.7 kg (21.4 lb) (charge)

Manufacturers/Contractors

Direction des Constructions Navales (DCN) (prime).
Mécanique Creusot-Loire, Marine Products (mountings).
DCN Ruelle (gun).
CSEE Défense, (servo equipment).

OTOBREDA 40 mm L/70 Compact

Four Bofors 40 mm guns (two twin) are installed in mountings in the waist either side of the stack.

Specifications

Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 600 rds/min
Muzzle velocity: 1,000 m/s
Max range:
  anti-surface: 6.75 n miles (12.5 km)
  anti-air: 4,000 m (13,120 ft)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Thomson-CSF DR 4000

DR 4000 is a highly sensitive crystal IFM ESM receiver covering the C to J bands. The display shows the tactical situation in the upper part and intercept parameters below. The system is interfaced with decoy dispensers and jammers, and automatically controls their operation. The system offers threat warning, surveillance, emitter identification, ELINT, and automatic EW system control capabilities. The antenna system of the DR 4000S includes two DF arrays (2 × 6 DF channels), one omni-antenna (frequency channel) and modules housing RF amplifiers. The two sets of DF antennas correspond to two complementary frequency bands, H to J (high band) and C to G (low band).

Specifications

Frequency coverage: C to J band
Bearing accuracy: approx ±5°
Dimensions and weight
Omni-antenna: 415 mm high × 300 mm diameter; 9 kg
DF antenna: 425 mm high × 480 mm diameter; 2 × 22 kg
IFM processor: 316 × 360 × 520 mm; 25 kg

Madina *(702) and the other three ships are now undergoing major modifications and modernisation at Toulon under 'Project Mouette'. This will involve modernising all electronic and weapon systems, and installing the Samahe helicopter handling system* (DCNI/Jean Biaugeaud)

Console: 590 × 1,100 × 1,543 mm; 310 kg

Manufacturer/Contractor
Thomson-CSF, Radars and Countermeasures Division, Elancourt, France.

Telegon VI
There is a Telegon VI radio direction-finder and HF communications jammer.

Manufacturer/Contractor
DASA, Ulm, Germany.

ELECTRONIC COUNTERMEASURES (ECM)

JANET jammer
The Janet naval ECM system is designed to jam locked-on missile radar seekers and surveillance radars operating in the H, I and J bands. The receiver is used for accurate target bearing and frequency measurement following an alert from the associated DR 4000 radar warning receiver. The computer controls the signal generator and selects the type of jamming used. This high flexibility in jamming modes programming and selection provides a variety of noise signals, including continuous or pulsed noise, as well as dual mode (noise/deception), complex deception and repeater signals. The system has been designed to store received target signals in order to recreate identical ones for deception purposes.

Janet is modular, comprising: up to four modules, each of which is a complete and autonomous jammer with its own two-horn receive antenna for tracking; radar detector; computer/signal generator; and two TWTs/directional transmit antennas. One TWT/directional antenna combination is used for noise jamming and the other for deception jamming, enabling the system to jam two radar threats simultaneously, even if they are arriving from completely different directions. Each jammer module can also jam two signals if these are located close to each other.

Manufacturer/Contractor
Thomson-CSF, Elancourt, France.

DECOYS

CSEE Défense DAGAIE countermeasures system
There are two DAGAIE launchers located either side of the mast. These can be loaded with either IR or chaff rockets. The firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, windspeed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises: (a) two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either 3-5 and 8-14 µm IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised fibreglass chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 µm bands.

Specifications
Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)
Container weight: 54 kg (119 lb)

Manufacturer/Contractor
CSEE Défense, Paris, France.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Thomson-CSF TAVITAC
The Thomson-CSF Naval Tactical Data Systems TAVITAC (TAVITAC = *Traitement Automatique et Visualisation Tactique*) is a federated system linked by a local area network (LAN) based on a Gina databus, with the associated sensors and weapons being connected directly to the LAN or via a network interface unit. The system uses two CIMSA Sintra 15M125 computers (32-bits; modular memory of 64-512 k words; operating speed of 1 Mips) and one CIMSA Sintra 15M05 (16-bit; 64 k memory), with programming using the LTR 2 language.

TAVITAC performs all the necessary tactical functions for the ship, and can carry up to 800 tracks, and can also provide a limited advisory capability in evaluating the tactical situation. In addition, using ruggedised disk storage, TAVITAC can provide a database management capability for other functions such as map display, ship resources and management. TAVITAC is integrated with the Vega fire-control system to create the Thomsea system

Manufacturer/Contractor
Thomson-CSF, Systèmes Navals de Combat, Bagneux, France.

COMMUNICATIONS AND DATALINKS

The ships are capable of receiving Link 11.

WEAPONS CONTROL

Vega (CTH) weapon control system

The Vega weapon control system uses the DRBV 15 search and the DRBC 32E and CASTOR IIC fire-control radars to provide versatility and resistance to enemy ECM through the use of different frequency bands, with both radars featuring linear digital filtering for improved performance and reliability. DRBV-15 is used for air/surface search, target designation and navigation (although there are also two Decca 1226s), with a roll-stabilised antenna. The DRBV-15 can be used for fire-control purposes, although this task is normally allocated to the DRBC 32E.

Manufacturer/Contractor

Thomson-CSF, Elancourt, France.

Naja electro-optical directors

There are three Naja electro-optical directors. Naja is an evolutionary development of Panda Mk 2 (designated DMAb by the French Navy) with a CILAS TMY 113 high repetition rate Nd:YAG laser rangefinder, an automatic tracking capability, local or remote control, a three-axis gyro unit and multiple weapon capability. The laser rangefinder operates in the 1.06 μm wavelength, has a peak power of >5 MW and a PRF of 20 pps.

Specifications

Naja
Height: 1.35 m (4.4 ft)
Width: 1.5 m (4.9 ft)
Weight: 480 kg (1058 lb)
Elevation: −20 to +70°
Max velocity
traverse: 60°/s
elevation: 60°/s

Manufacturer/Contractor

CSEE Défense, Paris, France.

DLT-5 torpedo fire-control system

The DLT-5 *(Direction de Lancement de Torpilles)* torpedo fire-control system consists of a torpedo launch control station in the combat information centre and interface boxes which provide the electrical supply and control links to the mechanical elements. The control console has a single display. Sonar data is received in the launch control station where it is processed. The most suitable tube or tubes are then selected and ballistic data is calculated before being transmitted to the weapon. The data provided includes gyro-deflection angle, time of trajectory and target depth. There are two launching modes; normal with automatic calculation of launch parameters, and emergency in which manual calculation of displayed parameters is undertaken.

Manufacturer/Contractor

Thomson-CSF, Paris Cedex, France.

RADARS

Type	Sea Tiger (DRBV 15)	TM 1226	Castor IIB (TRS 3200)	DRBC 32C
Company	Thomson-CSF	Racal-Decca	Thomson-CSF	Thomson-CSF
Role	Air/surface search/IFF	Surface search	Fire control	Fire control (100 mm gun)
Band	E/F	I	I/J	I
Beam	1.65 × 8° cos²	1.2°	2.3°	2.3°
Peak power	60 kW	25 kW	175 kW	30 kW
Gain	30 dB	30 dB	37 dB	
Pulsewidth	5.5/12 μs	0.05/0.25/1 μs	0.4 μs	4 μs
PRF	2,200/1,100 pps	—	4,000-8,000 pps (stepped)	
Scan rate	15/30 rpm	28 rpm	—	
Range	60 n miles (110 km) for 2 m² target		8 n miles (15 km) for 1 m² target	

SONAR

Diodon/Sorel sonar (TSM 2630)

Diodon is a hull-mounted sonar and Sorel the associated variable-depth sonar (VDS). They produce a panoramic medium-frequency sonar signal and a common data handling and sonar processing system provide target classification, automatic detection and tracking, and a man/machine interface. Embedded facilities include passive listening, sound ray tracer, an acoustic propagation prediction for the day and a recording system that can be used for debriefing and training.

Specifications

Acoustic array: 24 identical staves
Frequencies: 11 kHz, 12 kHz, 13 kHz
Transmitter: Omnidirectional transmission in CW and FM modes
Receiver: 36 preformed beams; advanced processing with replica correlator in FM and spectrum analysis (FFT) in CW
Video processing: Data processing in FM and CW modes: automatic detection and tracking; simultaneous multitrack extraction (up to 64); target analysis (apparent length, Doppler measurement)
Range scales: max 15,000 m
Display: High-resolution flicker-free colour TV monitors
Total weight: 1,500 kg

Manufacturer/Contractor

Thomson CSF, Sophia Antipolis Cedex, France.

AVIATION

AVIATION FACILITIES

Specifications

Fight deck: 17 × 12.5 m (57 × 41 ft)

1 Eurocopter AS 365F Dauphin 2 (ASW and light liaison)

Specifications

Dimensions:
rotor diameter: 13.29 m (43.6 ft)
fuselage length: 11.41 m (37.43 ft)
height to rotor head: 4.0 m (13.12 ft)
Weights:
empty: 2,262 kg (4,987 lb)
max take-off: 4,250 kg (9,370 lb)
Performance:
max speed (never exceed): 160 kts (296 km/h)
cruising speed (sea level): 148 kts (274 km/h)
rate of climb (sea level): 420 m (1,380 ft)/min
hovering ceiling (in ground effect): 2,600 m (8,530 ft)
Engines: 2 Turbomeca Ariel 1M1 turboshafts; take-off, 558 kW (749 shp); continuous, 487 kW (653 shp)
Accommodation: 2-man crew; 10 passengers

The Saudi Arabian ships are currently being modernised and one element is the installation of the French Samahe helicopter handling system (DCNI)

Samahe assists in both the recovery and the handling of helicopters (DCNI)

PROPULSION

Specifications
System: Combined diesel-and-diesel (CODAD)
Main machinery: 4 SEMT-Pielstick 16 PA6 280V BTC diesels; 28 MW (38,400 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

As with the land and air forces, the Royal Saudi Navy (RSN) has sought to modernise its systems but without becoming too dependent on any one external source. Thus, smaller surface combatants are of US origin, MCMVs are currently being constructed by the UK, and the major surface units have been built in France. The first of these were the four units of the 'Madina' class which were ordered from France in 1980, as part of the Sawari I contract, which provides for continuing French naval supplies and technical help.

The first of class was completed in 1985 and was followed by the other three in 1985 to 1986.

DESIGN

The F 2000 frigate was designed to be a multipurpose warship, but with a primary anti-surface role. A raised foredeck was originally envisaged, but a continuous deck was finally chosen, with the upper deck, which extends to the after end of the flight deck, as the strength deck. This gives a deep hull girder, with a high resistance to longitudinal stress.

One major factor in the design is that the ships spend virtually their entire operational lives in a very hot, dry and sandy environment. To cope with these, the ships are fitted with three air conditioning plants, each rated at 14,700 MJ/h (350,000 kcal/h), and there is also a wash-down system which is used to cleanse the superstructure of the fine-grained sand which is encountered.

The CODAD propulsion system was chosen for its simplicity, light weight and low fuel consumption. Each of the two shafts is driven by two reversible SEMT Pielstick 16PA6 BTC engines, linked to a reduction gearbox and mounted on a shock-absorbing raft.

Snach/Saphir retracting fin stabilisers are also fitted.

MODERNISATION

French national shipbuilders, DCN International (DCNI), signed an agreement in February 1994 with the Saudi Government, which involved all four frigates (plus two replenishment ships) being refitted and modernised. Known as 'Project Mouette' the first ship, *Madina,* was in the DCNI facility at Toulon from December 1995 to December 1996 and is being followed by one frigate per year until 1999.

The major changes involve upgrading the TAVITAC system, upgrading the Otomat missiles, upgrading the sonar system, and replacing the existing helicopter-handling system with the DCN Samahé. All other systems, including the engines, will be refurbished.

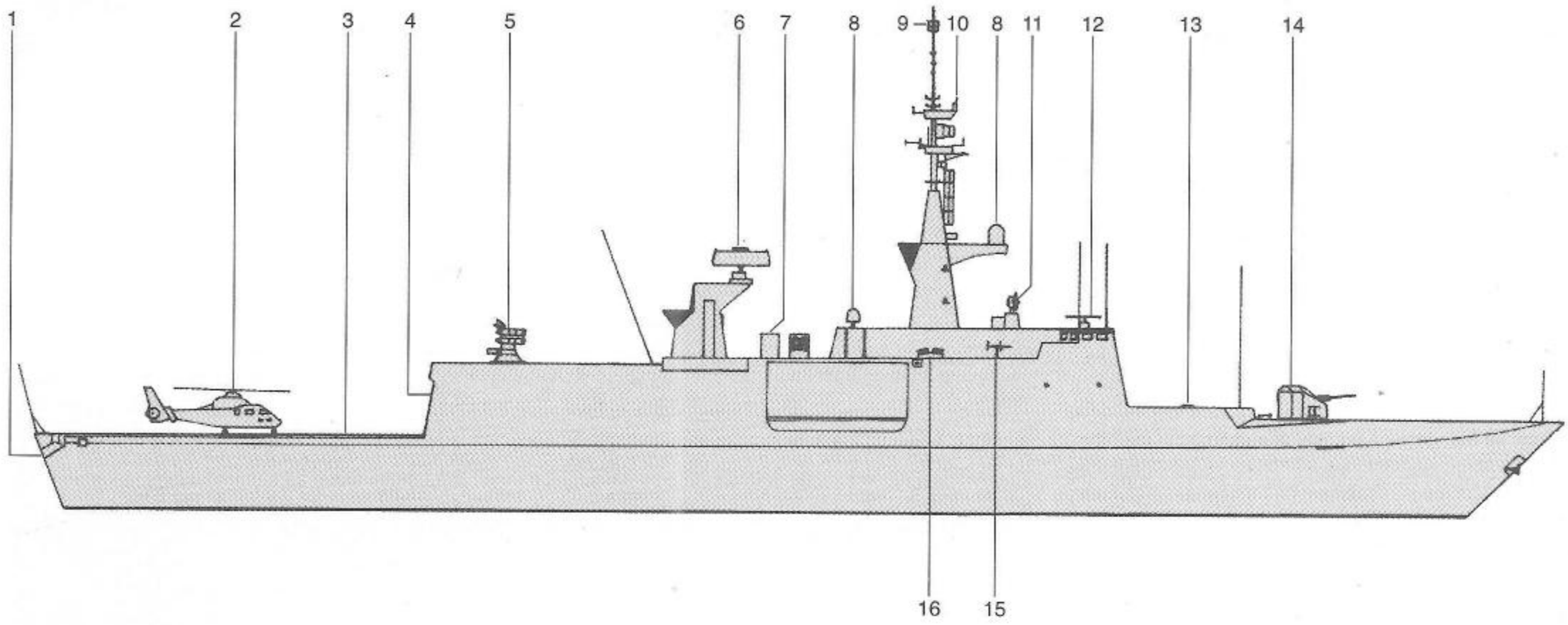
DEPLOYMENT

All four frigates are based at Jiddah, Saudi Arabia.

OPERATIONAL

It is reported that these four ships spend only a few weeks a year at sea. *Madina* had a severe engine-room fire in August 1991, but repairs were completed in December 1993 and the ship was operational again in May 1994.

LA FAYETTE



La Fayette (Ian Sturton)
1 *Stern-gallery hatch* **2** *Helicopter (Lynx, Panther or Super Frelon)* **3** *Flight deck* **4** *Hangar* **5** *Crotale Naval CN2 eight-tube launcher* **6** *Thomson-CSF DRBV 15C (Sea Tiger) air/surface search radar* **7** *Aerospatiale MM 40 Exocet (eight)* **8** *Satcom* **9** *Thomson-CSF ARBR 21 ESM* **10** *Thomson-CSF DIBV 10 (Vampir) IR detector* **11** *Thomson-CSF Castor II fire-control radar* **12** *Racal-Decca DRBN 32A (1226) navigation radar* **13** *SAAM VLS for 16 Aster SAM (F 713, 714, 715 only)* **14** *100 mm (3.9 in)/55 Mod 68 CADAM gun* **15** *GIAT 20F2 20 mm automatic cannon* **16** *CSEE Dagaie Mk 2 chaff/IR launchers*

GENERAL SPECIFICATIONS

Operator: France

Class: LA FAYETTE (FFG)

Active: 3
Building: 1
Projected: 1

Displacement:
light: 3,100 t
full load: 3,600 t

Dimensions
Length: 124.2 m (407.48 ft) (oa); 115.0 m (377.3 ft) (wl)
Beam: 15.5 m (50.9 ft)
Draught: 5.85 m (19.19 ft)

Speed: 25 kts
Range: 7,000 n miles at 15 kts; 9,000 n miles at 12 kts
Endurance: 50 days

Complement: 139 (15 officers) plus 12 aircrew plus 12 marines

SHIPS

LA FAYETTE (F 710)
Builder Arsenal de Lorient, Lorient, France
Laid down 15 Dec 1990
Launched 13 Jun 1992
Commissioned 27 Jan 1996

SURCOUF (F 711)
Builder Arsenal de Lorient, Lorient, France
Laid down 3 Jul 1992
Launched 3 Jul 1993
Commissioned Mar 1996

COURBET (F 712)
Builder Arsenal de Lorient, Lorient, France
Laid down 15 Sep 1993
Launched 12 Mar 1994
Commissioned Jan 1997

JAURÉGUIBERRY (F 713)
Builder Arsenal de Lorient, Lorient, France
Laid down 1996
Launched 1997
Commissioned 1999

GUÉPRATTE (F 714)
Builder Arsenal de Lorient, Lorient, France
Laid down 1998
Launched 2000
Commissioned 2002

Surcouf *(F 711) shows the dramatic design of the French 'stealth frigates'* (Jane's/H M Steele)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 40 anti-ship missiles

Eight MM 40 Exocet anti-ship missile launchers are installed on the superstructure roof, immediately before the main mast. Unlike most other tube-launched SSM installations these are not located so that they fire across the ship with their efflux going straight overboard, but rather face outwards in two groups of four at an angle of 90° to the centreline and at +12° to the horizontal. There is a central deflection plate which redirects the rocket efflux upwards.

The missiles are Block 2, featuring a new J-band (10-20 GHz) seeker with improved ECCM performance, associated electronics and a new guidance computer. The new electronics permit the missile to optimise its sea-skimming height, allowing it to operate in conditions to Sea State 7 even in severe ECM conditions. The fire-control system has also been adapted with the development of the Cat-Visac console which can operate with two types of the Exocet missile simultaneously. The new fire-control system allows improved target selectivity, attacks upon multiple targets by diverging and converging salvos. Targets for the missiles are acquired by the ship's sensors, and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence which can take up to 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change in the course of its flight. Once the missile has cleared the launcher-container, the sustainer carries it into the cruise phase and it then travels towards the general location of the target at a height of about 100 m (330 ft) which is low enough to reduce the chance of detection but adequate for target acquisition. Once the target is detected the missile descends to 9-15 m (30-50 ft) in the approach phase before descending to 8 m (26 ft) (2-5 m (6.5-16.4 ft) in a calm sea) for a sea-skimming terminal phase. A salvo may be fired in 12-20 seconds.

Specifications

MM 40 Block 2
Length: 5.80 m (19.2 ft)
Diameter: 35 cm (13.78 in)
Wing span: 1.13 m (3.7 ft)
Weight: 870 kg (19.8 lb)
Speed: Mach 0.9
Range: 2-40.5 n miles (4-75 km)
Warhead: 55 kg (121 lb) HE frag
Fuze: Impact/proximity
Guidance: Inertial and active radar

Manufacturers/Contractors

Aerospatiale Missiles, Paris Cedex, France (Prime)
Luchaire Défense, Versailles Cedex, France (Warhead)

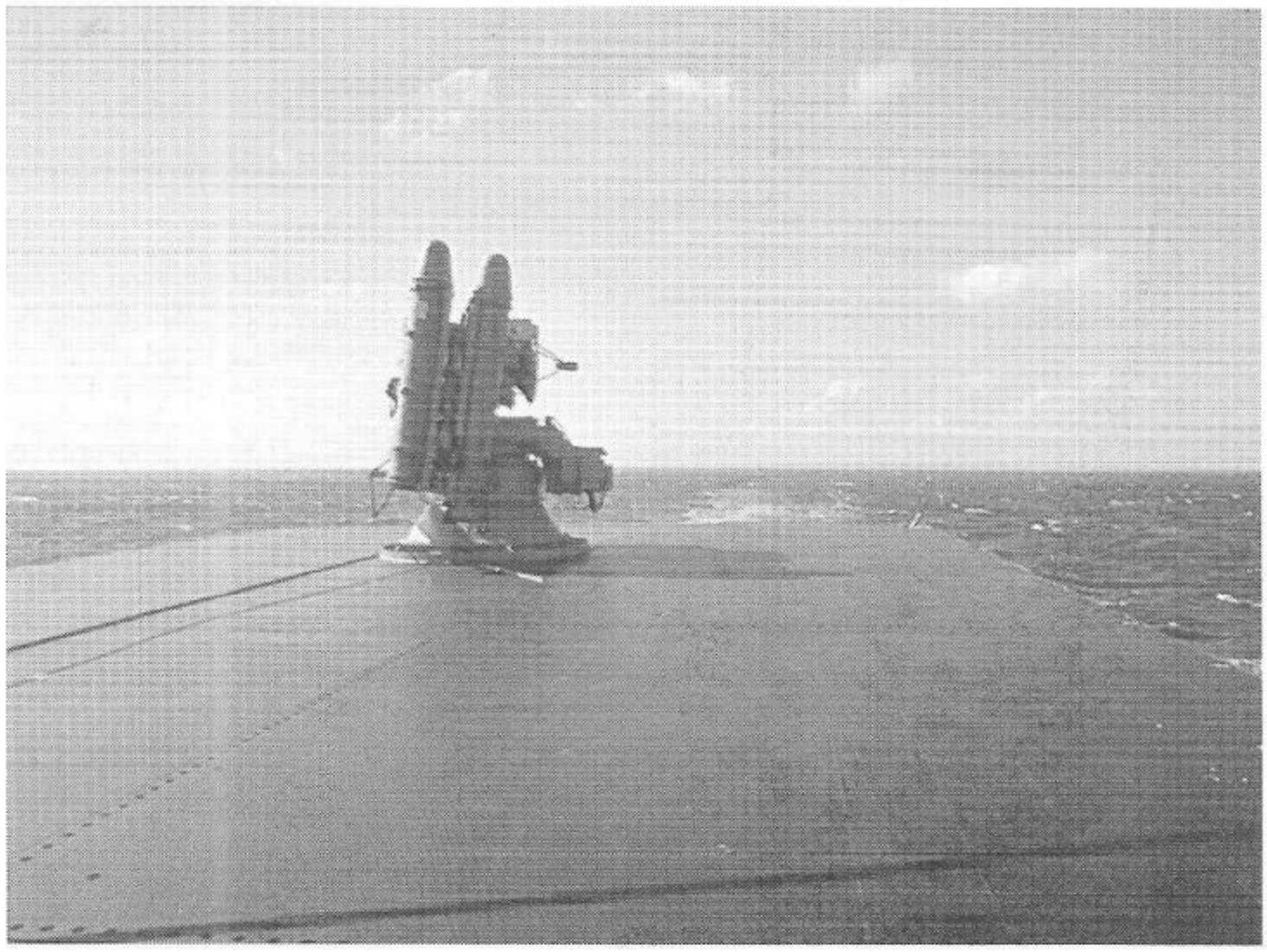
SURFACE-TO-AIR MISSILES (SAM)

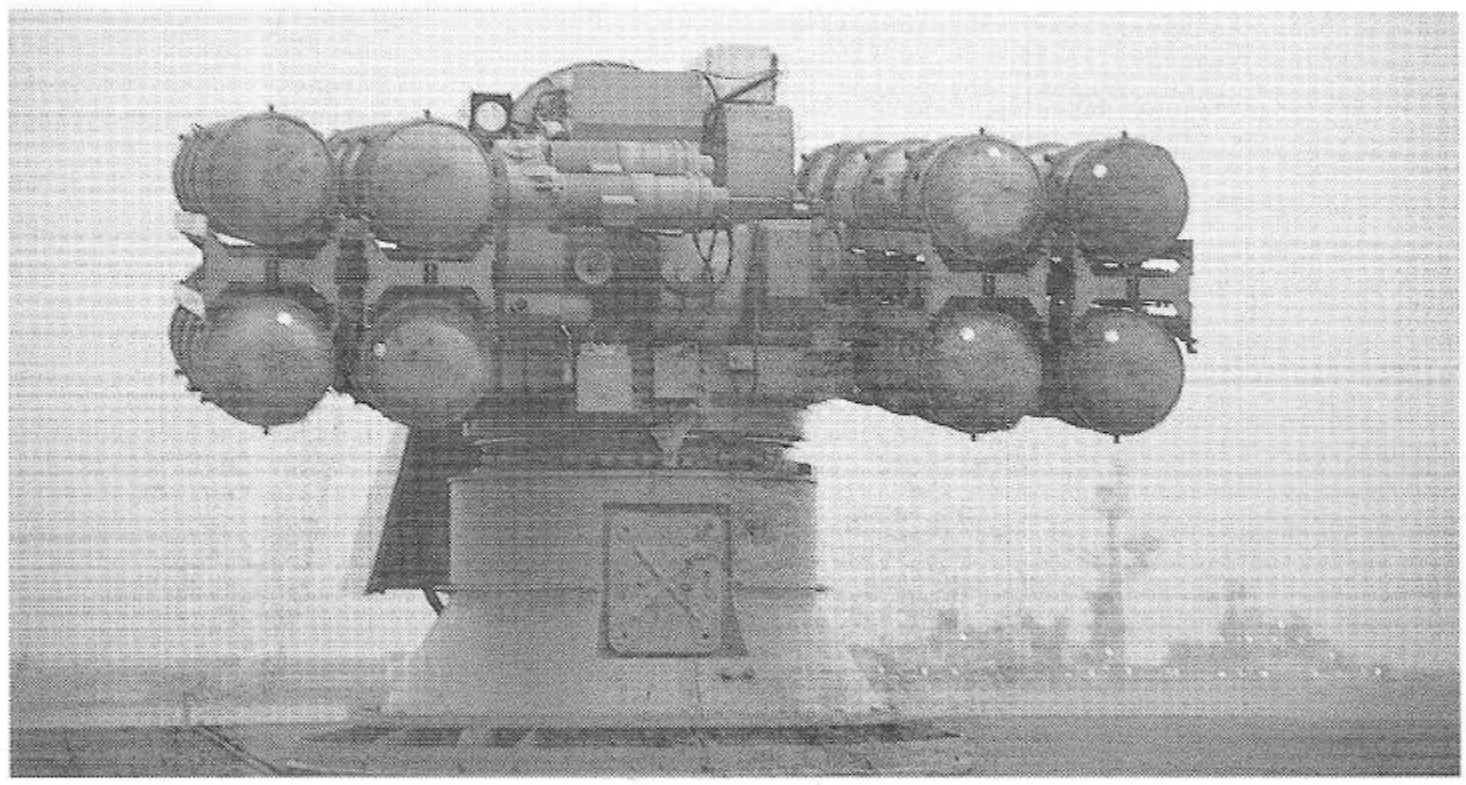
Crotale CN2

There is one Crotale CN2 launcher mounted at the after end of the hangar roof; a total of 16 missiles is carried. Crotale CN2 is based upon the new VT1 missile which can manoeuvre at up to 35 g, and is stored in a new, slimmer, launcher-container. The fire-control system, which can control two missile launchers and the 100 mm gun, is based upon the lightweight Castor radar director, which employs a 12-18 GHz J-band radar with four-horn antenna on one side and a daylight TV camera with SAT IR tracker on the other side. The launcher itself has six launch tubes on either side of the mounting and 'a TV escartometer' which helps automatically to bring the missile into line of sight with the target. The electronics fit weighs 2.6 tonnes while the loading system, which has only eight reloads weighs 3.2 tonnes.

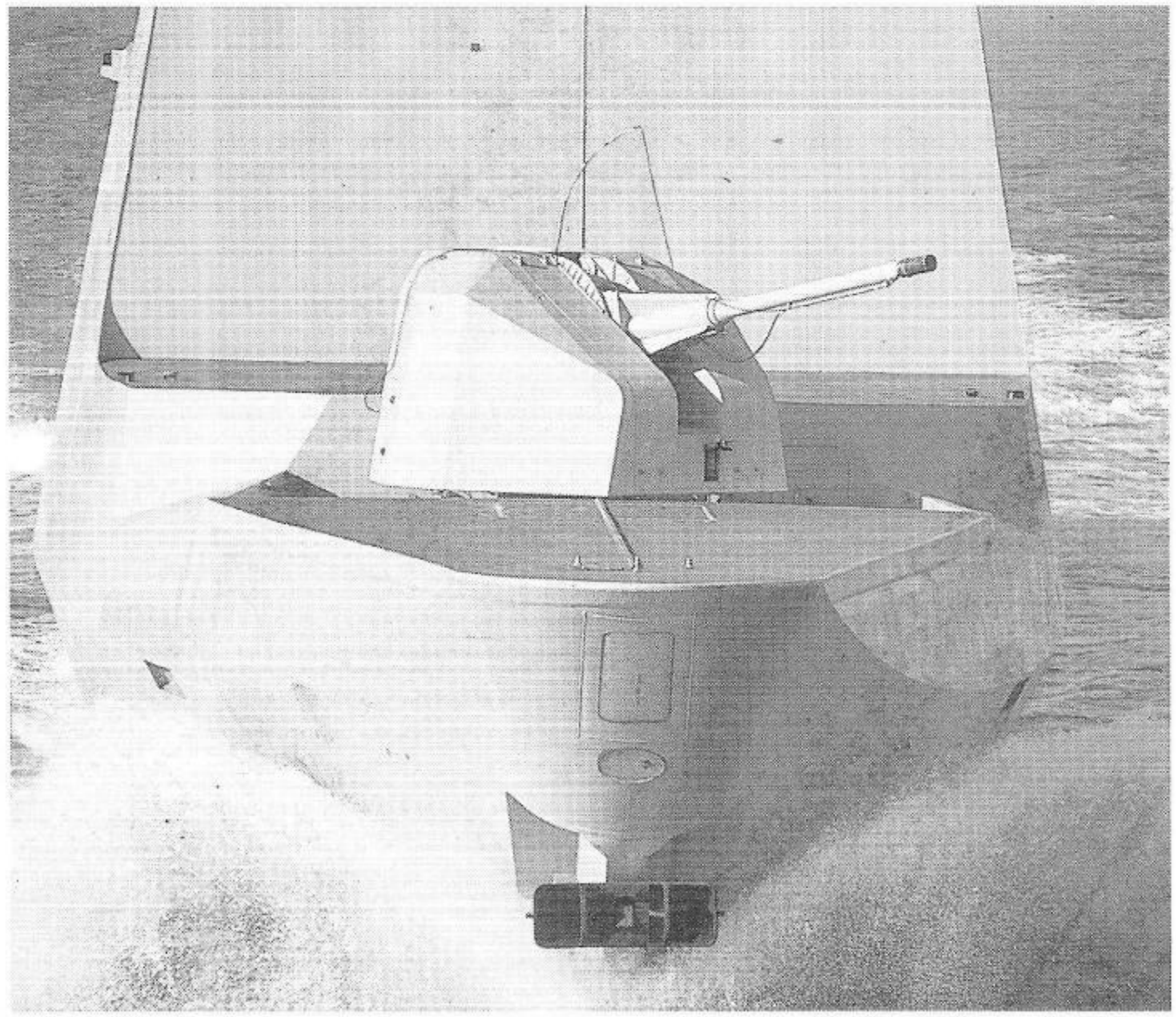
Specifications

Missiles: VT-1
Length: 2.34 m (7.68 ft)
Diameter: 16.5 cm (6.5 in)
Wing span: n/k
Weight: 73 kg (161 lb)
Speed: Mach 3.5
Range: 5 n miles (10 km)
Altitude: 4,000 m (13,000 ft)





Crotale is fitted to the first three ships, but is replaced by Aster in the fourth ship onwards (DCN)



Gun is a 100 mm/55 Modèle 1968-II CADAM. It has a 600 round magazine

Fuze: RF proximity fuze
Warhead: 13 kg (28.7 lb) focused fragment
Guidance: Command/line of sight
Homing: Radar/IR

Manufacturer/Contractor
Thomson-CSF, Division Systèmes Electroniques.

GUNS

100 mm/55 Modèle 1968
There is a single 100 mm/55 Modèle 1968-II CADAM dual-purpose mounting on the foredeck. This is normally operated in the fully automatic remote mode with an unmanned turret, although there is a fall-back manual mode, which requires two men in each turret. The turret was taken from an old ship and upgraded to CADAM (CADence AMéliorée) standard with improved recoil and feed systems, raising the firing rate from 60 rds/min to 78 rds/min.

Specifications
Calibre: 100 mm
Length of barrel: 55 calibres
Muzzle velocity: 870 m/s (2,854 ft/s)
Traverse: 360° at 40°/s
Elevation: −15 to +80° at 25°/s
Mounting weight: 21 t
Crew: 2 (optional) and 2 loaders
Range:
anti-surface: 9.15 n miles (17 km)
anti-air: 8,000 m (26,000 ft)
Rate of fire: 78 rds/min
Ammunition: 13.5 kg (29.8 lb) (multipurpose projectile); 9.7 kg (21.4 lb) (charge)

Manufacturers/Contractors
Direction des Constructions Navales (DCN) (prime).
Mécanique Creusot-Loire, Marine Products (mountings).
DCN Ruelle (gun).
CSEE Défense, Paris, France (servo equipment).

Giat 20mm F2 (20F2) Type A (M693) multipurpose cannon
Two Giat 20F2 cannon are mounted in the bridge wings.

Specifications
Calibre: 20 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,100 ft/s)
Traverse: 325°
Elevation: −15° to +80°
Mounting weight, loaded: 470 kg (1,036 lb)
Weight of shell: 0.25 kg (0.55 lb)
Crew: 2
Range: 3.5-5.5 n miles (6.75-10 km)
Rate of fire: 720 rds/min
Power requirement: 26 V (7A)

Manufacturer/Contractor
Giat, France

M2HB 12.7 mm (0.50 in) machine guns
Two M2HB 12.7 mm machine guns are carried and can be mounted when required.

Specifications
Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rdm/min
Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-air: 1,380 m (4,500 ft)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

ARBR 21 (DR-3000S) ESM receiver
The ARBR-21 ESM suite is a high-performance radar detection, analysis and threat warning system, covering conventional radar threat frequencies (that is, C- to J-bands). The system analyses the measured radar parameters and uses these characteristics to determine other parameters such as the radar's type and identity. There are two antenna assemblies, both on the mainmast. One is an omnidirectional array providing initial detection and threat frequency, and carrying out primary analysis, while below this are two eight-port directional antennas to provide more accurate bearing and frequency information. The antenna assemblies contain preamplifiers for improved performance.

Manufacturer/Contractor
Thomson-CSF, France.

DIBV 1A VAMPIR IR detector
VAMPIR (Veille Air-Mer Panoramique Infra-Rouge) is a passive surveillance and search system for both sea and low-level air targets. The equipment consists of a cylindrical housing carried on a vertically stabilised mount which is fixed on the ship's superstructure in a high position to ensure maximum range and freedom from obstruction. Stabilisation of the housing automatically compensates against ship motion, while the rotating optical head provides all-round scanning of the horizon. The equipment is a bi-spectral device operating in two distinct IR bands, thus achieving a very low false alarm rate in the presence of environmental noise. The two separate channels also enable target detection in a variety of weather conditions. A CSEE subsystem performs the signal processing. (Ships are currently 'fitted for but not with' VAMPIR.)

Specifications
Wavelength: 4-5 and 8-13 µm (simultaneous channels)
Field of view: 360° × 0 to +24° elevation
Detection range: <10 km for frontal attack by missile/aircraft
Target designation accuracy: 1 mrad in elevation and bearing
Sensor cooling: Joule Thompson cycle to about 80 K
Dimensions of stabilised unit: 125 × 60 cm diameter
Rotation rate: 60 rpm

Manufacturer/Contractor
CSEE Défense, Paris, France

ELECTRONIC COUNTERMEASURES (ECM)

ARBB 33 jammer
The ARBB 33 high-performance jammer has a multiple threat capability and is able to counter up to four threats simultaneously. It can jam all modern threats: target designation radars as well as pulsed fire-control radars and seeker heads. It has a wide range of jamming modes: continuous noise, pulsed noise, cover pulse jamming, synchronous and asynchronous false echoes, and range gate pull off. The system can be alerted initially by a threat detection equipment, but also possesses an autonomous detection subassembly. It provides a 360° coverage in azimuth by means of electronically switched antennas for both detection and jamming, instead of the conventional directional assembly, in order to allow faster reaction time in any direction. (Ships are currently fitted for but not with ARBB 33)

Specifications
Frequency: H, I and J-bands
Azimuth coverage: 2 sectors of 180°
Reaction time: <0.5 s
Output power: <100 kW
Threat handling: Two simultaneously
Detection sensitivity: Better than −50 dBm
Bearing accuracy: Better than 5° RMS

Manufacturer/Contractor
Thomson-CSF, France

DECOYS

DAGAIE CS Mk 2 countermeasures system
There are two DAGAIE CS Mk 2 launchers mounted on the upper deck immediately below the foremast. These

The Dagaie launcher can fire a variety of decoys to provide seduction, distraction and seduction/dissimulation

can be loaded with either IR or chaff rockets, and the firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, windspeed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate between them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises: (a) two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either 3-5 and 8-14 µm IR or I/J-band chaff projectiles.

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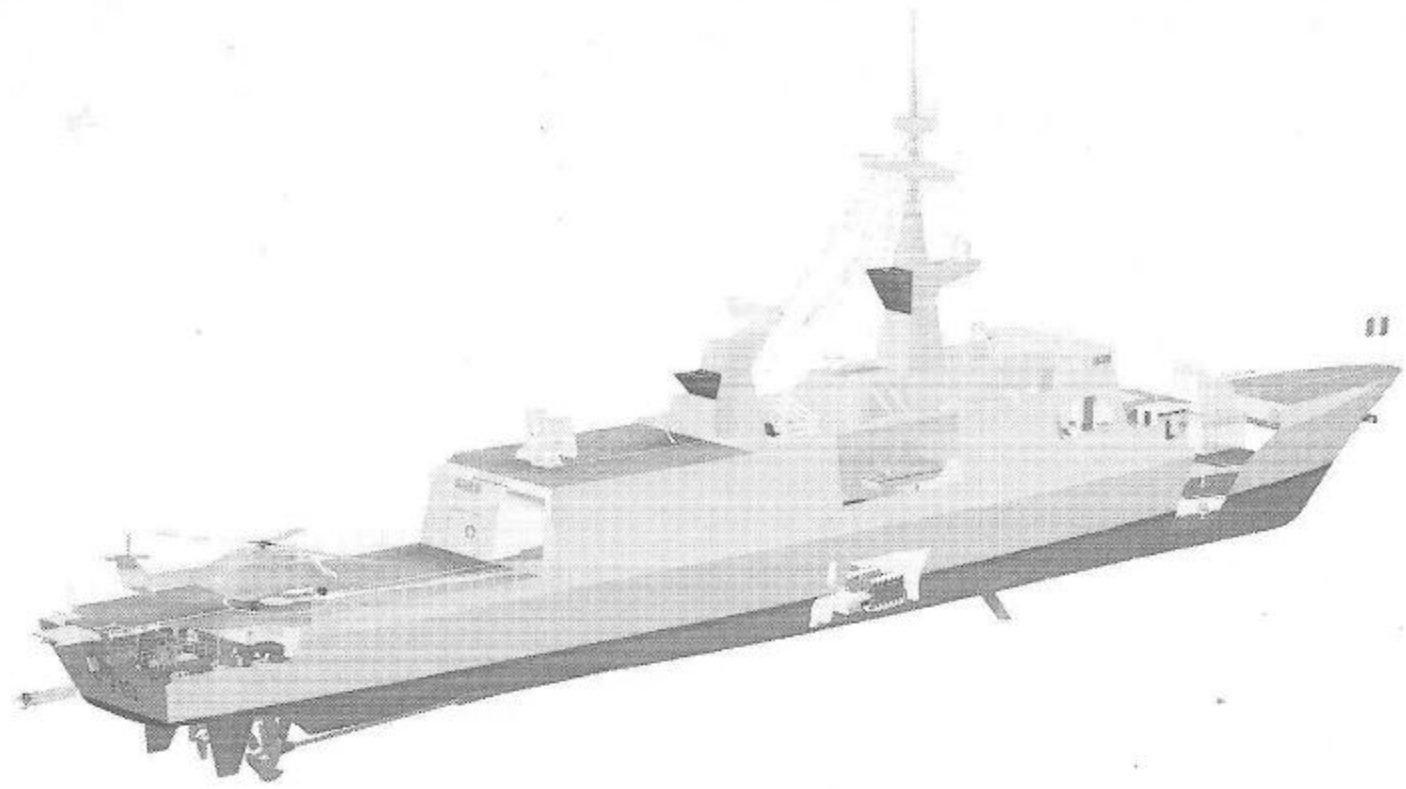


The stern gallery under the flight deck is used by the marines and accommodates three Gemini-type inflatables. The gallery door in the transom opens upwards and the Gemini is launched/removed using an overhead rail (DRN)

Specifications

Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)

LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)
Container weight: 54 kg (119 lb)

Manufacturer/Contractor

CSEE Défense, Paris, France

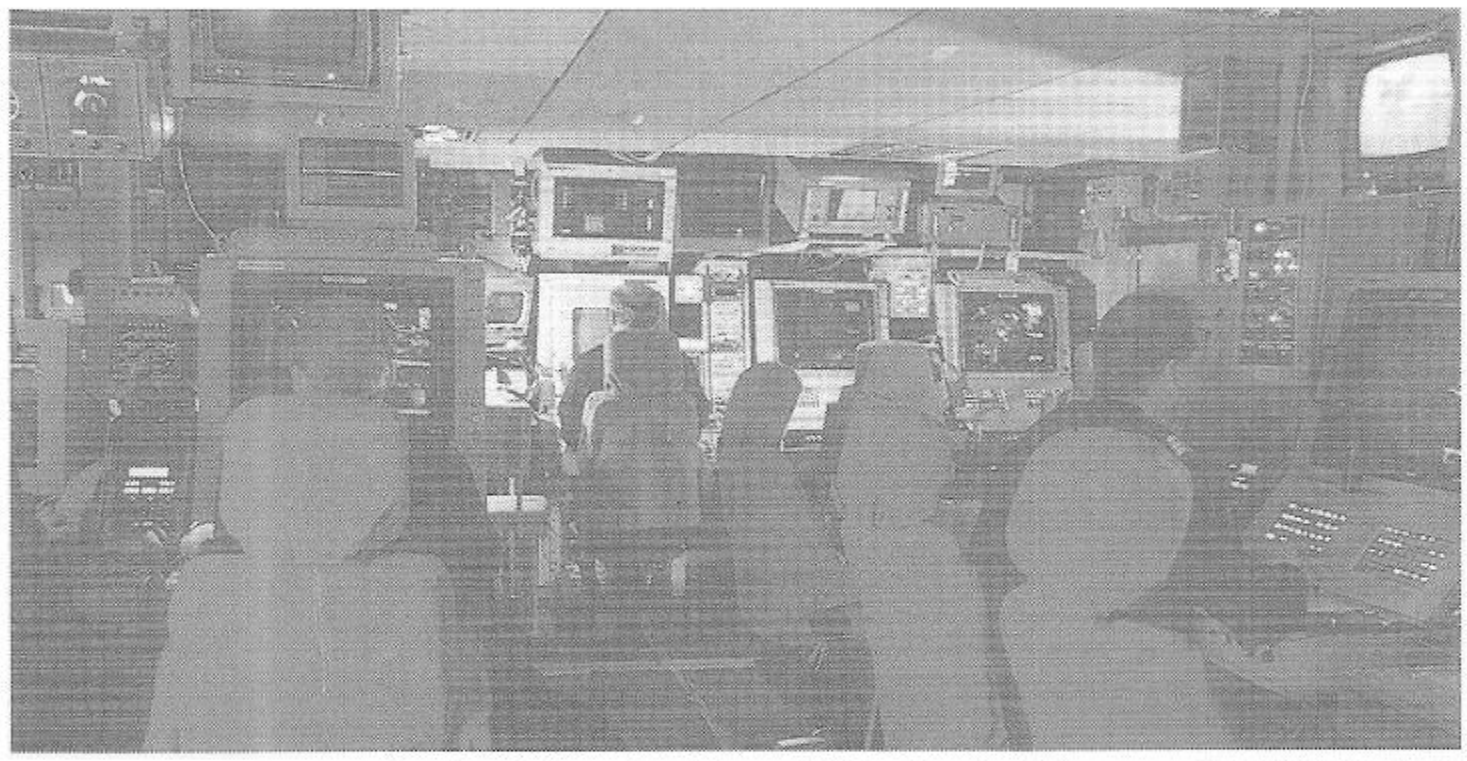
COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

THOMSON-CSF TAVITAC 2000

TAVITAC 2000 (TAVITAC = *Traitement Automatique et VIsualisation TACtique*) is a tactical picture compilation system which uses data from ship sensors and integrates data from offboard sensors through a Link 11 datalink system. It also designates targets to weapon systems. In the 'La Fayette' class TAVITAC 2000 controls:

- Thomson-CSF Sea Tiger Mk 2 2D radar
- Thomson-CSF ARBR 17 ESM suite
- Two Racal-Decca Type 1226 navigation and helicopter control radars
- Syracuse-2 Satcom systems
- Exocet MM 40 missiles
- 100 mm gun with radar fire-control unit
- Sea Crotale CN2
- Two 20 mm automatic cannon
- Two CSEE Dagaie Mk 2 decoy launchers



Officers operating in the Combat Information Centre (CIC) using the Thomson-CSF TAVITAC 2000 system

The TAVITAC 2000 system has a distributed architecture using the Thomson-CSF MLX-32 computers which are built around a Motorola 68030 microprocessor. The system uses Ada software language, the UNIX System V operating system and features a duplicated VMEbus 5 Mbyte/s Ethernet-standard local area network. A ruggedised disk storage system offers a database management capability for map displays, ship resources and management. The system includes the Vista raster scan software-driven display consoles which incorporate the Motorola 68020 microprocessor. The consoles, with high-resolution colour displays and a powerful radar scan converter, allow the radar video data to be superimposed upon the graphic picture. The displays use a 48.26 cm (19 in) colour 1,024 × 1,280 pixel screen, which is increased to 2,000 × 2,000 pixels at the graphic controller.

The Vista console is capable of processing up to 800 tracks and displaying 300 of them together with 30 circles, 30 ellipses, 500 vectors and 2,000 shoreline vectors. Options include a second 19 in television monitor. The MMI facilities include two programmable keyboards and a rollerball, with four associated buttons. Features which may be added include a second radar scan converter for window displays of further raw radar video and further MMI facilities.

Up to 15 display consoles and network interface units can be run from two computers. In the 'La Fayette' class there are two MLX-32 computers, one of which provides redundancy, and another two to interface with sensor and weapon systems as well as Link 11. There are six Vista consoles and a Precilec E8000 tactical

RADARS

Type	DRBV-15C (Sea Tiger)	DRBN-32 (Decca 1226) (two)	DRBC-33 Castor IIC
Manufacturer/ contractor	Thomson-CSF, France	Decca, UK	Thomson-CSF, France
Role	Air/surface search; target designation	One for navigation; one for close-range helicopter control	Fire control (Crotale NC2)
Band	E/F	I	J
Beam	csc² up to 50°	1.2°	2.45 × 2.3°
Peak Power	60 kW	25 kW	30 kW
Gain	30 dB	30 dB	36 dB
Pulsewidth	5.5/12 µs	0.05/0.25/1.0 µs	0.5 µs
PRF	2,200/1,100 pps	n/a	4,000-8,000 pps
Scan rate	12/24 rpm		—
Typical range	Pd <50% against 2 m² target at 60 n miles at heights up 15,240 m (50,000 ft)		range 15 km (8 n miles) for 1 m² target

table linked by an Ethernet dual-redundancy local area network.

Manufacturer/Contractor

Thomson-CSF, Division Systèmes Défense et Controle, Bagneux, France.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11
Satcom: Syracuse 2

Combat support system

The OPSMER combat support system is installed.

WEAPONS CONTROL

Thomson-CSF CTM radar/IR system. Sagem TDS 90 optical director and laser rangefinder.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 31.5 × 15.4 m (103 × 50 ft)
Helicopters: The ship facilities, flight deck and hangar are designed to accept and accommodate helicopters of up to 10 tonnes. Current plans are to operate one Aerospatiale AS 565 MA Panther, but an NH-90 in due course. The flight deck can accept a Super Frelon. Although the Panther is not armed it carries the equipment necessary to conduct over-the-horizon operations with MM 40 Exocet.

Eurocopter AS 365 Panther

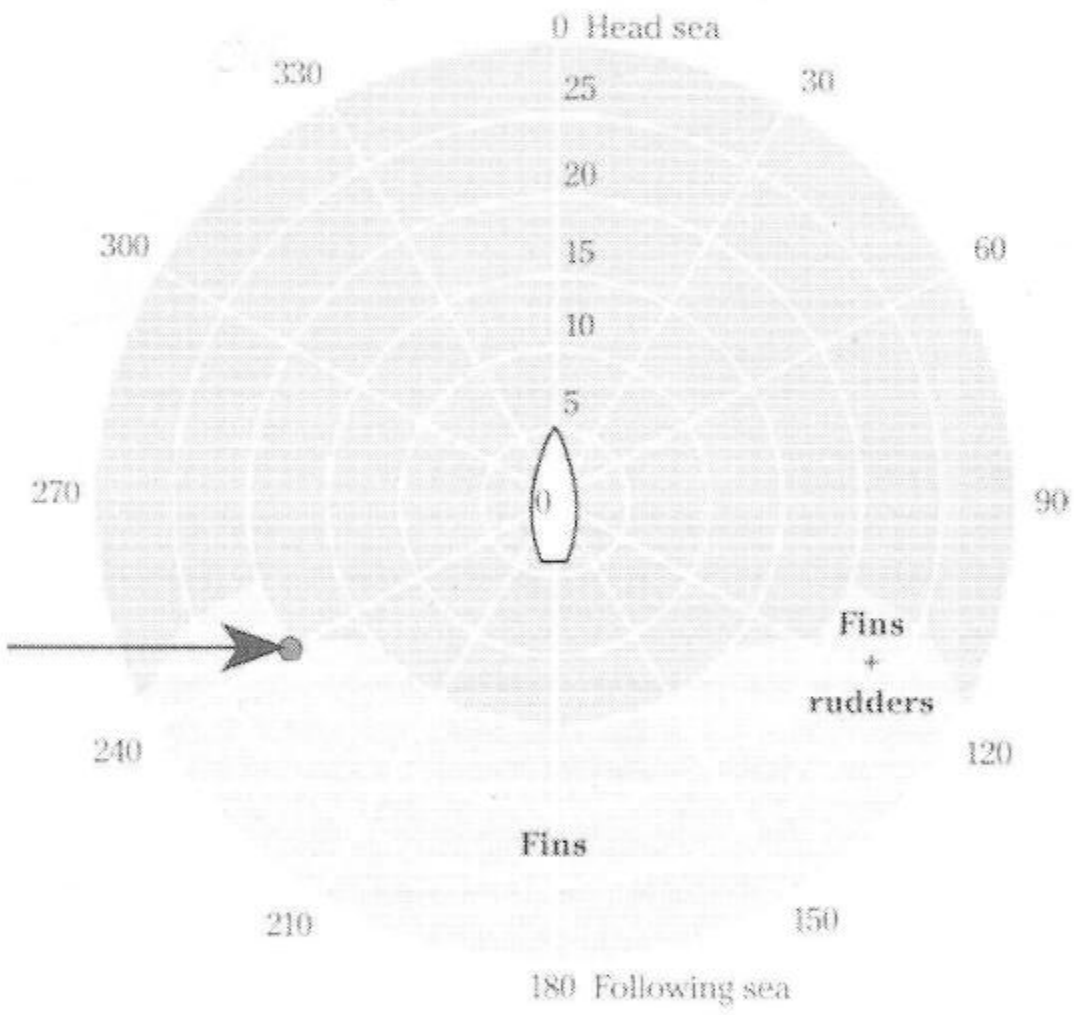
Specifications

Rotor diameter: 13.29 m (43.6 ft)
Fuselage length: 11.41 m (37.43 ft)
Height to rotor head: 4.0 m (13.12 ft)
Weights
empty: 2,262 kg (4,987 lb)
take-off: 4,250 kg (9,370 lb)
Performance
max speed (never exceed): 160 kts (296 km/h)
cruising speed (sea level): 148 kts (274 km/h)
rate of climb (sea level): 420 m (1,380 ft)/min
hovering ceiling (in ground effect): 2,600 m (8,530 ft)
Engines: 2 Turbomeca Ariel 1M1 turboshafts; take-off — 558 kW (749 shp), continuous — 487 kW (653 shp).
Accommodation: Two-man crew; cabin can hold 10 passengers.

PROPULSION

Specifications

System: Combined diesel and diesel (CODAD)
Main machinery: 4 SEMT-Pielstick 12PA 6V 280STC diesels; 15.52 MW (21,107 hp(m)) sustained;
Shafts: 2
Propellers: five-bladed, cp
Bow thruster: 1 bow thruster
Ship's services: 3 diesel-generator sets; each 750 kW



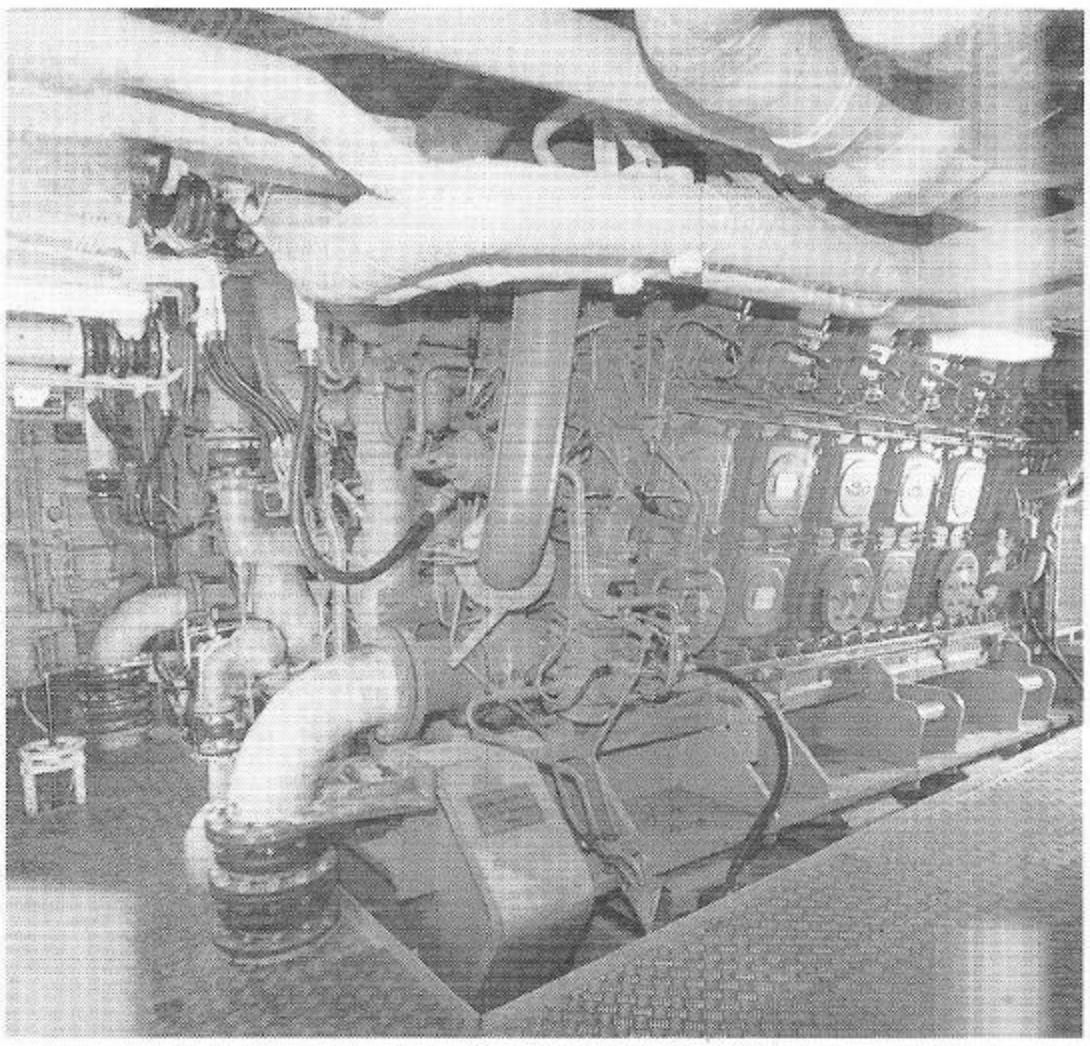
La Fayette

One of the ships for Taiwan; note the new coaming surrounding the foredeck platform

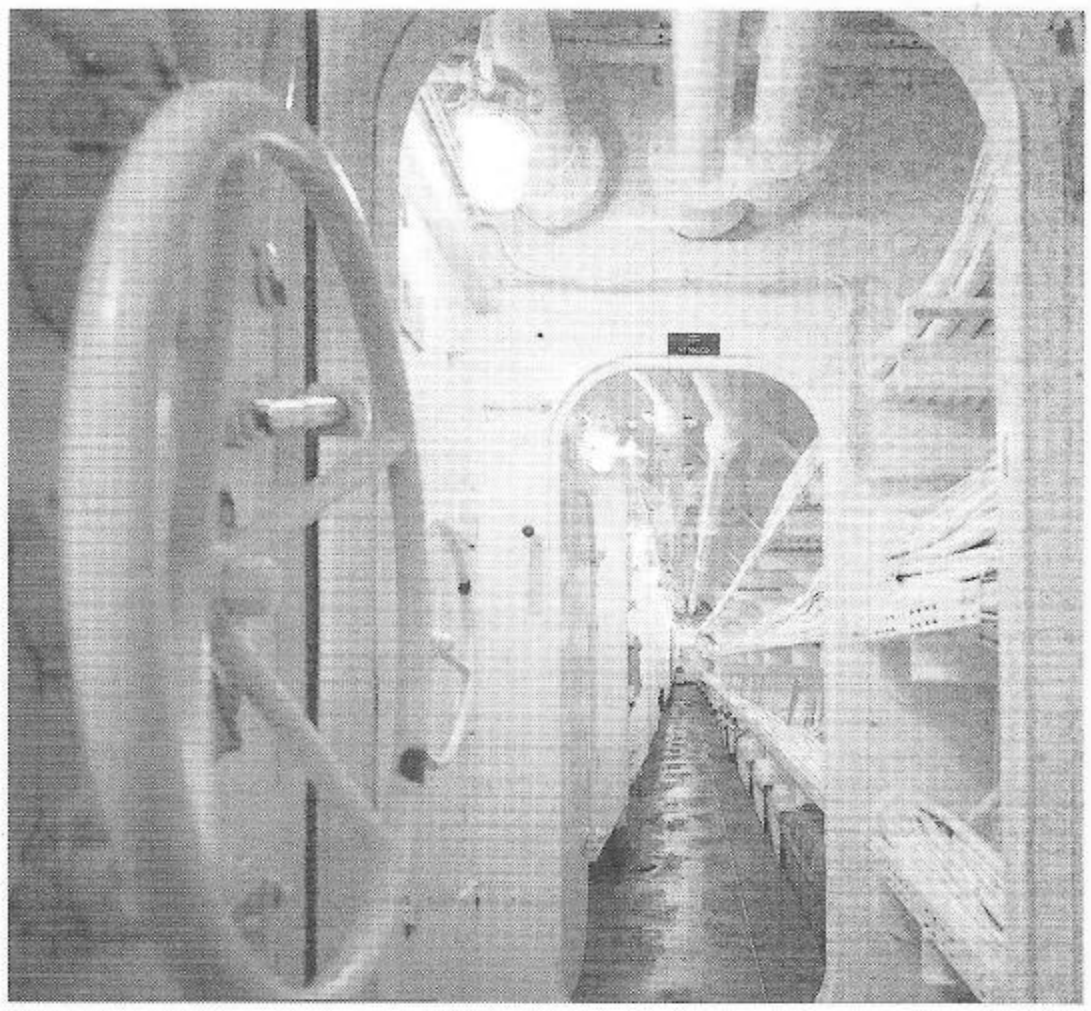
FURTHER INFORMATION

PROGRAMME

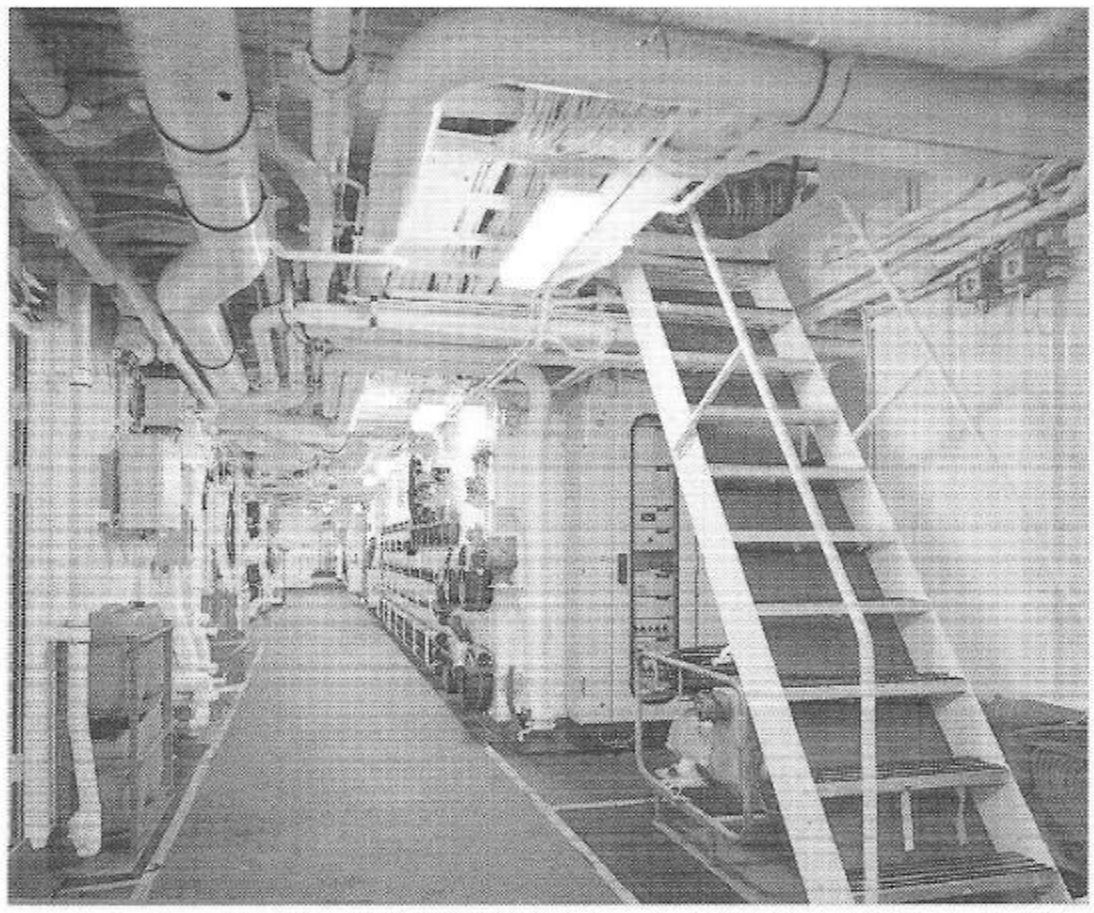
French naval analysis in the mid-1980s of its future tasks suggested that it will be more likely to become embroiled in crisis management and peacekeeping missions than in all-out war at sea, although the latter remains the ultimate threat. But ships engaging in convoy duties or imposing blockades still require considerable offensive power and defensive hardening, since even unsophisticated navies can mount serious attacks on warships, as events in the Gulf over the past ten years have shown. Sea-skimming missiles can be launched from aircraft, small boats or coastal batteries, guns, even when fitted to small vessels can do great damage, and mines can wreak havoc. Such problems are exacerbated by the fact that most rules of engagement will enable the 'other side' to fire first, before retaliatory action can be taken.



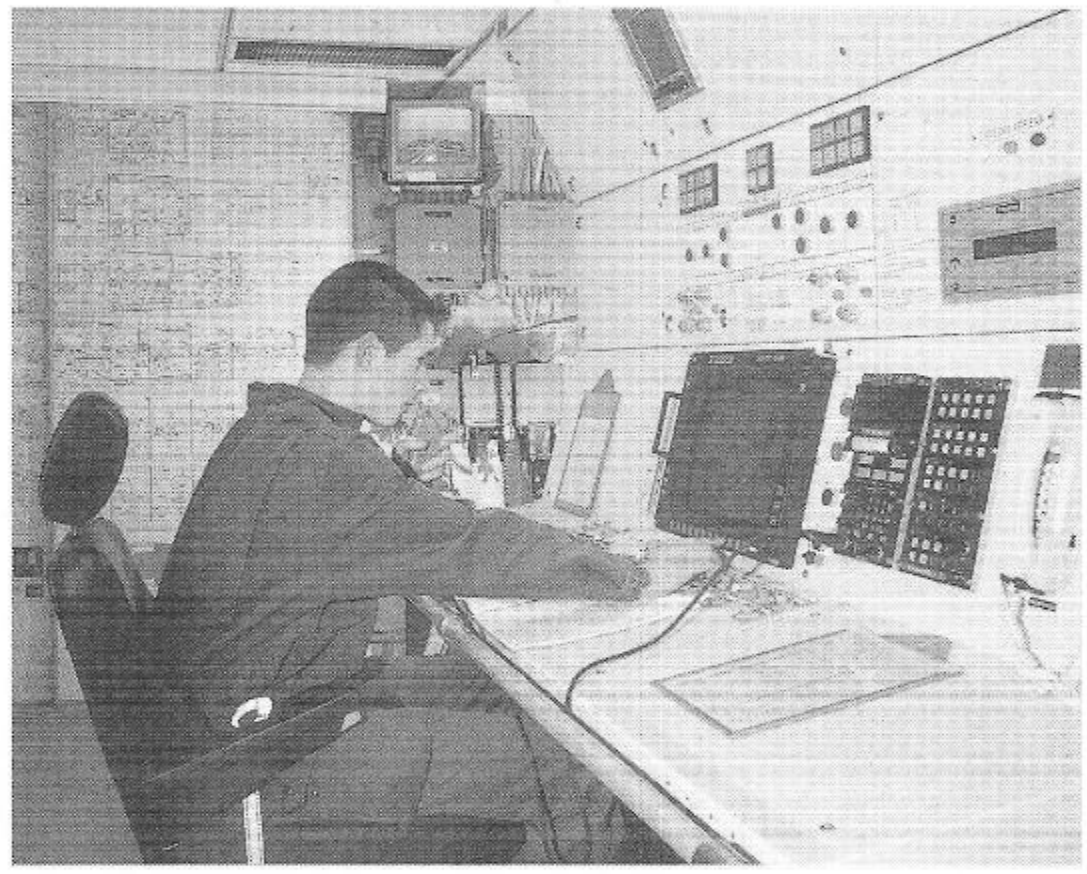
One of the four SEMT-Pielstick 12PA 6V 280 diesels, which use sequential supercharging to produce high performance in all torque regimes (DCN)



On the inner side of the hull there is a series of 'lateral galleries' which provide additional protection for the crew. The outer plates of the galleries are fabricated from armoured steel and the galleries themselves act as a form of spaced armour (DCN)



The main passageway runs down the centre of the ship and provides rapid and easy access to any location (DCN)



Damage Control HQ uses a computerised system to monitor the status throughout the ship, although the traditional large-scale paper diagrams can still be seen on the far bulkhead. There are three Damage Control Zones (DCN)

The missions which the La Fayette is designed to fulfil are:

Forward deployment and sea-control in sensitive areas
Intelligence collection
Participation in allied and international operations
Shadowing, deterrence and, when required, attack on hostile ships
Rescue of threatened French citizens
Landing special forces
Support of amphibious operations
Humanitarian missions
Search and rescue

The outcome of these analyses was the 'La Fayette' class, the first three of which were ordered for the French Navy on 25 July 1988, followed on 24 September 1992 by an order for three more. Current French plans call for a total of ten, but in view of the present round of severe cuts this may well be reduced to six.

DESIGNATION

The class was originally designated 'Frégates Légéres' (light frigates), but this was changed in 1992 to 'Frégates type La Fayette'.

DESIGN

The criteria laid down for the design were : stealth, reduced vulnerability to hits; good seakeeping; flexibility; a high degree of automation; and moderate costs. The result is a ship with a unique appearance.

The radar cross-section has been reduced by streamlining the hull, superstructure and masts, with all openings being covered by hatches, and the foredeck and stern completely covered in. All external vertical surfaces are inclined at 10° and there is a pronounced knuckle in the hull. Even the opening for the ship's boats is covered by a large roller blind, constructed of metallic links similar in design to mediaeval chain-mail. Radiation absorbing material and paint are used where needed. All reflecting equipment, such as capstans, bollards and fairleads have been placed under cover.

To reduce the acoustic signature, all four diesels are mounted on individual rafts and the gearboxes and propellers have been specially designed. The propellers have a bleed-air device and there is a noise suppression device which is described as 'Prairie/Masker-type' which suggests that it is French-designed, but using similar principles to the US original.

Vulnerability measures include redundancy, system dispersion, steel armour protection for vulnerable spots, advanced damage control and NBC protection.

The sea-keeping aspects of the design were very carefully considered, the result being a new hull form combining the economical U-form with the better sea-keeping of the V-form. A fully automated system correlates the operation of the fin stabilisers with that of the oversized rudders. As a result the ship can operate a 10 tonne helicopter up to Sea State 6 and can reverse course in 560 m (612 yd) at 20 knots with 30° rudder.

COMMANDOS

There is accommodation space for a maximum of 12 commandos. The stern gallery under the flight deck has storage space for the commandos' equipment and boats, and an upward-opening hatch in the transom lifts to allow the boats to be run out under a crane and lowered into the water for very quick and clandestine launches and recoveries.

THE FUTURE

A large number of future developments is planned for these ships. These include:

- Installing a SAAM launcher with a magazine holding 16 Aster 15 missiles forward of the bridge, which will enable the Crotale launcher to be removed from the hangar roof. This is planned to be

installed in F 713, F 714 and F 715 in build and to be retrofitted in the first three at their earliest refit.
- Replacing the Sea Tiger Mk 2 radar on the after mack by Arabel.
- Installing the SLAT anti-torpedo system, when available.
- A magazine for AM 39 Exocet and AS 15 missiles for the NFH-90 helicopter will be installed before the new aircraft enters service.
- Thomson-CSF TAVITAC 2000 will be replaced by SENIT 7 (the system developed for the nuclear carrier *Charles De Gaulle*).

Plans to fit sonar have been dropped, but it remains possible to produce an ASW version. Such a ship would have hull and towed array sonars, K 69 lightweight torpedo launchers, and an ASW configured helicopter.

DEPLOYMENT

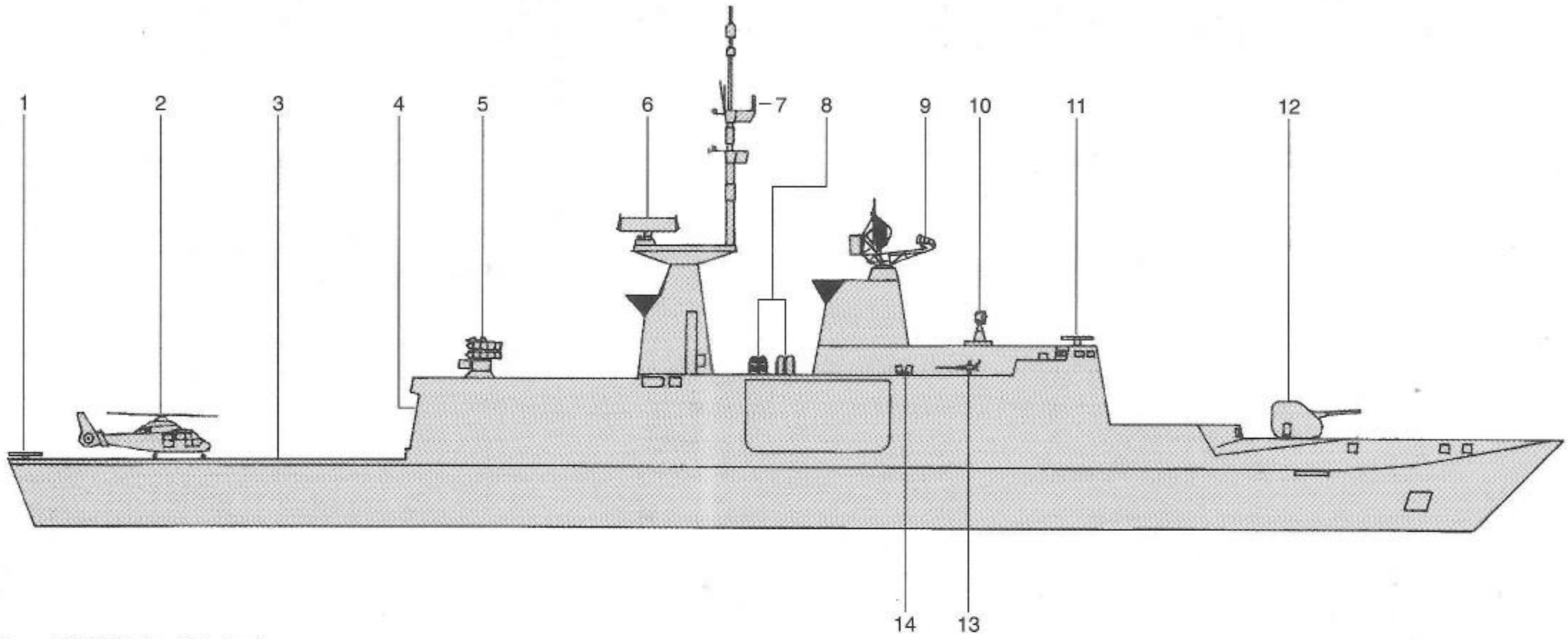
La Fayette started full sea trials on 27 September 1993, followed by *Surcouf* on 4 July 1994 and *Courbet* on 14 September 1995.

As these frigates are designed for out of area operations on overseas stations, the first three have been assigned to the Indian Ocean squadron of the Force d'Action Navale (FAN).

SALES

Two of an improved design have been ordered by Saudi Arabia and six are being built for shipping to Taiwan for completion: see next two entries.

LA FAYETTE (TYPE 3000S)



Type F 3000S (Ian Sturton)
1*Racal-Decca 1226 helicopter control radar* **2** *Aerospatiale SA 365 Dauphin 2 ASW helicopter* **3** *Flight deck* **4** *Hangar* **5** *Thomson CSF Crotale Naval eight-cell launcher* **6** *Thomson-CSF Sea Tiger air/surface search radar* **7** *Thomson-CSF DR 3000S-2 radar intercept* **8** *Aerospatiale MM 40 Exocet anti-ship missiles* **9** *Thomson-CSF DRBV 26C air search radar* **10** *Thomson-CSF Castor 2 fire control* **11** *Racal-Decca 1226 navigation radar* **12** *DCN 100 mm (3.9 in)/55 Modèle 68 CADAM automatic gun* **13** *Giat 20F2 20 mm cannon (open mount)* **14** *CSEE Défense Dagaie Mk 2*

GENERAL SPECIFICATIONS

Country of origin: France
Operator: Saudi Arabia
Type: 3000S

Class: LA FAYETTE (FFG)

Building: 2
Active: 0

Displacement:
full load: 4,100 t

Dimensions
Length: 128.0 m (419.9 ft)
Beam: 16.2 m (53.15 ft)
Draught: 4.1 m (13.45 ft)

Speed: 25 kts
Range: 7,000 n miles at 15 kts; 9,000 n miles at 12 kts
Endurance: 50 days

Complement: 139 (15 officers) plus 12 aircrew plus 12 marines

SHIPS

—

Builder	Lorient Dockyard, Lorient, France
Laid down	1996
Launched	1997
Commissioned	1999

—

Builder	Lorient Dockyard, Lorient, France
Laid down	1997
Launched	2000
Commissioned	2002

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 40 anti-ship missiles
Eight MM 40 Exocet anti-ship missile launchers will be installed on the superstructure roof, immediately abaft the forward mack. Unlike most other tube-launched SSM installations these will not be located so that they fire across the ship with their efflux going straight overboard, but rather face outwards in two groups of four at an angle of 90° to the centreline and at +12° to the horizontal. There will be a central deflection plate to redirect the rocket efflux upwards.

Specifications
MM 40 Block 2
Length: 5.80 m (19 ft)
Diameter: 35 cm
Wing span: 1.13 m (3.70 ft)
Weight: 870 kg (1,918 lb)
Speed: Mach 0.9
Range: 2-40.5 n miles (4-75 km)
Warhead: 155 kg (341 lb) HE frag
Fuze: Impact/proximity
Guidance: Inertial and active radar

Manufacturers/Contractors
Aerospatiale Missiles, Paris Cedex, France (prime).
Luchaire Défense, Versailles Cedex, France (warhead).

SURFACE-TO-AIR MISSILES (SAM)

Crotale CN2
The Saudi Navy has opted for Crotale CN2 with one launcher mounted at the after end of the hangar roof, and a total of 16 missiles being carried. Crotale CN2 is based upon the new VT1 missile which can manoeuvre at up to 35 *g*, and is stored in a new, slimmer, launcher-container. The fire-control system, which will control two missile launchers and the 100 mm gun, will be based upon the lightweight Castor radar director, which employs a 12-18 GHz J-band radar with four-horn antenna on one side and a daylight TV camera with SAT IR tracker on the other side.

Specifications
Missiles: VT-1
Length: 2.34 m (7.6 ft)
Diameter: 16.5 cm
Wing span: n/k
Weight: 73 kg (161 lb)
Speed: Mach 3.5
Range: 5.4 n miles (10 km)
Altitude: 4,000 m (13,120 ft)
Fuze: RF proximity fuze
Warhead: 13 kg (28.7 lb) focused fragment
Guidance: Command/line of sight
Homing: Radar/IR

Manufacturer/Contractor
Thomson-CSF, Division Systèmes Electroniques.

GUNS

100 mm/55 Modèle 1968 CADAM
There will be a single 100 mm/55 Modèle 1968-II CADAM dual-purpose mounting on the foredeck. This is normally operated in the fully automatic remote mode with an unmanned turret, although there is a fall-back manual mode, which requires two men in each turret. The turret was taken from an old ship and upgraded to CADAM (CADence AMéliorée) standard with improved recoil and feed systems, raising the firing rate from 60 rds/min to 78 rds/min.

Specifications
Calibre: 100 mm
Length of barrel: 55 calibres
Muzzle velocity: 870 m/s (2,854 ft/s)
Traverse: 360° at 40°/s
Elevation: −15 to +80° at 25°/s
Mounting weight: 21 t
Crew: 2 (optional) and 2 loaders
Range:
anti-surface: 9.15 n miles (17 km)
anti-air: 8,000 m (26,000 ft)

Rate of fire: 78 rds/min
Ammunition: 13.5 kg (29.7 lb) (multipurpose projectile); 9.7 kg (21.4 lb) (charge)

Manufacturers/Contractors
Direction des Constructions Navales (DCN) (prime).
Mécanique Creusot-Loire, Marine Products (mountings).
DCN Ruelle (gun).
CSEE Défense (servo equipment).

Giat 20 mm F2 (20F2) TYPE A (M693) multipurpose cannon
Two Giat 20F2 cannon will be mounted in the bridge wings.

Specifications
Calibre: 20 mm
Length of barrels: 90 calibres
Rate of fire: 720 rds/min
Muzzle velocity: 1,050-1,250 m/s (3,444-4,100 ft/s)
Traverse: 325°
Elevation: −15 to +80°
Mounting weight, loaded: 470 kg (1,036 lb)
Weight of shell: 0.25 kg
Crew: 2
Range: 5.5 n miles (10 km)
Power requirement: 26 V (7A)

Manufacturer/Contractor
Giat, France

M2HB 12.7 mm (0.50 in) machine guns
Two M2HB 12.7 mm machine guns will also be carried to be mounted when required.

Specifications
Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rds/min
Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-air: 1,380 m (4,500 ft)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

DR-3000S ESM receiver
The DR-3000S (ARBR-17) ESM suite is a high-performance radar detection, analysis and threat warning system, covering conventional radar threat frequencies (that is, C- to J-bands). The system analyses the measured radar parameters and uses these characteristics to determine other parameters such as the radar's type and identity. There are two antenna assemblies, both on the mainmast. One is an omnidirectional array providing initial detection and threat frequency, and carrying out primary analysis, while below this are two eight-port directional antennas to provide more accurate bearing and frequency information. The antenna assemblies contain preamplifiers for improved performance.

Manufacturer/Contractor
Thomson-CSF, France.

DECOYS

DAGAIE CS Mk 2 countermeasures system
There are two DAGAIE CS Mk 2 launchers mounted on the upper deck immediately below the foremast. These can be loaded with either IR or chaff rockets, and the firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, windspeed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate between them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises: (a) two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either 3-5 and 8-14 μm IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised glass fibre chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 μm bands.

Specifications
Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)
Container weight: 54 kg (119 lb)

Manufacturer/Contractor
CSEE Défense, Paris, France.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Thomson-CSF TAVITAC 2000
TAVITAC 2000 (TAVITAC = *Traitement Automatique et VIsualisation TACtique*) is a tactical picture compilation system which uses data from ship sensors and integrates data from offboard sensors through a Link 11 datalink system. It also designates targets to weapon systems. In the 'La Fayette' class TAVITAC 2000 controls:

- Thomson-CSF Sea Tiger Mk 2 2D radar
- Thomson-CSF ARBR 17 ESM suite
- Two Racal-Decca Type 1226 navigation and helicopter control radars
- Syracuse-2 Satcom systems
- Exocet MM 40 missiles
- 100 mm gun with radar fire-control unit
- Sea Crotale CN2
- Two 20 mm automatic cannon
- Two CSEE Dagaie Mk 2 decoy launchers

The TAVITAC 2000 system has a distributed architecture using the Thomson-CSF MLX-32 computers which are built around a Motorola 68030 microprocessor. The system uses Ada software language, the UNIX System V operating system and features a duplicated VMEbus 5 Mbyte/s Ethernet-standard local area network. A ruggedised disk storage system offers a database management capability for map displays, ship resources and management. The system includes the Vista raster scan software-driven display consoles which incorporate the Motorola 68020 microprocessor. The consoles, with high-resolution colour displays and a powerful radar scan converter, allow the radar video data to be superimposed upon the graphic picture. The displays use a 48.26 cm (19 in) colour 1,024 × 1,280 pixel screen, which is increased to 2,000 × 2,000 pixels at the graphic controller.

The Vista console is capable of processing up to 800 tracks and displaying 300 of them together with 30 circles, 30 ellipses, 500 vectors and 2,000 shoreline vectors. Options include a second 19 in television monitor. The MMI facilities include two programmable keyboards and a rollerball, with four associated buttons. Features which may be added include a second radar scan converter for window displays of further raw radar video and further MMI facilities.

Up to 15 display consoles and network interface units can be run from two computers. In the 'La Fayette' class there are two MLX-32 computers, one of which provides redundancy, and another two to interface with sensor and weapon systems as well as Link 11. There are six Vista consoles and a Precilec E8000 tactical table linked by an Ethernet dual-redundancy local area network.

Manufacturer/Contractor
Thomson-CSF, Division Systèmes Défense et Controle, Bagneux, France.

RADARS

Type	DRBV-26C	Sea Tiger (DRBV-15C)	Type 1226 (two)	Castor IIC (DRBC-33)
Manufacturer/ contractor	Thomson-CSF	Thomson-CSF	Racal-Decca, UK	Thomson-CSF
Role	Air search	Air/surface search; target designation	One for navigation; one for close-range helicopter control	Fire control (Crotale NC2)
Band	D	E/F	I	J
Beam	2.5 × 8.3 csc² to 50°	csc² up to 50°	1.2°	2.45 × 2.3°
Peak Power	2 MW	60 kW	25 kW	30 kW
Gain	29 dB	30 dB	30 dB	36 dB
Pulsewidth	2.5 μs	5.5/12 μs	0.05/0.25/1.0 μs	0.5 μs
PRF	450 pps	2,200/1,100 pps	n/a	4,000-8,000 pps
Scan rate	7.5/15 rpm	12/24 rpm		—
Typical range		Pd <50% against 2 m² target at 60 n miles at heights up to 15,240 m (50,000 ft)	8 n miles (15 km) for 1 m² target	

Manufacturer/Contractor
Thomson-CSF, Division Systèmes Défense et Controle, Bagneux, France.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11
Satcom: Syracuse 2

Combat support system

The OPSMER combat support system will be installed.

WEAPONS CONTROL

CTM (DIBC-1A PIRANA) gun fire-control system

CTM (*Conduit de Tir Modulaire*) is the fire-control system for the 100 mm gun, after the targets have been designated by the combat information centre using inputs from the ship's search radar. The PIRANA system (PIRANA = *Pointeur Infra-Rouge pour l'Artillerie Navale*) consists of an IR tracker fitted to the Thomson-CSF Castor IIc director, which includes a TV camera and the DRBC-33 radar. The CTM system features a single operator console and two Cimsa Sintra 15MO5E computers, this being an extended (Etendu) version of the 15MO5. The software is in the national LTR language. The CTM interfaces with the TAVITAC 2000 computers for firing designation and engagement monitoring.

Manufacturers/Contractors

DCN International, Paris, France (CTM).
SAT, Paris Cedex 13, France (PIRANA).

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 31.5 × 15.4 m (103 × 50 ft) 33.2 × 16.2 m (109 × 50.5 ft)

HELICOPTERS

One Eurocopter AS 365F Dauphin 2 ASW and light liaison

Specifications

Dimensions:
rotor diameter: 13.29 m (43.6 ft)
fuselage length: 11.41 m (37.43 ft)
height to rotor head: 4.0 m (13.12 ft)
Weights:
empty: 2,262 kg (4,987 lb)
max take-off: 4,250 kg (9,370 lb)
Performance:
max speed (never exceed): 160 kts (296 km/h)
cruising speed (sea level): 148 kts (274 km/h)
rate of climb (sea level): 420 m (1,380 ft)/min
hovering ceiling (in ground effect): 2,600 m (8,530 ft)
Engines: two Turbomeca Ariel 1M1 turboshafts; take-off – 558 kW (749 shp), continuous – 487 kW (653 shp)
Accommodation: Two-man crew; 10 passengers

PROPULSION

Specifications

System: Combined diesel and diesel (CODAD)
Main machinery: 4 SEMT-Pielstick 12PA 6V 280STC diesels; 15.52 MW (21,107 hp(m)) sustained;
Shafts: 2
Propellers: cp
Bow thruster: 1 bow thruster

FURTHER INFORMATION

PROGRAMME

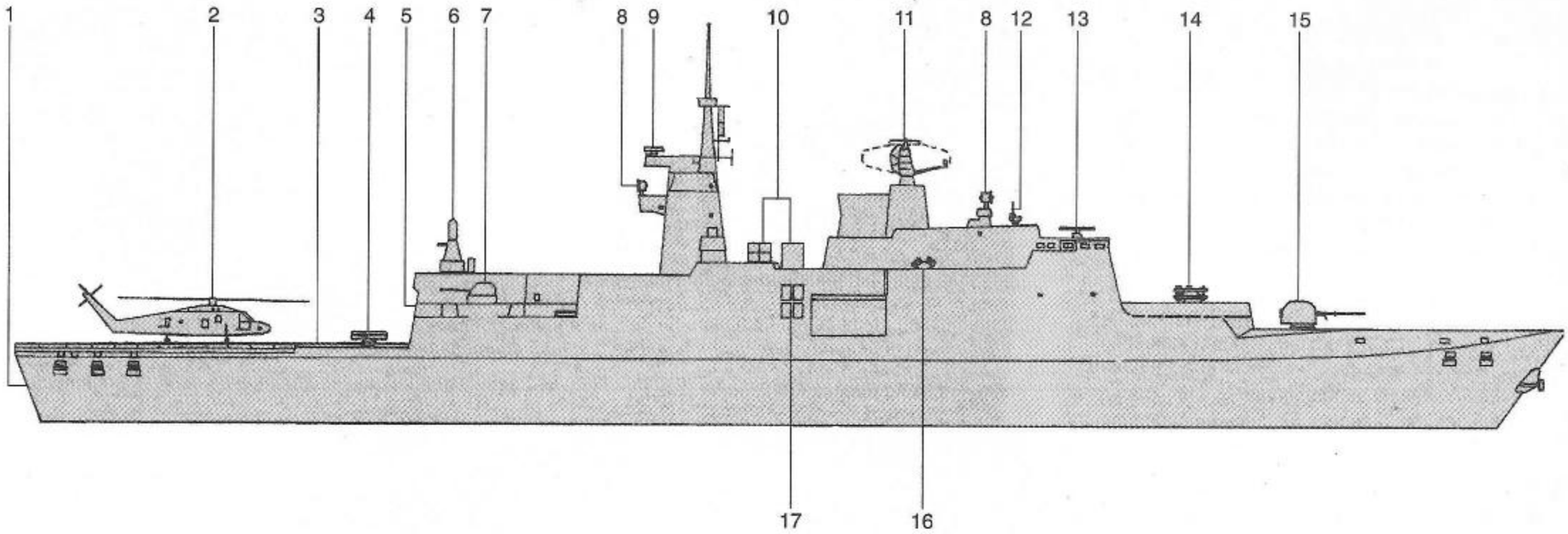
The Saudi Navy's first major warships were the four F 2000S ('Madina' class) frigates, which were built in France and delivered between 1985 and 1986. While that order was still in hand the Saudi Navy was searching for a new class of ships and the order was eventually won by the French F 3000S against strong international competition, particularly from Canada's St John Shipbuilding. The contract, known as Sawari II, is for two modified versions of the La Fayette, which will be delivered in 1999 and 2002, respectively.

DESIGN

The design of the Saudi Arabian ships is generally similar to that of the French prototype. The Saudi ships will, however, be 3 m (9.8 ft) longer and 0.8 m (2.62 ft) broader in the beam, and have an 820 t greater full load displacement. According to drawings so far released, the superstructure will be more like that of the Taiwanese ships, particularly the raised section behind the bridge and the arrangement and design of the macks.

The La Fayette flight deck is already large by frigate standards (31.5 × 15.4 m (103 × 50 ft)), but that of the Saudi ships will be even larger at 33.2 m (109 ft) long and 16.2 m (53 ft) wide. This will enable large helicopters to be handled, although the Saudi Navy has no known plans to purchase anything larger than the SA 365 Dauphins currently in the inventory.

KANG DING (LA FAYETTE)



Kang Ding (Ian Sturton)
1 *BAe/Thomson CSF ATAS(V)2 active sonar* **2** *Sikorsky S-70C(M)1 helicopter* **3** *Flight deck* **4** *US Navy Mk 32 triple 324 mm torpedo tubes* **5** *Hangar* **6** *Hughes Mk 15 20 mm CIWS* **7** *Bofors 40 mm/70 (enclosed mount)* **8** *Thomson-CSF Castor IIC fire control* **9** *Thomson-CSF Triton G surface search radar* **10** *Hsiung Feng II anti-ship missiles (8 launchers)* **11** *Thomson-CSF DRBV-26D air/surface search radar* **12** *CSEE Najir Mk 2 electro-optic director* **13** *Navigation radar* **14** *Sea Chapparal SAM launcher (4 missiles)* **15** *OTOBREDA 76 mm/62 automatic gun* **16** *CSEE Défense Dagaie chaff/IR launcher* **17** *Rocket motor efflux vents for Hsiung Feng missile*

GENERAL SPECIFICATIONS

Country of origin: France
Operator: Taiwan
Type: La Fayette

Class: KANG DING

Building: 6
Active: 0

Displacement:
full load: 3,500 t

Dimensions
Length: 125.0 m (410.1 ft)
Beam: 15.4 m (50.5 ft)
Draught: 4 m (13.1 ft)

Speed: 25 kts
Range: 7,000 n miles at 15 kts

Complement: 134 (15 officers) plus 25 spare

SHIPS

KANG DING (1202)
Builder Lorient Dockyard, Lorient, France/China SB Corporation, Kaohsiung, Taiwan
Laid down 1 Feb 1992
Launched 12 Mar 1994
Commissioned Jun 1996

SI NING (1203)
Builder Lorient Dockyard, Lorient, France/China SB Corporation, Kaohsiung, Taiwan
Laid down Oct 1992
Launched 5 Nov 1994
Commissioned Feb 1997

KUN MING (1205)
Builder Lorient Dockyard, Lorient, France/China SB Corporation, Kaohsiung, Taiwan
Laid down Jul 1993
Launched Jul 1995
Commissioned Nov 1997

DI HUA (1206)
Builder Lorient Dockyard, Lorient, France/China SB Corporation, Kaohsiung, Taiwan
Laid down Sep 1993
Launched Aug 1995
Commissioned Dec 1997

WU CHANG (1207)
Builder Lorient Dockyard, Lorient, France/China SB Corporation, Kaohsiung, Taiwan
Laid down Mar 1994
Launched Apr 1996
Commissioned Aug 1998

— (1208)
Builder Lorient Dockyard, Lorient, France/China SB Corporation, Kaohsiung, Taiwan
Laid down Nov 1994
Launched May 1996
Commissioned Oct 1998

Taiwanese frigate Si Ning *(1203) fitting out at Lorient. These ships will provide a substantial boost to the combat capability of the RoCN which for many years has relied on Second World War-vintage, ex-US Navy destroyers* (Jane's/H M Steele)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Hsiung Feng II short/medium-range anti-ship missile

There are eight launcher-container tubes for Hsiung Feng II anti-ship missiles. They are located in the same place as the La Fayette's Exocet launchers, and like them they point directly over the side, with an efflux deflection plate in the centre of the ship. Hsiung Feng II is a short-range anti-ship missile, derived from the Israeli Gabriel, powered by a turbojet cruise engine, with rocket boosters for take-off. The fire-control system is similar to that used in Gabriel with a radar tracker (usually HR 76), a display control and processing unit, a vertical reference unit and an optical sight which is usually the Kollmorgen Mk 35 or Model 985. The launcher-containers are also identical to those used in Gabriel and are generally similar to the Harpoon's Mk 141.

The launcher operation is likely to follow that of most conventional medium-range anti-ship missiles with the target acquired by long-range surface search radars with over-the-horizon targeting facilities through a Ta Chen datalink. The launcher and target locations are inserted into the inertial guidance system, the missile is launched and adopts a low-level cruising altitude. The target is acquired by both the radar and the IR sensors and the returns are compared with an onboard library. If significant deviations in one sensor's returns occur then the guidance system assumes it is being jammed and gives priority to the other as the missile enters the sea-skimming terminal phase.

Specifications

Hsiung Feng II
Length: 3.9 m (12.8 ft)
Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)
Weight: 540 kg (1,190 lb)
Speed: Mach 0.85
Range: 32 n miles (60 km)
Guidance: Semi-active radar, manual or IR homing
Warhead: 150 kg (330 lb) HE
Engine: Microturbo TRI-60 single spool turbojet

Launch of Hsiung Feng II anti-ship missile. Each Kang Ding frigate will carry eight

SURFACE-TO-AIR MISSILES (SAM)

RIM-72C Sea Chaparral

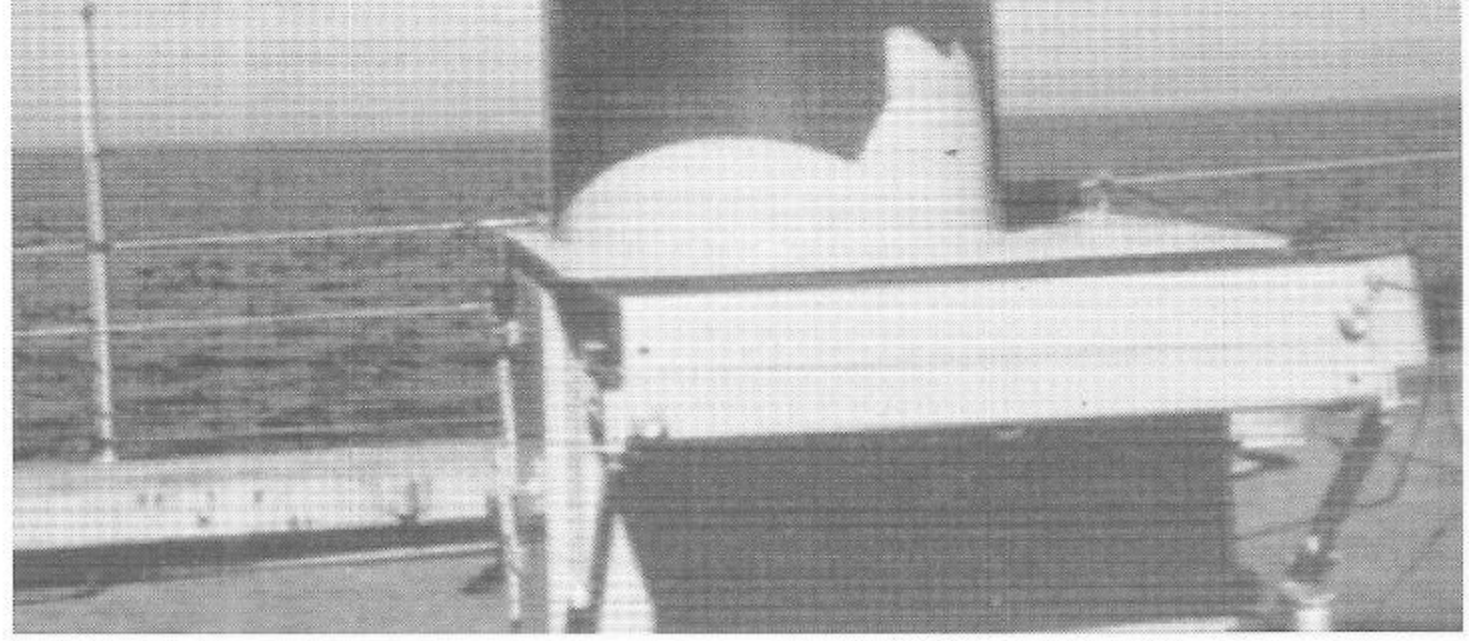
One Sea Chaparral quad launcher is sited immediately before the bridge screen in the location earmarked in the French ships for Aster 15. The Chaparral system was originally developed for the US Army and consists of a manned Mk 54 mounting with two rails on each side, each of which carries a single Sidewinder SAM. In addition to the four missiles on the mounting there are 16 reloads in the below-decks magazine. The rails elevate from −9 to +90°. The Sidewinder missile has an all-aspect IR seeker, a blast fragmentation warhead, and is powered by a single-stage, solid propellant rocket motor.

The operator sits in an air conditioned cab with controls for activating the system, selecting the missile and initiating the launch sequence. Early warning of the target is provided by the ship's radar and the CIC directs the operator to which direction he should turn the mounting. He acquires the target optically, tracks it and selects and activates a missile for the engagement. When the missile's IR detector has acquired the target an audio tone sounds and the operator launches the missile. Proportional navigation guidance commands are generated from seeker tracking rates and used to control the missile's flight path.

Sea Chaparral is only in service with the RoCN.

Specifications

Length: 2.91 m (9.5 ft)
Diameter: 12.7 cm (5 in)
Wing span: 63 cm (25 in)
Weight: 86.2 kg (190 lb)
Speed: Mach 1.2
Range: 4.75 n miles (9 km)
Guidance: Optical aiming, infra-red homing
Warhead: Picatinny Arsenal M-250 12.6 kg (27.7 lb) HE blast-fragmentation
Motor: Hercules/Atlantic Research Corporation M-121 single-stage, solid propellant rocket motor.



Sea Chaparral launcher. The RoCN continues to be the only user of this system which combines Sidewinder missiles with a launcher/operator unit

Manufacturer/Contractor
Loral, Aeronutronic.

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited at the forward end of the flight deck, in the open.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)

Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Compact

There is a single OTOBREDA 76 mm (3 in)/62 calibre Compact mounting in 'A' position.

Specifications

Elevation: −15 to +85°
Training speed: 70°/s
Elevation speed: 40°/s
Weight (unloaded): 12 t
Muzzle velocity: 900 m/s (2,952 ft/s)
Rate of fire: 85 rds/min
Range: 8.5 n miles (15.75 km)
Weight of shell: 6 kg (13.2 lb)

Hughes Mk 15 CIWS Phalanx

There is one Hughes Mk 15 Phalanx close in weapons system (CIWS) sited at the after end of the hangar roof. The mount consists of a 20 mm M61A1 Vulcan, six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n miles (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min (Block 0, Block 1 Baseline 0), 4,500 rds/min (Block 1 Baseline 1)
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA (System).

Bofors 40 mm/70

There are two single Bofors 40 mm in enclosed mountings on small platform decks at the after end of the hangar. These appear to be the same mounts as in the 'Cheng Kung' class frigates.

Specifications

Traverse: 360° (nominal) at 90°/s
Elevation: −3 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Chang Feng IV (AN/SLQ-32(V)5) ESM/ ECM suite

An order was placed with the Hughes Company to deliver eight AN/SLQ-32(V)5 systems to the US Navy and one to Taiwan, an order which was eventually taken over and completed by Raytheon. AN/SLQ-35(V)5 is now produced in Taiwan as the Chang Feng IV system.

The ESM component gives radar warning on B- to J-bands, while the additional 'Sidekick' ECM element provides active onboard countermeasures, employing a high-gain, multibeam antenna system and with full ECM techniques repertoire for both ship defence and counter-targeting roles. Sidekick can counter simultaneous threats from any azimuth angle.

Manufacturer/Contractor

Raytheon Company, Electromagnetic Systems Division, Goleta, California, USA.

DECOYS

DAGAIE CS Mk 2 countermeasures system

There are two DAGAIE CS Mk 2 launchers mounted on the upper deck immediately below the foremast. These can be loaded with either IR or chaff rockets, and the firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, windspeed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate between them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises: (a) two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either 3-5 and 8-14 μm IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/ dissimulation modes. The electromagnetic decoys are normally based upon aluminised glass fibre chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 μm bands.

Specifications

Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)
Container weight: 54 kg (119 lb)

Manufacturer/Contractor

CSEE Défense, Paris, France.

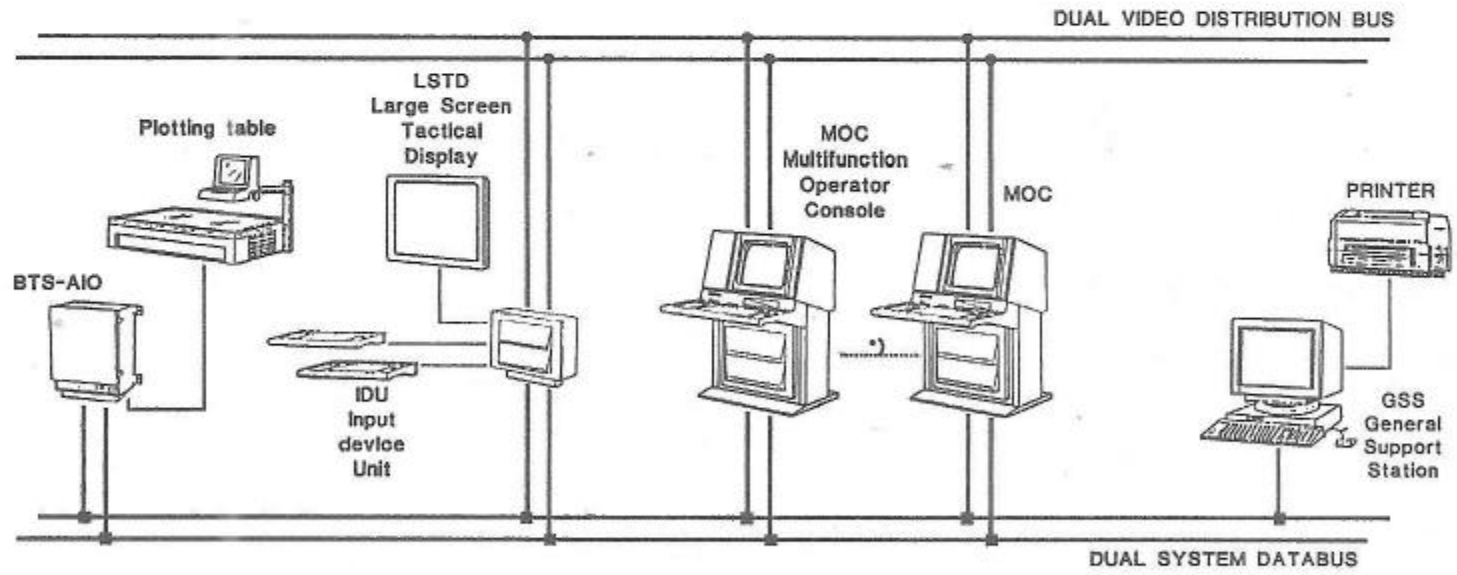
COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

TACTICOS combat management system

TACTICOS (TACTical Information and COmmand System) results from merging the best elements of Signaal's STACOS and Thomson's TAVITAC 2000. TACTICOS comprises command and control, command support and fire-control facilities on behalf of anti-air warfare, surface warfare, anti-submarine warfare, electronic warfare as well as naval gunfire support. It allows the command team to assess and monitor the tactical situation, to plan and co-ordinate naval operations and to control the sensor and weapon systems. Tasks include:

- Short- and long-term planning of maritime operations
- Control of online surveillance sensors, datalinks and communication equipment
- Presentation of raw or digitised sensor information
- Compilation and presentation of the tactical situation in the air, surface and subsurface environments, including the EW situation
- Decision support for the command team
- Automatic threat evaluation and threat ranking
- Automatic target designation to weapon systems and tracking/illumination sensors
- Assistance in operations, including navigation and the direction of aircraft and other assets under control
- Scenario and simulation facilities for wargaming, planning and training

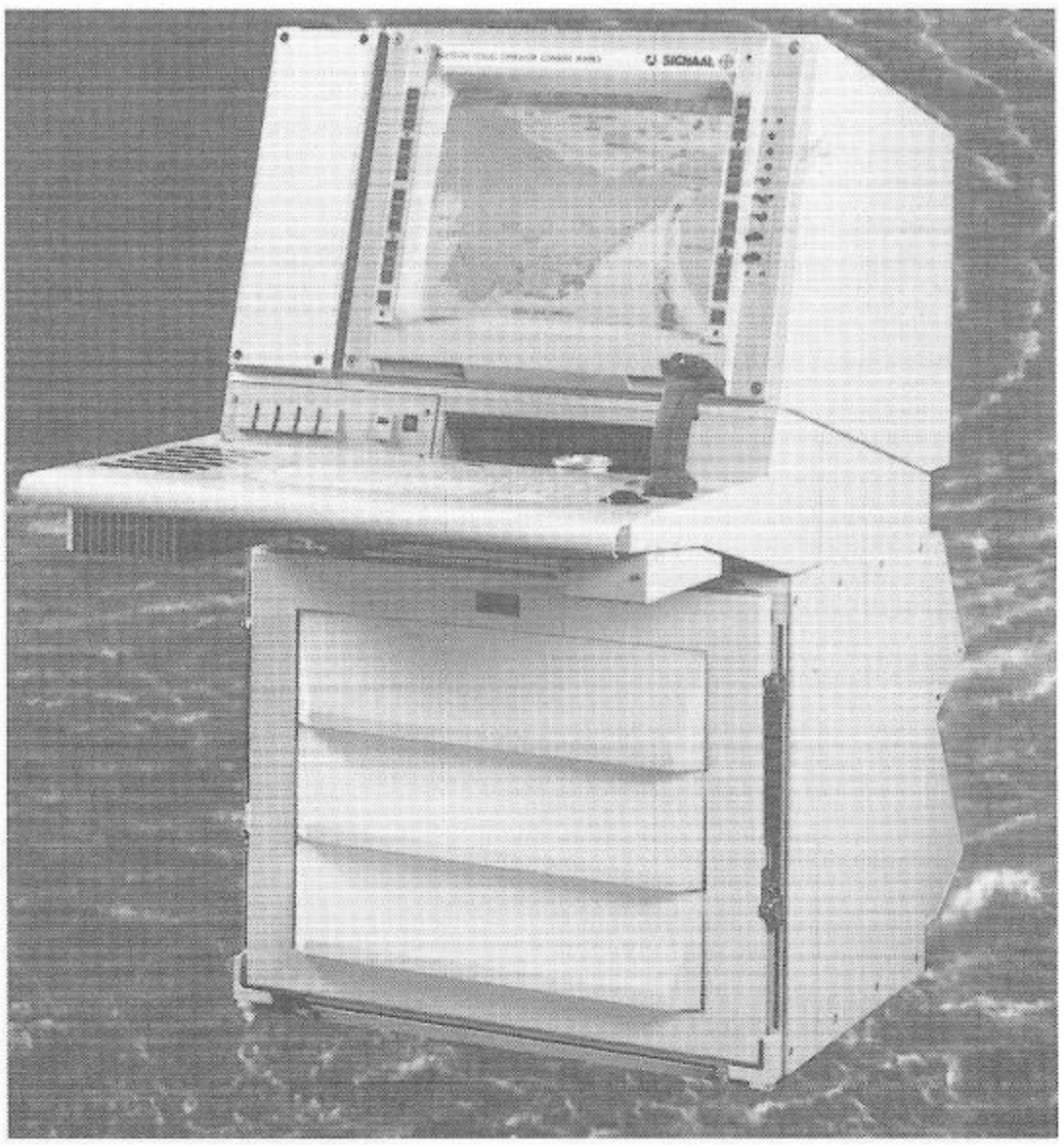


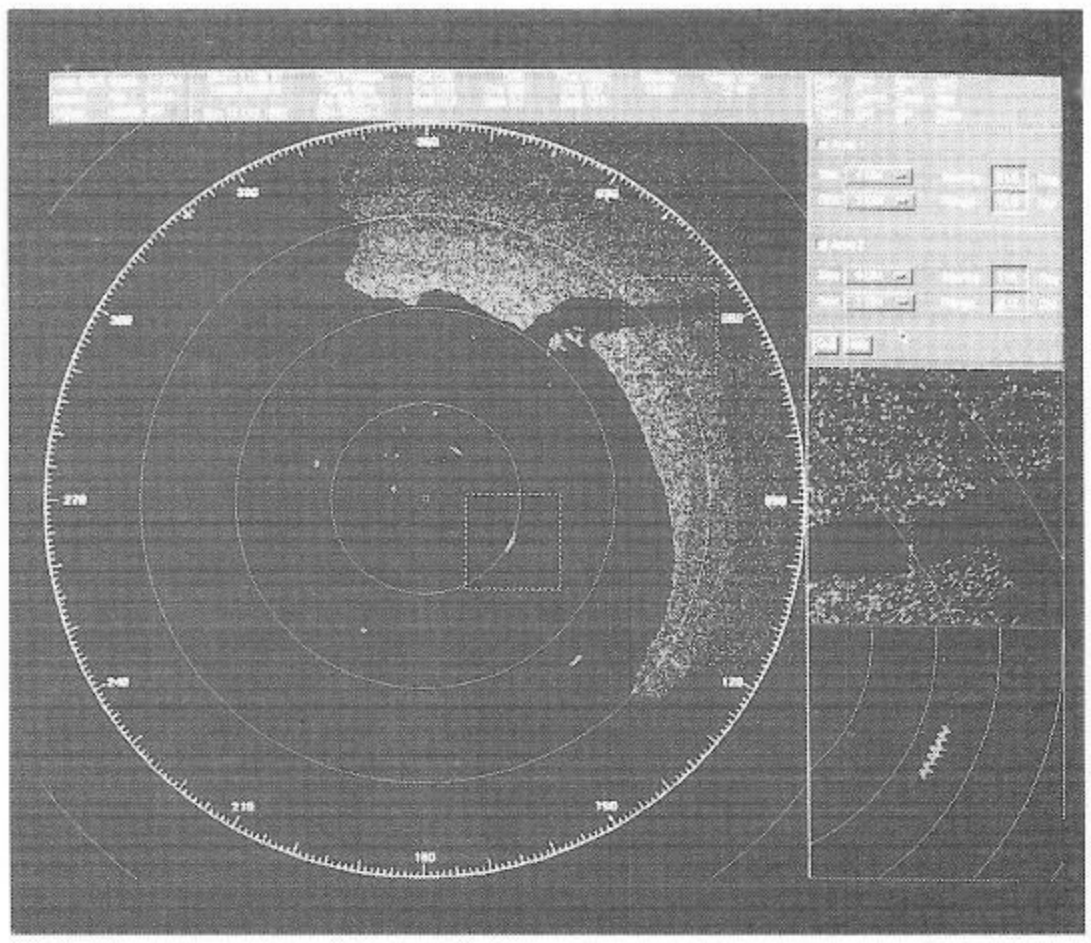
The TACTICOS system

TACTICOS employs a distributed computer architecture, applying a multinode, multiprocessor concept in a battle damage-resistant configuration. The nodes are hosted in the Multifunction Operator Consoles (MOCs) and Bus Terminal Servers (BTSs) and contain two to seven state-of-the-art SPARC processor boards. The package is known as SigMA3-S (Signaal's Modular Architecture, release 3 with SPLICE). The software is written in the Ada language and includes the SPLICE distributed database and data communication software that operates alongside a real-time version of UNIX. The hardware is linked through a dual Ethernet (IEEE 802.3) standard local area network, which may be extended to a quadruple network or which can be replaced by a redundant FDDI network. A redundant video distribution bus collects the radar, TV and/ or IR videos and distributes these to the various operator consoles, where a selection can be made from the available videos for presentation on the console.

Some subsystems can be linked directly to the local area network and video bus, and those that cannot do so use the BTS to interface with the local area network and the video bus. The BTS contains spare interface card positions that will allow NTDS, MIL-STD-1553B, RS-432 or any other subsystem interface, to link into TACTICOS.

Other hardware includes an online plotting table for automatic and manual plotting on various types of charts and a General Support Station (GSS). The latter is a standard commercial workstation with a 16 in colour raster scan display and a laser printer and is used for system monitoring, database support and training.





At the heart of the TACTICOS system to be used by the RoCN is the Multifunction Operator Console (MOC) (above left). A typical presentation (above right) shows filled map data in the background, a TV picture and a series of dialogue windows (Signaal)

Manufacturers/Contractors

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Thomson-CSF, Division Systèmes Défense et Controle, Bagneux, France.

WEAPONS CONTROL

CSEE Najir Mk 2 electro-optic director

Najir (designated DMAc by the French Navy) is an autonomous, deck-mounted director for use in air defence operations to complement the radar fire-control system. It has similar functions to Panda/Naja but the manned element supplements the Ericsson Nd:YAG laser rangefinder with an SAT Murène thermal imager operating in the 8-11 µm range. The latest production Najir features Radamec television cameras and consideration is being given to an eye-safe laser rangefinder. The manned element has, in addition to three sensors, a servo cabinet, a ballistic unit based upon two Motorola 68000 microprocessors and a power supply box.

Specifications

Najir
Height: 1.35 m (4.4 ft)
Width: 1.5 m {4.9 ft)
Weight: 560 kg (1,235 lb)
Max velocity
traverse: 90°/s
elevation: 60°/s

Manufacturer/Contractor

CSEE Défense, Paris, France

RADARS

Type	Jupiter (DRBV 26D) (Note 1)	Triton G (DRBV-51)	Castor IIC (DRBC-33) (two)
Manufacturer/ contractor	Thomson-CSF, France	Thomson-CSF, France	Thomson-CSF, France
Role	Air/surface search; target designation	Surface search	Fire control (Crotale NC2)
Band	E/F	I	J
Beam	2.5 × 8.3 csc² to 50°	2.1 × 22°	2.45 × 2.3°
Peak Power	2 MW	8 kW	30 kW
Gain	29 dB	27 dB	36 dB
Pulsewidth	2.5 µs	6.5/12 µs	0.5 µs
PRF	450 pps		4,000-8,000 pps
Scan rate	7.5/15 rpm	40 rpm	—
Typical range		Air: 2 m² target 16 n miles (30 km) distance, 6,000 m altitude Surface: 10 m² target at 24.25 n miles (45 km)	8 n miles (15 km) for 1 m² target

Note: (1) Uses Signaal LW-08 antenna

SONARS

BAe/Thomson Sintra ATAS (V)2 active towed array

ATAS comprises a high-power, low-frequency transmitter, operating in three frequencies around the 3 kHz band, which can be deployed at up to 900 m (2,953 ft) behind the towing platform, together with an in-line receiver array towed a further 300 m (984 ft) behind the transmitter, all of which may be towed at depths suited to prevailing oceanographic conditions. The port/starboard ambiguity normally associated with a towed array is automatically and instantaneously resolved within the system without the need for ship manoeuvre. ATAS can be operated at depths of 235 m (771 ft). The transmitter has a high-power acoustic sound source consisting of a vertical stave of 10 in low-frequency flextensional transducers. Transmissions in CW or FM are omnidirectional in the horizontal plane with a vertical beamwidth of 25°. The receiver array is a 30 m (98 ft) long flexible tube housing a line of hydrophones and associated electronics to condition and digitise hydrophone signals. The receiver gives full azimuth cover and in the broadside direction a bearing resolution of up to 0.5°. The receiver uses 96 preformed beams with bearing stabilisation. The processing equipment uses current technology to provide high processing capability within a single compact unit.

Manufacturers/Contractors

BAeSEMA Marine Division, Bristol, UK.

Thomson Sintra Activités Sous-Marines, Sophia Antipolis Cedex, France.

TSM 2633 (Spherion) hull-mounted sonar

TSM 2633 is the hull-mounted version of the Spherion VDS and is a long-range active sonar for ASW surface combatants. It comprises a spherical hull-mounted array with an electronic processing system that allows for real-time computation in transmission and reception modes; three-dimensional stabilisation to compensate for pitch, roll and yaw in the parent vessel; and a beam-tilting capability to counter adverse sound velocity profiles and strong reverberation.

Specifications

Acoustic array: Spherical with 160 individual transducers
Frequency: 7 kHz (approx)
Transmitter: Omnidirectional and sectoral transmissions in CW and FM modes, various modes including TRDT
Receiver: 36 preformed beams stabilised in azimuth and elevation; advanced processing with replica correlator in FM and spectrum analysis (FFT) in CW
Video processing: Data processing in FM and CW modes: automatic detection and tracking; simultaneous multitrack extraction (up to 64); target analysis (apparent length, Doppler measurement).
Display: High-resolution, flicker-free colour TV monitors
Total weight: 4,000 kg (8,818 lb)

Manufacturer/Contractor

Thomson Sintra Activités Sous-Marines, Sophia Antipolis Cedex, France.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 31.5 × 15.4 m (103 × 50 ft)

HELICOPTERS

One Sikorsky S-70C(M)1

Specifications

Dimensions

Main rotor diameter: 16.36 m (53.66 ft)

Tail rotor diameter: 3.35 m (11.00 ft)

Length overall

fuselage: 15.26 m (50.0 ft)

rotors turning: 19.76 m (64.83 ft)

Height to top of rotor head: 3.79 m (12.43 ft)

Weights:

empty: 6,191 kg (13,648 lb)

mission gross weight: 9,182 kg (20,244 lb)

Performance:

cruising speed at sea level: 147 kts (272 km/h)

dash speed at 1,525 m (5,000 ft): 126 kts (234 km/h)

vertical rate of climb at sea level: 213 m (700 ft)/min

Power plant: 2 General Electric T700-GE-401C turboshafts rated at 1,417 kW (1,900 shp)

Accommodation: 3 (pilot, airborne tactical officer/back-up pilot, sensor operator)

Communications: Collins AN/ARC-159(V)2 UHF, Collins AN/ARC-174(V)2 HF, Hazeltine AN/APX-76A(V) and Bendix/King AN/APX-100(V)1 IFF transponders, TSEC/KG-45(E-1) communications security set, TSEC/KY-75 voice security set, Telephonics OK-374/ASC communications system control group.

Radar: Telephonics AN/APS-128PC

Flight: Collins AN/ARN-118(V) Tacan, Teledyne Ryan AN/APN-127 Doppler, Collins AN/ARA-50 UHF DF, Honeywell AN/APN-194(V) radar altimeter.

Mission: Sikorsky sonobuoy launcher, Edmac AN/ARR-75 and R-1651/ARA sonobuoy receiving sets; Control Data AN/AYK-14 (XN-1A) digital computer, Sierra Research AN/ARQ-44 datalink and telemetry; Bendix AN/AQS-18(V) dipping sonar; Bendix AN/AQS-18(V) dipping sonar and Litton AN/ALR-606(V)-2 ESM integrated with radar antenna

Armament: 2 Mk 46 torpedoes

PROPULSION

Specifications

System: Combined diesel and diesel (CODAD)

Main machinery: 4 SEMT-Pielstick 12 PA6 V 280 STC diesels; 17.00 MW (23,228 hp(m))

Shafts: 2

FURTHER INFORMATION

PROGRAMME

The sale of up to 16 of the 'La Fayette' class was authorised by the French Government in August 1991. These ships are generally similar to the French prototypes, but with a number of differences arising in part from different requirements, but also because of the limitations placed on weapons supplied to Taiwan. The role of the ships is also different, with the 'Kang Ding' class having a major ASW function, for which it is fitted with sonar and ASW torpedo tubes, and carrying an ASW helicopter.

The contract for the first six was signed with Thomson-CSF in early 1992, with the ships being constructed in France, but with some weapon assembly by the China Shipbuilding Corporation at Kaohsiung in Taiwan. The first of class arrived in Taiwan in March 1996 and the last is due to arrive in July 1998. A second batch of 10 is due to be built by the China Shipbuilding Corporation, although recent reports suggest that 1,500 tonne corvettes are being considered as a cheaper alternative.

NAMES

The five names so far announced are those of cities in mainland China, all provincial capitals:

Kang Ding (1202), Hsikiang province
Si Ning (1203), Qinghai province
Kun Ming (1205), Yunnan province
Di Hua (1206), Sinkiang province
Wu Chang (1207), Hupeh province

It should be noted that the number 4 or numbers whose digits add up to 4 are never allocated by the RoCN as they are deemed to be unlucky.

DESIGN

While these are basically the same design as the French 'La Fayette' class there are considerable external differences, and there may be even more differences internally.

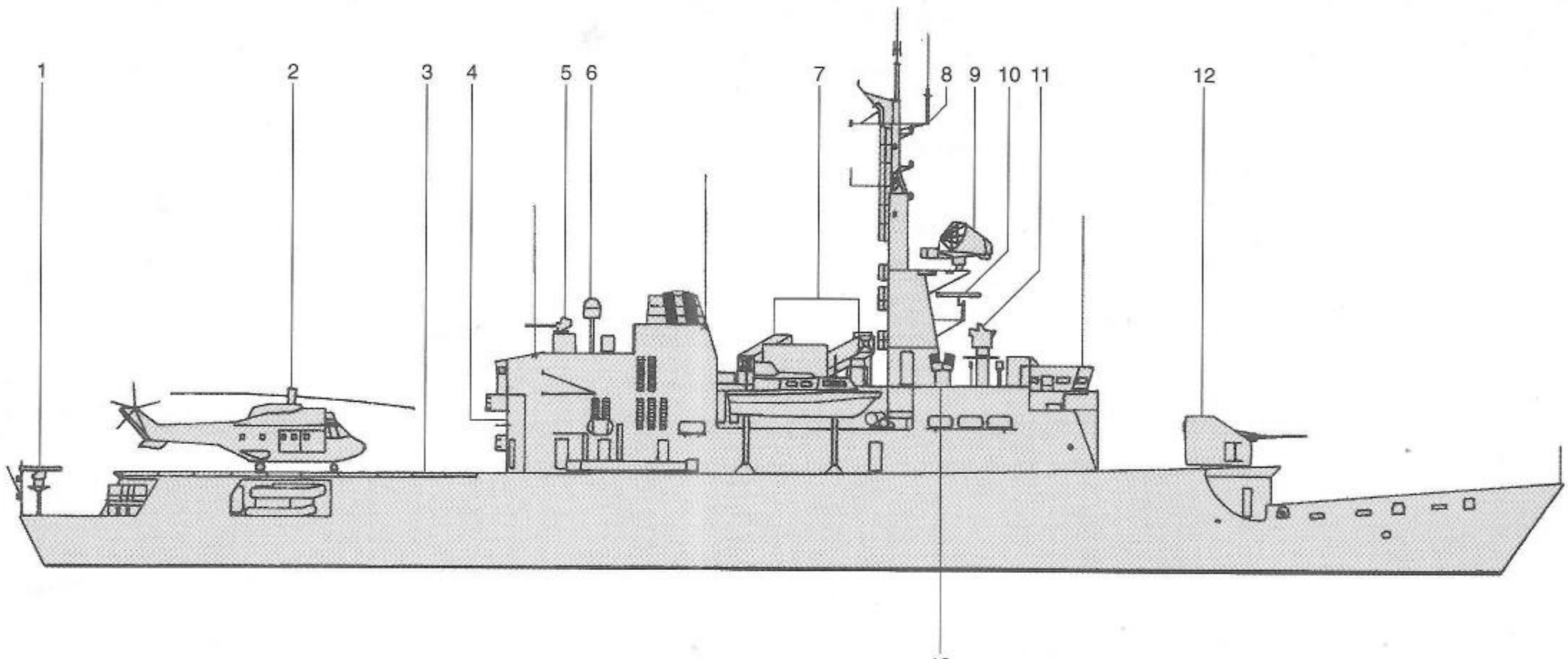
The macks are quite different, those on the Taiwanese ship being lower and more substantial, with the forward mack carrying the main search radar (DRBV 26D) array.

In terms of armament, the Taiwanese ships have an OTOBREDA 76 mm gun instead of the French 100 mm and its only air defence weapon is the short-range Sea Chaparral, while the indigenous Hsiung Feng II anti-ship missile replaces the Exocet carried in the French ships. The Taiwanese ship also mounts a Mk 15 CIWS, giving it a capability lacking in the French ships.

The superstructure immediately behind the bridge is higher in the Taiwanese ship and midships there are four square apertures immediately abaft the opening for the ship's boats. It appears, however, that the Hsiung Feng missiles are fired across the ship and these apertures (which are immediately below the missile launch tubes) may well be exhaust channels for the rocket motors. The after end of the superstructure is also different, with a large recess on either side of the hangar. Each recess has two levels, with the lower one destined to take the Bofors 40 mm mount; what is to be mounted in the upper level is not yet clear.

Aft, the Taiwanese ships do not have the RAST helicopter flight deck handling gear. Nor is there a stern hatch to launch commandos and presumably the internal space is used for other purposes, one of which will be housing the ATAS towed sonar array.

FLORÉAL



Foréal (Ian Sturton)
1 *Racal-Decca DRBN 34A radar (helicopter control)* **2** *AS 322F Super Puma helicopter* **3** *Flight deck* **4** *Hangar* **5** *Giat F2 20 mm cannon* **6** *Syracuse 2 Satcom* **7** *Aerospatiale MM 38 Exocet (two)* **8** *Thomson-CSF ARBR 17 ESM* **9** *Thomson-CSF DRBV 21A air/surface search radar* **10** *Racal-Decca DRBN 34A navigation radar* **11** *CSEE Najir electro-optic director* **12** *DCN 100 mm (3.9 in)/55 model 68 CADAM gun* **13** *CSEE Dagaie Mk II chaff and IR launcher*

GENERAL SPECIFICATIONS

Operator: France

Class: FLOREAL (FFG)

Built: 6
Active: 6

Displacement:
standard: 2,600 t
full load: 2,950 t

Dimensions
Length: 93.5 m (306.8 ft)
Beam: 14 m (45.9 ft)
Draught: 4.3 m (14.1 ft)

Speed: 20 kts
Range: 10,000 n miles at 15 kts

Endurance: 50 days
Complement: 86 (10 officers) (including air crew) plus 24 marines plus 13 spare

SHIPS

FLORÉAL (F 730)
Builder Chantiers de l'Atlantique, St Nazaire, France
Laid down 2 Apr 1990
Launched 6 Oct 1990
Commissioned 27 May 1992

PRAIRIAL (F 731)
Builder Chantiers de l'Atlantique, St Nazaire, France
Laid down 11 Sep 1990
Launched 23 Mar 1991
Commissioned 20 May 1992

NIVOSE (F 732)
Builder Chantiers de l'Atlantique, St Nazaire, France
Laid down 16 Jan 1991
Launched 10 Aug 1991
Commissioned 16 Oct 1992

VENTOSE (F 733)
Builder Chantiers de l'Atlantique, St Nazaire, France
Laid down 28 Jun 1991
Launched 14 Mar 1992
Commissioned 5 May 1993

VENDEMIAIRE (F 734)
Builder Chantiers de l'Atlantique, St Nazaire, France
Laid down 17 Jan 1992
Launched 29 Aug 1992
Commissioned 20 Oct 1993

Germinal *(F 735). This class of six has been built to commercial standards and to a very straightforward design to produce surveillance/patrol ships and to provide 'pressure' in distant waters* (French Navy)

GERMINAL (F 735)
Builder Chantiers de l'Atlantique, St Nazaire, France
Laid down 17 Aug 1992
Launched 13 Mar 1993
Commissioned 17 May 1994

Nivose *(F 732)*

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 38 medium-range anti-ship missile

These ships mount two Aerospatiale MM 38 Exocets immediately abaft the mast in two individual ITS *(Installation de Tir Standard)* launcher-containers, within which they are suspended from a launch rail in the ceiling. These launcher-containers point outwards and are inclined at an angle of 12° to the horizontal. Targets are acquired by the ship's DRBV-21A radar and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence. This involves turning on the thermal battery, releasing the mechanical safety locks, igniting the booster, and, finally, breaking the umbilical cord; the total process takes some 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change of course during its flight.

The attack consists of three phases: cruise, approach and terminal. A salvo may be fired in 12-20 seconds. An additional two missiles can be carried, if necessary.

Specifications

MM 38
Length: 5.21 m (17.1 ft)
Diameter: 35 cm (13.78 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s
Booster: 100 kg (220 lb), SNPE Epervier boost motor, burn time of 2.4 s
Warhead: Luchaire 165 kg (364 lb) fragmentation warhead
Fuzes: Delayed impact fuze and autopilot-controlled proximity fuze

Manufacturer/Contractor

Aerospatiale Tactical Missiles, Chatillon Cedex, France.

GUNS

100 mm/55 Modèle 1968 CADAM

There is one single 100 mm/55 Modèle 1968-II CADAM dual-purpose mounting located on the foredeck. This is normally operated in the fully automatic remote mode with an unmanned turret, although there is a fallback manual mode, which requires two men in the turret. The turrets have been taken from an old ship and upgraded to CADAM (CADence AMéliorée) standard with improved recoil and feed systems, raising the firing rate from 60 rds/min to 78 rds/min.

Specifications

Calibre: 100 mm
Length of barrel: 55 calibres
Muzzle velocity: 870 m/s (2,854 ft/s)
Traverse: 360° at 40°/s
Elevation: −15 to +80° at 25°/s
Crew: 2 (optional) and 2 loaders
Range:
anti-surface: 9.15 n miles (17 km)
anti-air: 8,000 m (26,000 ft)
Rate of fire: 78 rds/min
Ammunition: 13.5 kg (29.8 lb) (multipurpose projectile); 9.7 kg (21.4 lb) (charge)

Manufacturers/Contractors

Direction des Constructions Navales (DCN) (prime).
Mécanique Creusot-Loire, Marine Products (mountings).
DCN Ruelle (gun).
CSEE Défense (servo equipment).

Giat 20 mm F2 Type A M 693 multipurpose cannon

There are two manually operated 20 mm cannon mounted in the two after corners of the hangar roof. It is intended that these will be replaced by SIMBAD in due course.

Specifications

Calibre: 20 mm
Length of barrel: 90 calibres
Rate of fire: 720 rds/min
Muzzle velocity: 1,050-1,250 m/s (3,445-4,100 ft/s)
Traverse: 325°
Elevation: −15 to +80°
Weight of shell: 0.25 kg (0.55 lb)
Crew: 2
Range: 3.5-5.5 n miles (6.75-10 km)

Manufacturer/Contractor

Giat, France.

Germinal *(F 735) with a French Army Super Puma helicopter embarked. Note the two 20 mm guns on the hangar roof and the DRBN 34A helicopter control radar on the quarterdeck*

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Thomson-CSF ARBR-17

The Thomson-CSF ARBR-17 ESM suite is a high-performance radar detection, analysis and threat warning system, covering conventional radar threat frequencies (such as, C- to J-bands). The system analyses the measured radar parameters and uses these characteristics to determine other parameters such as the radar's type and identity. There are two antenna assemblies, the first being an omnidirectional system installed on the ship's mainmast which provides initial detection and threat frequency, and carries out primary analysis. Below this are two eight-port directional antennas which provide more accurate bearing and frequency information. The antenna assemblies contain preamplifiers for improved performance.

Manufacturer/Contractor

Thomson-CSF, Sophia Antipolis, France.

DECOYS

DAGAIE countermeasures system

There are two DAGAIE launchers located either side of the mast. These can be loaded with either IR or chaff rockets. The firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, windspeed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises: (a) two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either 3-5 and 8-14 µm IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised glass fibre chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 µm bands.

Specifications

Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)
Container weight: 54 kg (119 lb)

Manufacturer/Contractor

CSEE Défense, Paris, France.

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

Syracuse 2 Satcom.

WEAPONS CONTROL

NAJIR (DMAc) electro-optic director

Najir (French Navy designation: DMAc) entered service in July 1988 and is an autonomous deck-mounted electro-optic director, which is used in this class in air defence operations. Najir has similar functions to the earlier Panda/Naja but the Ericsson Nd:YAG laser rangefinder is supplemented by an SAR Muréne thermal imager operating in the 8-11 µm range. The latest production Najir also features Radamec television cameras.

Specifications

Height: 1.35 m (4.43 ft)
Width: 1.5 m (4.9 ft)
Weight: 560 kg (1,235 lb)
Elevation: −20 to +70°
Max velocity
traverse: 90°/s
elevation: 60°/s

Manufacturer/Contractor

CSEE Défense, Paris, France.

RADARS

DRBV 21A (Mars) air and surface surveillance radar

DRBV 21A is a D-band radar intended for ocean-capable patrol vessels and operates with a simplified transmitter assembled with the receiver in a single electronics cabinet. The antenna weighs approximately 600 kg (1,323 lb), has a gain of 26 dB and rotates at 12 rpm. Instrumented ranges are 52 n miles (110 km) for the air channel and 43 n miles (80 km) for the optional surface channel. The radar cabinet is fitted for extraction/tracking unit for automated surveillance. The transmitter is solid state with frequency agility,

The operations centre aboard Germinal *(F 735) is spartan by warship standards, but is tailored to the surveillance frigate's needs* (French Navy)

burst-to-burst with Doppler processing, or pulse-to-pulse.

Manufacturer/Contractor
Thomson-CSF, Systèmes Navals de Combat, Bagneux, France.

Decca 1226
There are two Racal-Decca 1226 radars. One is used for navigation, the other for helicopter control. In the French Navy their designation is DRBN 34A.

Specifications
Role: Surface search
Band: I
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1 µs
Scan rate: 28 rpm

Manufacturer/Contractor
Racal-Decca.

SONAR

No sonar is fitted in these ships.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 23 × 14 m (76 × 46 ft)

HELICOPTER

The ships normally deploy with a Panther, although Alouette IIIs are sometimes also used. The hangar and flight deck are, however, large enough to accommodate an AS 332F Super Puma, when required to do so. They are capable of operating helicopters up to Sea State 5.

Eurocopter AS 365MA Panther
One Eurocopter AS 365MA Panther light liaison, search-and-rescue helicopter

Specifications
Rotor diameter: 13.29 m (43.6 ft)
Fuselage length: 11.41 m (37.43 ft)
Height to rotor head: 4.0 m (13.12 ft)
Weights
empty: 2,262 kg (4,987 lb)
take-off: 4,250 kg (9,370 lb)
Performance
max speed (never exceed): 160 kts (296 km/h)
cruising speed (sea level): 148 kts (274 km/h)
rate of climb (sea level): 420 m (1,380 ft)/min
hovering ceiling (in ground effect): 2,600 m (8,530 ft)
Engines: 2 Turbomeca Ariel 1M1 turboshafts; take-off — 558 kW (749 shp), continuous — 487 kW (653 shp).
Accommodation: 2-man crew; cabin can hold 10 passengers.

Pilot's view of the very large flight deck aboard Floreal *(F 730)* (Chantiers de l'Atlantique)

PROPULSION

Specifications
System: Combined diesel and diesel (CODAD)
Main machinery: 4 SEMT-Pielstick 6 PA6 L 280 diesels; 6.5 MW (8,820 hp(m)) sustained

Shafts: 2
Propellers: cp
Bow thruster: 250 kW (340 hp(m))
Ship's services: 3—590 kw diesel generator sets

FURTHER INFORMATION

PROGRAMME

These are unique ships, which were built to operate in the offshore zone in low-intensity operations. They are officially described as *'Frégates de Surveillance'* or ocean-capable patrol vessel.

The first two were ordered on 20 January 1989, followed by the second pair on 9 January 1990 and the third pair in January 1991. All have been built at Chantiers de l'Atlantique at St Nazaire, with the weapons systems being fitted by DCAN Lorient.

NAMES

The ships are named after six of the months of the new calendar introduced during the French Revolution.

DESIGN

The ships have been designed for patrol duties in distant waters. The hull, accommodation and most facilities are built to merchant passenger marine standards, and all four engines, for example, are grouped together in one large engine room to reduce watchkeeping and maintenance requirements. Damage control, however, together with magazines and helicopter facilities are to full Service standards.

The ships are fitted with two screws and a bow thruster, making them extremely manoeuvrable, an essential requirement in overseas areas, where normal harbour facilities will not always be available. They have stabilisers and are air conditioned throughout. The range proved, during sea trials, to be even better than planned.

Aviation facilities are excellent for the size of ship. The hull is wider that usual for its length to enable a large flight deck to be fitted and a new stack design has been developed to improve the airflow over the flight deck. Thus, although the helicopter normally embarked will be a Dauphin or Alouette, 9 to 10 tonne helicopters (such as, Puma/Cougar) can also be operated, which will be of particular importance when operations involving troop landings are being undertaken.

Medical facilities are good, with a small hospital and, included in the design, is a freight bunker aft, which will take about 100 tonnes of cargo.

MODERNISATION

It is planned to replace the manually operated 20 mm guns with two Matra Simbad twin launchers in due course.

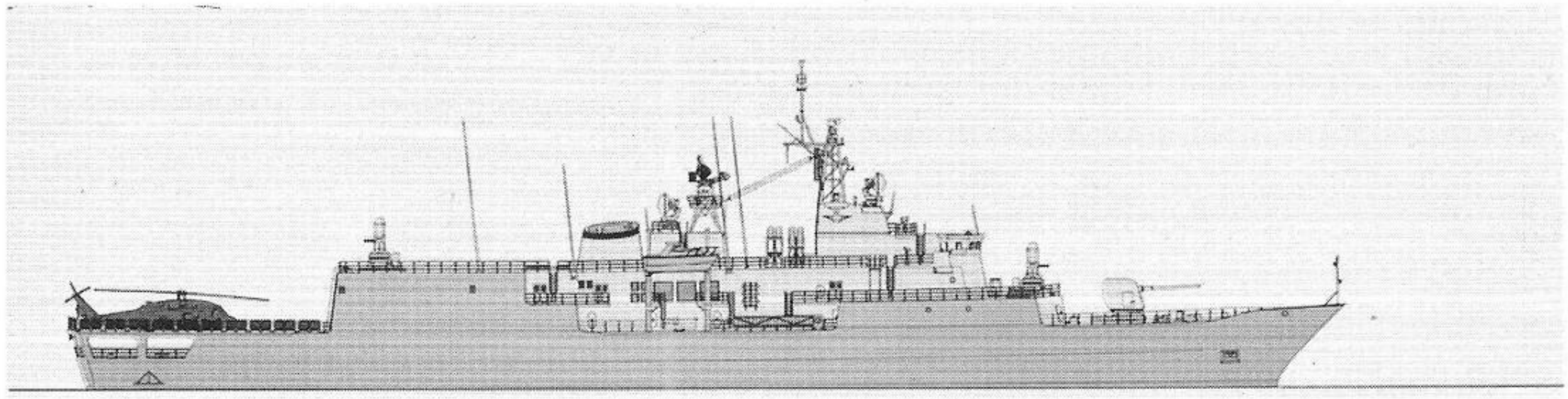
DEPLOYMENT

Normal deployment of the ships is:
Floréal — South Indian Ocean
Ventose — Antilles
Germinal — tender to training ship Jeanne d'Arc
Prairial, Vendemiaire — Tahiti
Nivose — Nournea

Prairial *(F 731)*

MEKO

OVERVIEW



Typical of the MEKO ships built to date is the MEKO 200 PN, built for the Portuguese Navy (Blohm + Voss)

The MEKO* series of destroyers and large frigates designed by Blohm + Voss has proved to be very successful, with 30 ships so far ordered. The MEKO design was produced to meet a number of requirements, but the essential elements are that it is based on the Functional Unit System or FES. This enables customers to place orders for weapons, sensors, command and control equipment and other electronics to meet their individual requirements, whilst taking full advantage of a common hull and avoiding a large proportion of the usual development costs involved in a new class of ship.

*MEKO = *Merhzwecks Kombination* (Multirole Combination)

Hulls

The hulls are to a common overall design, although the length can vary: the two MEKO 360s are both 119 m (390 ft) long (waterline), while of the six MEKO 200s, five are 109 m (357.6 ft) long but one (the Turkish MEKO 200 Track I) is only 102 m (334.6 ft) long. Hulls and superstructures are all constructed of high-tensile steel, there is no aluminium, and fin stabilisers are standard.

The hull design incorporates the results of considerable analysis and trialling, combining good seakeeping, range and speed, with reduced radar, infra-red and optical signatures. Radar signature reduction measures include slanting the hull shape above the waterline and sloping the external superstructure. The hangar door and the bridge screen are also sloped, while possible corner reflectors have been identified and eliminated and a low-median point for the radar cross-section (RCS) has been achieved.

Measures to reduce the infra-red signature include insulating radiating elements such as the CIC, together with careful design and routeing of ventilation ducts and their exits to the atmosphere. Attention has also been paid to the stacks, especially with regard to their position relative to antennas. Current work is being carried out on cooling the ship's structure using a seawater spraying system, and on inhibiting soot particles in the exhaust plume to see whether either can be used to reduce the IR signature yet further.

Reduction of the optical signature is mainly achieved by minimising the topside.

Functional units

Weapons and electronic systems are installed in the form of Functional Units, known as FES from the initials of their German designation, which are mounted either in a container, a pallet or a framework. Allied to this, there are standardised installation and removal routes throughout the ship, which ease construction, and make it much easier to remove units for repair/overhaul, or to replace them with new equipment during refits.

One of several advantages of this system is that construction of the hull and of the weapons systems are decoupled from each other, so that they can be built concurrently, with a major saving in overall construction time. In addition to this, the functional units can be built by subcontractors at sites remote from the shipyard and fully tested ashore, prior to installation in the ship.

Some functional units such as guns are hard mounted to the ship platform, using standard mechanical interfaces. The unit is placed in position, levelled using hydraulic jacks, bedded down using a quick-setting epoxy resin and then bolted down using bolts of a standard size positioned at standard intervals. For units requiring shock absorption, the shockmounts are installed at the interface between the platform and the functional unit, thus enabling all equipment within the unit to be hard mounted, which is not only more efficient, but also saves in complexity and the expense of shockmounting every individual item of equipment. The most time-consuming function in these procedures is the setting of the resin during installation and undoing the bolts in removing a unit.

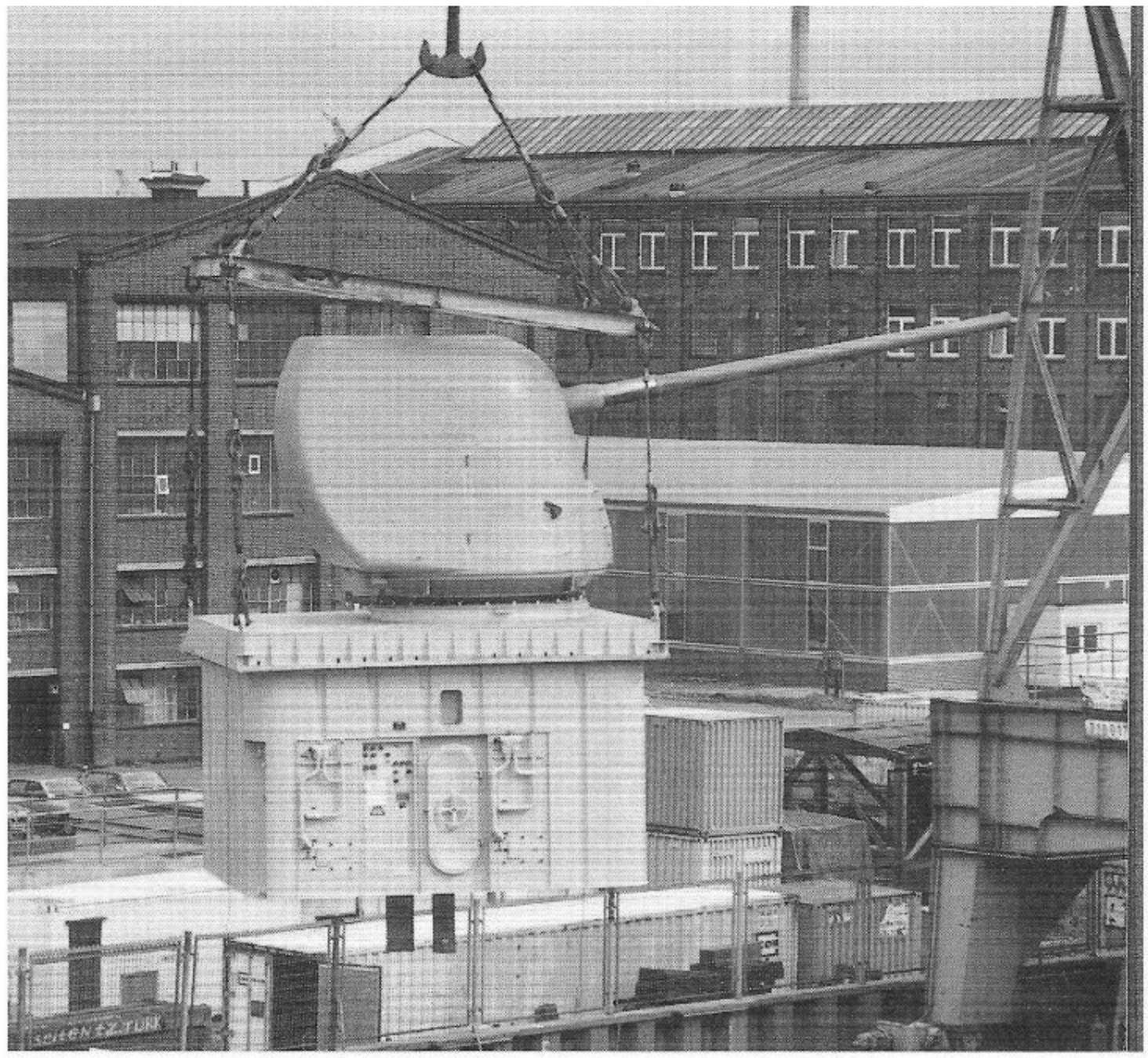
The interfaces between Functional Units and ship's services have also been standardised. Every functional unit has its own air conditioning unit and a switchboard/connecting panel, and there are standard connectors in standard locations for data, electric power, ventilation, cooling water, and so on.

Weapon Functional Units come in four standard sizes:

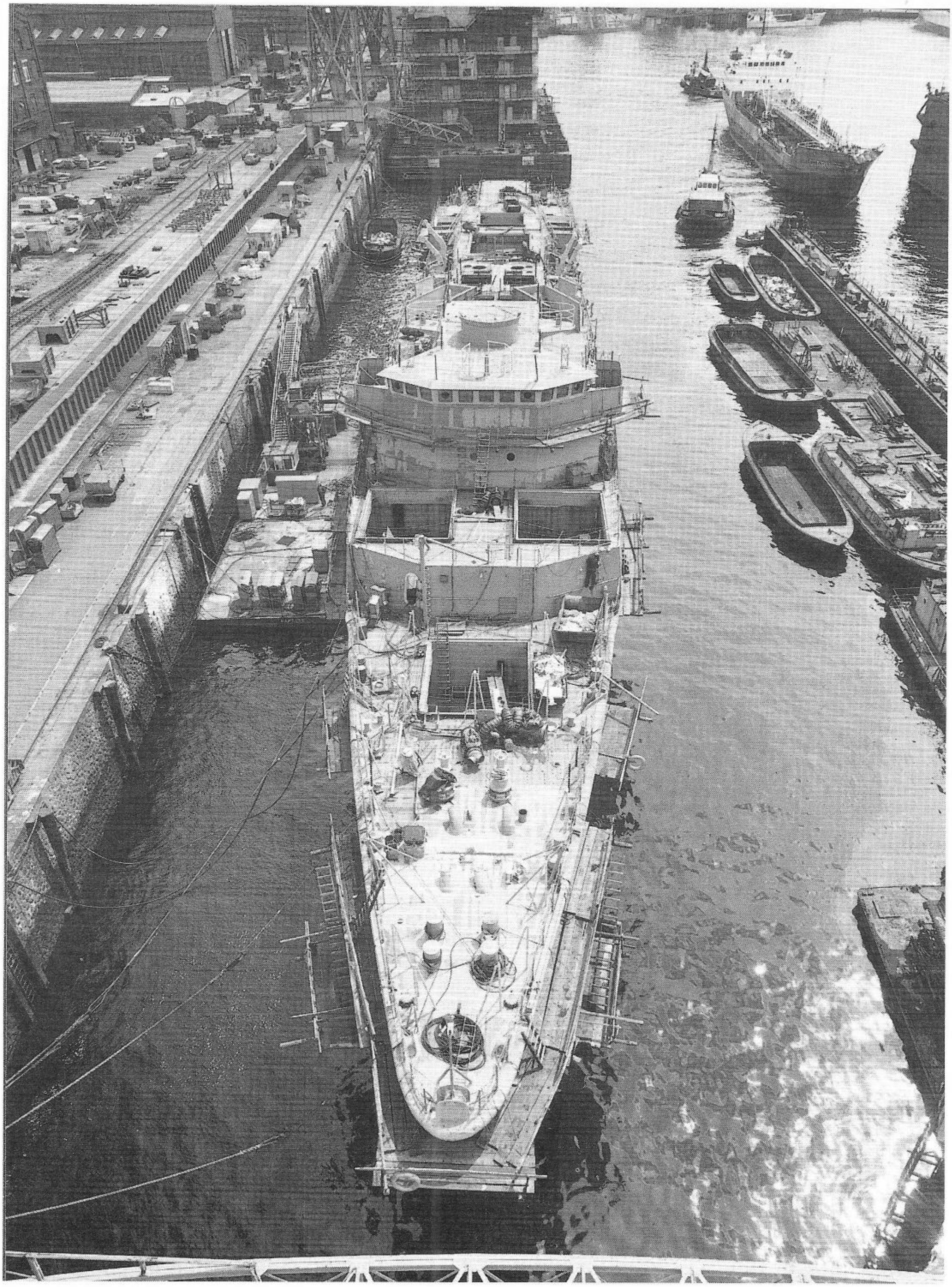
Type	Length	Breadth	Sample Equipment
AAA	4.10 m (13.45 ft)	3.50 m (11.5 ft)	RAM missile launcher
AA	4.70 m (15.42 ft)	4.10 m (13.45 ft)	OTOBREDA 76 mm Compact gun
A	6.50 m (21.32 ft)	5.30 m (17.4 ft)	GMVLS Mk 41 with 16 launcher tubes
B	9.30 m (30.5 ft)	6.50 m (21.32 ft)	

The Electronic Functional Units conform to ISO container standards for height and breadth, but vary in length between 3.0 and 4.5 m (9.84 and 14.76 ft). Maximum height of 2.15 m (7.05 ft) is determined by deck height.

There are already numerous examples of navies operating equipment pools in other types of ship, with a small number of high-value items such as Mk 15 Phalanx CIWS being transferred between operational ships, so that the item does not sit unused in a ship during refits. The MEKO system considerably facilitates such intership transfers, with the removal of a major module taking no more than three hours.



A Weapons Functional Unit containing a 127 mm (5 in) gun. Such WFUs come in four standard sizes (Blohm + Voss)



A MEKO 360 H1 frigate outfitting. The two large holes immediately before the bridge will be filled by WFUs containing OTOBREDA 40 mm/70 guns, while the hole in the foredeck will accommodate a 127 mm (5 in) gun (Blohm + Voss)

The mast module incorporates sensors according to customer's requirements, but it has a standard footprint, standard foundation, and standard connections.

Data highway

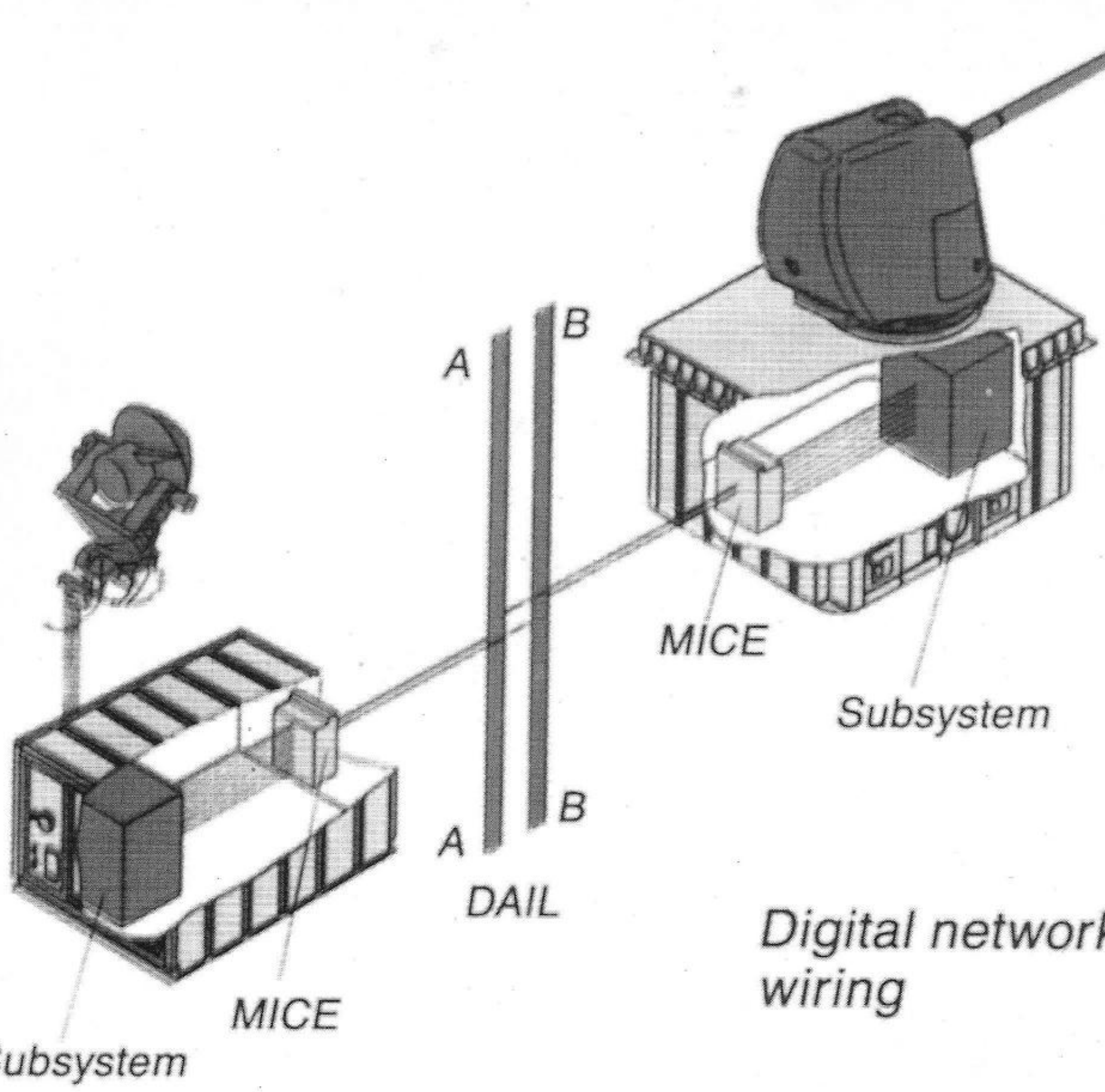
B+W has developed its own data highway with its own software clock. All modules have their own MICE (Multi-Interface Computer Equipment) system and are connected to the DAIL (DAta Information Link) highway using the Ethernet IEEE 802.3 protocol. Distributed processing within each module greatly reduces the transmission load on the highway, since only processed data needs to be passed. The network is fully redundant with two buses following physically separate routes around the ship. Bus A normally handles command and control data (for example, targeting and status) while Bus B normally handles navigation and 'own ship' data, but both have sufficient capacity to take the entire load, if necessary. There is also a separate databus within the command and control system, with the various consoles and other equipment in the CIC having their own

TABLE 1: MEKO FRIGATES

	Country	Argentina	Nigeria (Note 2)	Australia/ New Zealand (Note 1)	Greece	Portugal	Turkey	Turkey
Class details	Model	MEKO 360 H2	MEKO 360 H1	MEKO 200 ANZ	MEKO 200 HN	MEKO 200 PN	MEKO 200 TN Track I	MEKO 200 TN Track II
	National class name	Almirante Brown	Aradu	ANZAC	Hydra	Vasco da Gama	Yavuz	Barbaros
	Construction years	1980-1984	1979-1982	1993-2004	1990-1997	1989-1991	1985-1989	1993-2000
	Number ordered	4	1	10	4	3	4	4
	Construction							
	Germany	4	1	—	1	3	2	2
	In-country	—	—	10	3	—	2	2
Ship details	Displacement							
	Design	2,900 t	—	—	2,710 t	2,700 t	2,414 t	
	Full load	3,360 t	3,380 t	3,600 t	3,200 t	3,300 t	2,919 t	3,350 t
	Dimensions (Note 3)							
	Length (wl)	125.6	125.6	115.9	117.0	115.9	11.05	115.9
	Beam (m)	15.00	15.0	14.8	109.0	14.8	14.2	14.8
	Draught (m)	4.30	4.30	4.10	4.10	4.10	4.14	4.10
	Performance							
	Speed	30.5 kts	30.5 kts	27 kts	31 kts	32 kts	27 kts	32 kts
	Range	4,500 n miles/ 18 kts	4,500 n miles/ 18 kts	6,000 n miles/ 18 kts	4,100 n miles/ 18 kts	4,900 n miles/ 18 kts	4,100 n miles/ 18 kts	4,100 n miles/ 18 kts
Weapons systems	Missiles SSM							
	Type	Exocet	Otomat	—	Harpoon	Harpoon	Harpoon	Harpoon
	Number	8	8	—	8	8	8	8
	Missiles SAM							
	Launcher type	Albatros Aspide	Albatros Aspide	Mk 41 VLS Sea Sparrow	Mk 48 VLS Sea Sparrow	Mk 29 Sea Sparrow	Mk 29 Aspide	Mk 29 Aspide
	Number	24	24	8	16	?	24	24
	Guns							
	Main	1 × 127 mm	1 × 127 mm	1 × 127 mm	1 × 127 mm	1 × 100 mm	1 × 127 mm	1 × 127 mm
	Close in	8 × 40 mm	8 × 40 mm		2 × Mk 15	2 × 20 mm	3 × 25 mm	3 × 25 mm
	Torpedo tubes (all 324 mm)	6 × ILAS	6 × STWS-1B	6 × Mk 32	6 × Mk 32	6 × Mk 32	6 × Mk 32	6 × Mk 32
Shipboard aviation	Helicopters	2 × Alouette III	1 × Lynx	AUS:1 × SH-60B NZ: ?	1 × S70B-6	2 × Super Sea Lynx	1 × AB212ASW	1 × AB212ASW
Propulsion	System	COGOG	CODOG	CODOG	CODOG	CODOG	CODAD	CODOG
	Boost	2 × Olympus	2 × Olympus	1 × LM2500	2 × LM2500	2 × LM2500	—	2 × LM2500
	Cruise	2 × Tyne	—	—	—	—	—	—
	Diesel	—	2 × MTU	2 × MTU	2 × MTU	2 × MTU	4 × MTU	2 × MTU
Electronic systems	Combat data system	Signaal SEWACO	Signaal SEWACO-BV	Celsius 9LV453 Mk 3	Signaal STACOS	Signaal SEWACO	Signaal STACOS-TU	Signaal TACTICOS FD
	Radars							
	Air search	DA08A[A]	AWS-5D[B]	SPS-49(V)8[C]	MW 08[A]	MW 08[A]	DA 08A	ASW 9[B]
	Surface	ZW06[A]	—	9LV453TIR[D]	DA 08[A]	DA 08[A]	AWS 6[B]	AWS 6[B]
	Navigation	1226[B]	1226[F]	9600ARPA[E]	2690BT[F]	1007[G]	1226[F]	2690[F]
	Sonar							
	Hull	SQS-21(BZ)[E]	DSQS-21[E]	Spherion B[H]	SQS-56[C]	SQS-501(V)[J]	AN/SQS-56[C]	AN/SQS-56[C]
	VDS	—	—	—	DE 1160C	(Note 5)	—	—
Crew	Officers	?	38	22	22	26	?	23
	PO	?		41	101	48	?	95
	Ratings	?	192	100	66	110	?	68
	TOTAL	200	230	163	189	184	180	186

Notes

1. Two ships for New Zealand are being built in Australia and are virtually identical with the ships for the Australian Navy
2. This ship is no longer serviceable and is included here for purposes of comparison.
3. Length is length overall; beam is maximum width; draught is depth of hull at full load, excluding sonar and propellers
4. Manufacturers
   - [A] = Thomson/Signaal
   - [B] = Plessey
   - [C] = Raytheon
   - [D] = Celsius Tech
   - [E] = STN Atlas
   - [F] = Racal-Decca
   - [G] = Kelvin Hughes
   - [H] = Thomson-Marconi
   - [J] = Computing Devices of Canada
5. Space has been left for VDS to be fitted in due course.



Digital network wiring

All modules have their own MICE (Multi-Interface Computer Equipment) and are connected to the fully redundant DAta Information Link (DAIL)

closed data network, which interfaces with the ship-wide DAIL through two or more MICE, which serve as gateways.

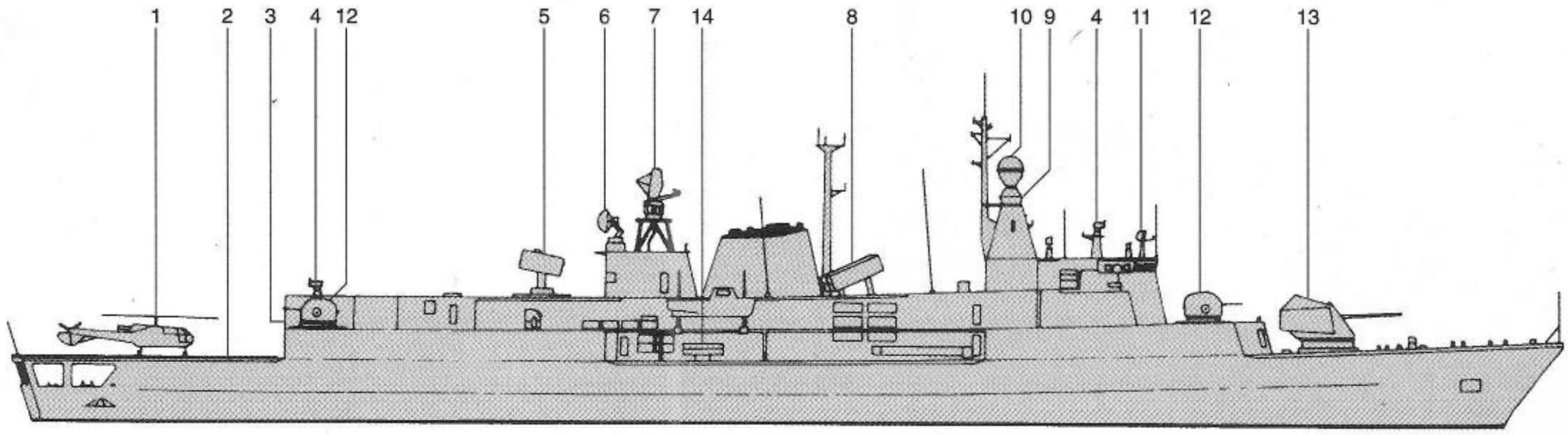
Ship's services

One of the components of MEKO Mod 3 technology is compartmental independence, with each watertight compartment being independent of other compartments. One of the major benefits of this approach is that compartments are individually sealed and vertically integrated for environmental control and monitoring, firefighting, power distribution and NBC protection. The only exceptions to this are the fore and after ends, consisting of two compartments each, which are combined.

Electrical power is generated by three diesel generators which are located on the 4th deck level below the waterline and widely separated from each other. These feed power to two Main Switchboards , one each in the forward and after damage control centres. Power is fed from the switchboards via cables running along the ship centreline and well below the waterline to the Load Centres, of which there is one in every compartment, and which are responsible for distributing power to the main and subsystems within the compartment. Each Load Centre includes changeover facilities, a main distribution group, a weapons group, a 24 V group and chargers.

These ship's services are monitored by NAUTOS (Naval Automation System), which also controls and monitors all propulsion and auxiliary machines and valves.

ALMIRANTE BROWN (MEKO 360)



Almirante Brown (Ian Sturton)
1 *Aerospatiale SA 319B Alouette III* **2** *Flight deck* **3** *Hangar* **4** *Signaal LIROD radar/electro-optic system* **5** *Alenia Albatros launcher for Aspide missiles* **6** *Signaal STIR target indication radar* **7** *Signaal DA 08 air/surface search radar* **8** *Aerospatiale MM40 Exocet anti-ship missiles (eight)* **9** *Sphinx/Scimitar ESM arrays* **10** *Signaal WM25 fire direction radar* **11** *Signaal ZW06 surface search radar* **12** *OTOBREDA twin 40 mm/70 'Fast Forty'* **13** *OTOBREDA 127 mm (5 in)/54 automatic gun* **14** *US triple Mk 32 324 mm torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Argentina
Type: MEKO 360H2

Class: ALMIRANTE BROWN

Built: 4
Active: 4

Displacement:
standard: 2,900 t
design load: 3,360 t full load

Dimensions
Length: 125.90 m (413.10 ft)
Beam: 14.0 m (46.0 ft)
Draught: 5.80 m (19.0 ft)

Speed: 30.5 kts (20.5 kts cruising)
Range: 4,500 n miles at 18 kts

Complement: 200 (26 officers)

SHIPS

ALMIRANTE BROWN (D 10)

Builder	Blohm + Voss, Hamburg, Germany
Laid down	8 Sep 1980
Launched	28 Mar 1981
Commissioned	26 Jan 1983

LA ARGENTINA (D 11)

Builder	Blohm + Voss, Hamburg, Germany
Laid down	30 Mar 1981
Launched	25 Sep 1981
Commissioned	4 May 1983

HEROINA (D 12)

Builder	Blohm + Voss, Hamburg, Germany
Laid down	24 Aug 1981
Launched	17 Feb 1982
Commissioned	31 Oct 1983

Almirante Brown *(D 10) and* La Argentina *(D 11) at sea together* (Blohm + Voss)

SARANDI (D 13)

Builder	Blohm + Voss, Hamburg, Germany
Laid down	9 Mar 1982
Launched	31 Aug 1982
Commissioned	16 Apr 1984

Heroina *(D 12) third of the Argentine Navy's four MEKO 36 ships to be completed. Armament on the foredeck comprises a single 127 mm/54 and two twin 'Fast Forties', all made by OTOBREDA. Note also the two quad Exocet MM 40 launchers immediately forward of the bifurcated stacks* (Adam Goodrich)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 40 medium-range anti-ship missile

Two pairs of quad Exocet MM 40 launchers are mounted immediately forward of the stack, firing across the ship.

Specifications

	MM 40 Block	1 MM 40 Block 2
Length	5.78 m (19 ft)	5.80 m (19.02 ft)
Diameter	35 cm (13.7 in)	35 cm (13.7 in)
Wing span	1.13 m (3.7 ft)	1.13 m (3.7 ft)
Weight	855 kg (1,885 lb)	870 kg (1,918 lb)
Speed	Mach 0.9	Mach 0.9
Range	2-38 n miles (4-70 km)	2-40.5 n miles (4-75 km)
Warhead	165 kg (363 lb) HE frag	155 kg (342 lb) HE frag
Fuze delay	impact/proximity	impact/proximity
Guidance	Inertial and active radar	Inertial and active radar

SURFACE-TO-AIR MISSILES (SAM)

The Albatros Mk 2 Mod 9 system comprises three elements:

Riva-Calzoni launcher
Aspide missile
WM 25 fire-control system

Riva-Calzoni Albatros launcher

The single, eight-cell Albatros launcher is located atop the deckhouse at the forward end of the hangar. Produced by Riva-Calzoni, it has eight launch cells, four on each side of the mounting, each with a frangible front and rear cover. Each cell contains a loading guide to which the launching rail of the missile is electrically and mechanically connected. Sixteen reload missiles are stored horizontally in a hydraulically operated store and reload system in the deckhouse forward of the launcher; they are in four rows of four missiles each, their location corresponding to that of the launcher cells, and each storage cell has an autonomous missile travel device.

Pilot's view of an Argentine MEKO 360H2. Either side of the hangar are OTOBREDA 'Fast Forties', and on the hangar roof are (from front to rear of picture) a Signaal LIROD electro-optic director, Alenia octuple Albatros launcher, Signaal STIR and Signaal DA 08 air/surface search radar (Blohm + Voss)

Specifications
Albatros launcher
Height: 2.98 m (9.8 ft)
Width: 3.82 m (12.5 ft)
Length: 3.82 m (12.5 ft)
Weight (loaded): 8.5 t
Traverse: 360° at 45°/s
Elevation: −5 to +80° at 25°/s

Alenia Aspide missile
The system uses the Selenia (now Alenia) Aspide SAM, a missile developed by Selenia from the US Sparrow. Targets are detected by the ship's primary search radar and then allocated to the Signaal WM25 fire-control system. The target is acquired by the fire-control system radar and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews in the target's direction. The missile control system selects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds. When the decision is made to engage the target with missiles the reversible pre-launch commands are issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode. In the latter, two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at once may be controlled by the tracker, according to the manufacturer who also claims the system can engage horizontal targets at up to 15 km, vertical ones at 5 km and lateral ones at 8 km. A short reaction time gives the system the ability to destroy anti-ship missiles even when detection is late.

Specifications
Aspide missile
Length: 3.7 m (12 ft)
Diameter: 20.3 cm (8 in)
Wing span: 80 cm (31 in)
Weight: 220 kg (485 lb)
Speed: Mach 2.5
Range: 7 n miles (13 km)
Altitude: 15-5,000 m (49-16,405 ft)
Warhead: 33 kg (72.7 lb)
Guidance: Semi-active radar

Manufacturer/Contractor
Alenia-Elsag Sistemi Navali, Rome, Italy (system/missile).
Riva-Calzoni, Bologna, Italy (launcher).

TORPEDOES

B515 (ILAS-3) anti-submarine torpedo launching system
There are two B515 (also known as ILAS-3) triple mounts on the main deck below the stack. The tubes are manually loaded and trained but remotely operated from the combat information centre, although emergency local operation is possible.

Specifications
Length: 3.4 m (11 ft)
Height: 1.2 m (4.0 ft)
Width: 1.285 m (4.2 ft)
Weight: 1,050 kg (2,315 lb) (unloaded)

Manufacturer/Contractor
Whitehead, Division of Gilardini SpA, Salviano, Italy.

A 244/S
A244/S lightweight air/surface-launched anti-submarine weapon. There are 18 reloads. The seeker in this weapon is the Alenia CIACIO-S which is capable of active, passive or mixed modes for closing on to its target and can discriminate between decoys and real targets in the presence of heavy reverberations, using specially emitted pulses and signal processing. It also discriminates between target noise and reverberations, as well as having a series preset of programmable search patterns and tactical manoeuvres (including re-attack procedures). The seeker has a large search volume covered by multiple preformed beams following a number of self-adaptive search patterns and is reported capable of target detection at −5 dB in good acoustic conditions. The computerised homing system also provides for presettable combinations of signal processing, spatial filtering and tactical torpedo manoeuvring. The software may be reprogrammed by the customer to meet new tactical conditions. Upon launching, the A244/S initially steers a straight course and, if the target is not detected, it then begins a search pattern which may be either a spiral between preselected depths or a helix pattern.

Specifications
Length: 2.7 m (8.85 ft)
Diameter: 324 mm (12.75 in)
Weight: 215 kg (474 lb) (warshot version)
Warhead: 34 kg (75 lb) shaped charge HBX-3 HE
Propulsion: Electric; silver-zinc batteries
Range: 3.5 n miles (6 km)
Speed: 30 kts
Guidance: Active/passive sonar, self-adaptive programmed patterns

Manufacturer/Contractor
Whitehead, Division of Gilardini SpA, Salviano, Italy.

GUNS

OTOBREDA 127 mm/54 Compatto
There is one OTOBREDA 127 mm/54 Compatto mounting in 'A' position. This weapon is designed to provide naval gunfire support, to engage surface targets and to engage air targets, including anti-ship missiles and fixed-wing aircraft which do not have standoff weapons. The turret is unmanned and is enclosed by a glass fibre shield. Much of the turret and the lower part of the mounting are made of aluminium alloy. The below-deck element of the mounting consists of three drums each containing 22 rounds, which are stocked automatically from two chain-driven lower hoists which lead to the magazines and are loaded manually. The gun captain uses his control to select which drums are to be replenished and with what ammunition. The weapon is compatible with all US 5 in L/54 ammunition.

Specifications
Gun
Calibre: 127 mm (5 in)
Length of barrel: 54 calibres
Muzzle velocity: 808 m/s (2,625 ft/s)

Almirante Brown *(D 10). On the bridge roof are (right) Signaal ZW 06 surface search radar and the LIROD electro-optic fire director. The forward tower is topped by a Signaal WM25 'egg' with below it the DF arrays of the Sphinx ESM system surrounding the neck of the tower like a collar. Protruding from the tower are the jammers of the Scimitar system* (Blohm + Voss)

Argentine Navy's Almirante Brown *(D 10)* (Argentine Navy)

Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 13,600 m (45,000 ft)
Rate of fire: 45 rds/min
Weight of shell: 32 kg (70 lb)

Mounting
Compatto
Training: 330° at 40°/s
Elevation: −15 to +85° at 30°/s
Crew: 5

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm L/70 Compact (Type 70) twin mounting

There are four twin 40 mm turrets: two either side of the hangar and two in 'B' position on the foredeck.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 600 rds/min/mount
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC COUNTERMEASURES

CSEE DAGAIE Mk 2 countermeasures system

There are two CSEE DAGAIE Mk 2 ten-barrelled, trainable launchers, which can be loaded with either IR or chaff rockets. The firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, windspeed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed guidance missile systems cannot discriminate between them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised glass fibre chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 µm bands.

Specifications
Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)

Manufacturer/Contractor
CSEE Défense, Paris, France.

OTOBREDA SCLAR rocket launchers

Two 20-tube, 105 mm (4 in) OTOBREDA SCLAR, multipurpose, rocket launchers. The control unit is linked to the ship's radar and a control panel in the ECM compartment to provide the necessary operating signals, with the data needed to stabilise the two launchers against pitch and roll being provided by the ship's gyrocompass. The system provides defence against radar and IR homing missiles, confuses enemy radars, and provides illumination for visual fire control at night. Provision is made to load different types of rockets in various arrangements (long-range chaff, medium-range chaff, illuminating) to permit mixed salvos. Automatic selection of the rockets to be fired is possible from the remote fire-control unit and the time fuzes and launch sequence may be similarly controlled. The rockets all have double-base propellant motors with folding fins and electronic fuzes while their speed to burnout is 260-645 m/s (853-2,146 ft/s).

Specifications
Launcher weight: 1.15 t (empty); 1.75 t (with 20 rockets)
Trunnion height: 1.17 m (3.8 ft)
Traverse: 300° at 60°/s
Elevation: −5 to +60° at 30°/s
Rate of fire: 1 rd/s

Chaff distraction rocket
Type: SNIA 105 LR-C
Length: 1.85 m (6.0 ft)
Diameter: 105 mm (4 in)
Max range: 12 km
Weight: 27 kg (59.5 lb)
Payload: 10.2 kg (22.5 lb)

Chaff seduction rocket
Type: SNIA 105 MR-C
Length: 1.83 m (6.0 ft)
Diameter: 105 mm (4 in)
Max range: 4.7 km
Weight: 29 kg (64 lb) (SNIA 105 MR)
Payload: 17.4 kg (38 lb)

Infra-red seduction
Type: SNIA 105 MR-IR

Illumination
Type: SNIA 105 LR-I
Payload: 10.2 kg (22.5 lb)
Range: 4 km

Manufacturers/Contractors
Breda Meccanica Bresciana SpA (launcher).
SNIA BPD (rockets).

DECOYS

Graseby G1738 towed torpedo decoy equipment

The Graseby G1738 is a solid-state, export version of the Grasey 182 torpedo decoy, which is designed to decoy both active and passive homing torpedoes, using signals electronically generated within the ship and fed, via the towing cable, to electroacoustic transducers within the towed body. The equipment produces two independently controllable output signals which are radiated simultaneously from the towed decoy. An amplitude modulated noise signal simulates the ship's propeller noise and causes passive homing torpedoes to be seduced away from the ship towards the towed decoy. The second signal is a swept CW

signal, which simulates sonar echoes, in order to confuse or jam the guidance system of active homing torpedoes, thus causing them to miss the ship. The frequency bands covered by both types of output are switchable to meet tactical scenarios and to enable concurrent operation of other sonar and communication equipments.

Specifications

Towed decoy:
diameter: 533 mm (21 in)
length: 2,005 mm (79 in)
weight: 74 kg (163 lb)
Towing cable:
length: 411 m (1,348 ft)
diameter: 14.48 mm (0.6 in))
weight: 269 kg (593 lb)

Manufacturers/Contractors

Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Thorn EMI Scimitar ECM system

Scimitar is a descendant of a system developed by MEL; others are Signaal's Reprogrammable Advanced Multimode Shipborne ECM System (RAMSES) and the Canadian SLQ-503. Scimitar is a modular naval electronic countermeasures system designed to provide protection against radar threats. It is an integrated responsive jammer capable of long-range jamming of search radars and the deception of missiles once launched. In its normal mode of operation, Scimitar is controlled by the Mentor 2 system, so that a dedicated ECM operator is not therefore required. In the back-up mode, Scimitar can be manually controlled (target designation and jamming) from the remote-control panel located near the EW operator.

Scimitar operates in I/J-band and is capable of high pulse and CW Effective Radiated Power (ERP). Multimode jamming operation is possible with multitarget handling capability. There are two antennas in small 'egg-shaped' radomes on each side of the ship, at the end of the yard-arms. The two Scimitar antennas are vertically separated with the receive antenna uppermost. On receiving orders from Mentor the Scimitar receiver trains towards the designated threat, searches for it and then locks onto it, whereupon the system automatically triggers a programmed response. With two separate systems, two targets can be handled simultaneously, but, in addition to this, jamming sequences for the next targets can be set up, so that as soon as one target has been dealt with the next can be tackled.

Manufacturer/Contractor

Thorn EMI, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Thomson-CSF/Signaal SEWACO command and fire-control system

The Argentine ships are fitted with a Signaal SEWACO action data automation system, which is an automatic threat evaluation, weapon assignment and sensor allocation system, and which can also be used as a planning aid through inputs of intelligence data and decision support facilities. The software package, designated STACOS, is written in RTL-2

Manufacturer/Contractor

Signaal, Hengelo, Netherlands

COMMUNICATIONS AND DATALINKS

Datalinks
Link 10
Link 11.
Satcoms can be fitted.

WEAPONS CONTROL

Signaal LIROD 8 electro-optic director

LIROD (Lightweight Radar Optronic Director) is a lightweight fire-control system based upon a K-band tracking radar and a TV camera. It is used in these ships to control the two twin 40 mm mounts, while tracking one air and one surface target. The system reaction time from detection to the beginning of the engagement is about 4.5 seconds. It is based upon a 0.6 m (1.97 ft) diameter parabolic antenna with monopulse cluster. It has a very narrow pencil beam and is resistant to clutter through the application of pulse Doppler tracking combined with FFT techniques. There are also sophisticated ECCM facilities. The radar can track fighter-size targets up to 18 km away and is capable of tracking targets with a maximum speed of 1000 m/s (3,280 ft/s). In addition to the radar there is a militarised TV camera with CCIR standard video format, which can detect fighter-size targets at about 5.44 n miles (10 km) and large surface ships at about 10.9 n miles (20 km).

Heroina *(D 12) and* Espora *(F 41) (then F-10), two variations on the MEKO theme* (H & L van Ginderen Collection)

Specifications
Director
Traverse: 360° at 120°/s
Elevation: −25 to +150° at 80°/s
Radar: K-band
Field of view
TV camera: 3-30° (2-20°)
IR camera: 3°

Laser rangefinder
Pulse length: 20 ns
Max repetition frequency: 10 Hz
Beam divergency: 1.2-1.5 mrad

Laser tracker
Max repetition frequency: 25 Hz
Beam divergency: 1.5 and 6 mrad

Manufacturer/Contractor
Hollandse Signaalapparatan BV, Hengelo, Netherlands.

SONARS

STN Atlas 80 (DSQS 21BZ) hull-mounted sonar
The DSQS-21BZ sonar was originally designed by (the then) KAE for the German Navy's Type 122 frigate, the ASO 80 series being the subsequent export models. Computer-aided detection techniques are used for classification and tracking and the information is presented on colour CRT displays to permit Doppler coding and the discrimination of data on the integrated displays. The transducer array is 1 m (3.28 ft) in diameter and consists of 32 staves.

Manufacturer/Contractor
STN Atlas Elektronik GmbH, Bremen, Germany.

RADARS

Set	DA 08	ZW 06	STIR	WM 25	TM 1226
Company	Signaal	Signaal	Signaal	Signaal	Racal-Decca
Role	Surface search/ target indication	Surface search	Fire control (SAM)	Fire control (SSM/ 127 mm gun)	Navigation
Band	F	I	I/J/K	I/J	I
Range	92 n miles (170 km)	14 n miles (26 km)	76 n miles (140 km)	25 n miles (46 km)	48 n miles
Beam	1.5 × csc² to 40°	0.9 × 19°	1.4°	1.5 × 4/7° (search) 2.4° (track)	1.2°
Peak power	145 kW	60 kW	220 kW	200 kW	25 kW
Gain	33 dB	32 dB	—	33.5 dB	30 dB
Pulsewidth	35/69 µs	0.06/0.6 µs	0.29 µs	0.22/4.5 µs	0.05/0.25/1.0 µs
PRF	1,000/500 pps	4,000/2,000 pps	1,800/3,600 pps	3,600/1,800 pps	
Scan rate	10/20 rpm	24 rpm	—	60 rpm	28 rpm

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 23.16 × 14.8 m (76 × 49 ft)
Hangar: hangar accommodates two helicopters

HELICOPTERS

It was originally intended to use Lynx with these ships, but the sale was embargoed. Alouettes are now used.

SA 319B Alouette III

Specifications
Dimensions:
main rotor diameter: 11.02 m (36.15 ft)
length overall (rotor turning): 12.84 m (42.15 ft)
fuselage length: 10.17 m (33.7 ft)
height to rotor head: 3.00 m (9.84 ft)
Weights
empty: 1,143 kg (2,520 lb)
max take-off: 2,200 kg (4,850 lb)
Performance
max speed (never exceed): 113 kts (210 km/h)
max cruising speed: 100 kts (185 km/h)
service ceiling: 3,200 m (10,500 ft)
range (max fuel): 267 n miles (495 km)
Engines: 1—694 kW (870 shp) Turbomeca Artouste IIIB turboshaft derated to 425 kW (570 shp)
Accommodation: 7 (pilot plus 6)
Weapons: In the ASW role the Alouette III would carry two lightweight torpedoes

PROPULSION

Specifications
System: combined gas turbine or gas turbine (COGOG)
Main machinery: 2 Rolls-Royce Olympus TM3B gas turbines; 37.4 MW (50,000 hp) sustained; 2 Rolls-Royce Tyne RM1C gas turbines, 7.4 MW (9,900 hp(m))
Shafts: 2
Propellers: 2, cp
Auxiliary generators: 4—775 kVA diesel-generator sets

FURTHER INFORMATION

PROGRAMME

Six of these ships were originally ordered by the Argentine Navy in 1978, but the order was later reduced to four when the six Meko 140 frigates were ordered in 1979. The first of the four ships was commissioned in 1983, too late for the Falklands (Malvinas) War.

HELICOPTERS

These ships were intended to operate two Westland Lynx helicopters, but the order was embargoed by the British Government in the aftermath of the 1982 war. The Argentine Navy then sought to order Agosta-Bell AB212ASW from Italy, but failed to obtain funding and the order lapsed. As a result, the Alouette IIIs already operated by the navy are used, but they are inadequate for the ASW mission.

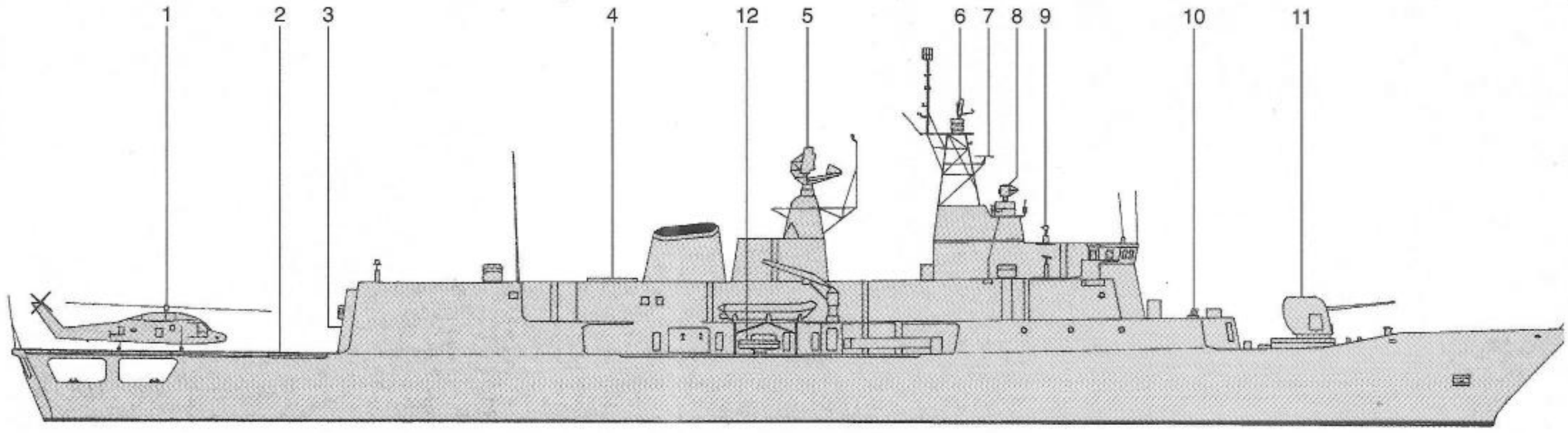
DEPLOYMENT

Almirante Brown (D 10) took part in allied Gulf operations in late 1990, together with one of the navy's MEKO 140 frigates.

ENGINES

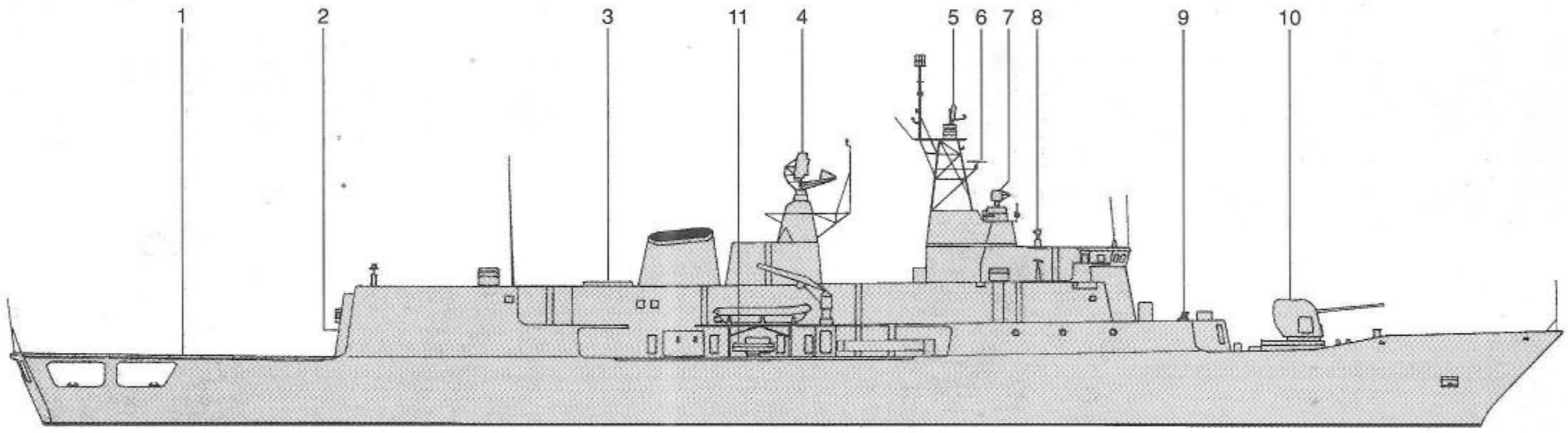
One of the major problems facing the Argentine Navy with these ships is the lack of spares for the Rolls-Royce gas turbines. There were unconfirmed reports at the time of the Gulf War that *Almirante Brown*'s engines were given a covert refit while the ship was en route to the Gulf, and there have also been reports that at least some spares have been obtained on the international markets.

ANZAC (MEKO 200)



ANZAC (Ian Sturton)

1 *Sikorsky S70B ASW helicopter* **2** *Flight deck* **3** *Hangar* **4** *Lockheed Martin Mk 41 Mod 5 vertical launcher for Raytheon Sea Sparrow* **5** *Raytheon SPS-49 (V) 8 ANZ air search radar* **6** *CelsiusTech 9LV 453 TIR air/surface search radar* **7** *STN Atlas 9600 ARPA navigation radar* **8** *CelsiusTech 9LV 453 fire-control radar* **9** *CelsiusTech 9LV 453 electro-optic director* **10** *G & D Aircraft GD 36 Mod 1 chaff launcher* **11** *United Defense 127mm (15in)/54 Mk 45 Mod 2 gun* **12** *US Mk 32 324 mm triple torpedo tubes*



Te Kaha (Ian Sturton)

1 *Flight deck (helicopter yet to be decided)* **2** *Hangar* **3** *Lockheed Martin Mk 41 Mod 5 vertical launcher for Raytheon Sea Sparrow* **4** *Raytheon AN/SPS-49 (V) 8 ANZ air search radar* **5** *CelsiusTech 9LV 453 TIR air/surface search/target indication radar* **6** *STN Atlas 9600 ARPA navigation radar* **7** *CelsiusTech 9LV 453 fire direction radar* **8** *CelsiusTech 9LV 453 electro-optic director* **9** *Sea Gnat/Mk36 SRBOC Chaff/IR launcher* **10** *United Defense 127mm (5 in)/54 Mk 45 Mod 2 gun* **11** *US Mk 32 324 mm triple torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Australia/New Zealand
Type: MEKO 200 ANZAC

Class: ANZAC*

Building: 9
Active: 1

Displacement:
standard: 3,195 t
full load: 3,600 t

Dimensions
Length: 118.0 m (387.1 ft) (oa); 109 m (357.6) (wl)
Beam: 14.80 m (48.6 ft)
Draught: 4.40 m (14.44 ft)

Speed: >27 kts
Range: 6,000 n miles at 18 kts

Complement: 163 (22 officers; 41 POs; 100 ratings)

***Note:**
The name 'ANZAC' is the abbreviated title of the 'Australian and New Zealand Army Corps' which was formed during the First World War. It suffered great losses during the Gallipoli campaign in 1915 which had a major impact on the small (then) colonial territories from which it was raised. Ever since, the term 'ANZAC' has had a deep emotional significance in both Australia and New Zealand.

SHIPS

Australia

ANZAC (150)
Builder Transfield Shipbuilding, Williamstown, Australia
Laid down 5 Nov 1993
Launched 16 Sep 1994
Commissioned Mar 1996

ARUNTA (151)
Builder Transfield Shipbuilding, Williamstown, Australia
Laid down 22 Jul 1995
Launched Jul 1996
Commissioned Nov 1997

WARUMUNGU (152)
Builder Transfield Shipbuilding, Williamstown, Australia
Laid down Jul 1997
Launched Jul 1998
Commissioned Nov 1999

STUART (153)
Builder Transfield Shipbuilding, Williamstown, Australia
Laid down Jul 1998
Launched Jul 1999
Commissioned Nov 2000

PARRAMATTA (154)
Builder Transfield Shipbuilding, Williamstown, Australia
Laid down Jul 1999
Launched Jul 2000
Commissioned Nov 2001

BALLARAT (155)
Builder Transfield Shipbuilding, Williamstown, Australia
Laid down Jul 2000
Launched Jul 2001
Commissioned Nov 2002

TOOWOOMBA (156)

Builder	Transfield Shipbuilding, Williamstown, Australia
Laid down	Jul 2001
Launched	Jul 2002
Commissioned	Nov 2003

PERTH (157)

Builder	Transfield Shipbuilding, Williamstown, Australia
Laid down	Jul 2002
Launched	Jul 2003
Commissioned	Nov 2004

New Zealand

TE KAHA (F77)

Builder	Transfield Shipbuilding, Williamstown, Australia
Laid down	19 Sep 1994
Launched	22 Jul 1995
Commissioned	May 1997

— (F111)

Builder	Transfield Shipbuilding, Williamstown, Australia
Laid down	Jul 1996
Launched	Jul 1997
Commissioned	Nov 1998

First of class, Anzac *(150). Eight of these MEKO 200 design ships are being built for Australia and two (with a possible third) for New Zealand* (Jane's/H M Steele)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Both Australian and New Zealand ships are fitted for but not with (FFBNW) Harpoon anti-ship missiles.

SURFACE-TO-AIR MISSILES (SAM)

GMVLS Mk 41 Mod 5 Vertical Launch System

The Australian frigates are equipped with one eight-cell version of the Guided Missile Vertical Launch System (GMVLS) Mk 41, which was developed specifically for the Sea Sparrow missile. The system is currently known as the 'Mk 41 Vertical Launching System — Vertical Launch RIM-7 Sea Sparrow Missile' (VLS-VL/RIM-7). The launcher uses the same structural and electronic components as the other versions of the system but the module is 6.86 m (22.5 ft) high and an eight-cell unit weighs 24.36 t. The Sea Sparrows are housed in Mk 22 canisters which are 5.79 m (19.0 ft) deep and weigh 1,503 kg (3,314 lb) (complete with missile) and which actually revert to the original design of canister before it was modified for the Tomahawk missile.

Raytheon Sea Sparrow VL/RIM-7P point-defence missile system

Eight RIM-7P Sea Sparrow missiles are carried and the system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast/fragmentation warhead and a dual-purpose proximity-impact fuze.

Specifications

VL/RIM-7P
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 231.5 kg (510 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors

Raytheon Company, Equipment Division (prime system contractor).

Raytheon Company, Missile Systems Division (prime missile contractor).

Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

Launch of Anzac *(150) on 16 September 1994. Note the broad, curving bow and the straight stem without any bow sonar* (Transfield)

TUBES

Six 324 mm US Mk 32 Mod 5 (two triple) torpedo tubes will be fitted in each ship after acceptance by the navy. The tubes will be located on the main deck immediately below the RIB.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

GUNS

Mk 45 Mod 2 single 127 mm (5 in) L/54 gun mounting
One single United Defense Mk 19 Mod 2 127 mm/54 calibre gun in a Mk 45 Mod 2 mounting is mounted forward. The weapon fires semi-fixed ammunition with point detonating, proximity (variable time or infra-red), mechanical time and electronically set fuzes. The theoretical rate of fire is 20 rds/min and a gun crew of six is required, all below decks, of which four are ammunition handlers. The Mod 2 incorporates a number of improvements, including the ability to change the type of ammunition under remote control and electronic fuze setting.

Specifications
Calibre: 127 mm (5 in)
Length of barrel: 54 calibres
Muzzle velocity: 807.72 m/s (new barrel), 762 m/s (mid-life)
Crew: 6 (1 mount captain, 1 panel operator, 4 ammunition handlers)
Traverse: 340° at 30°/s
Elevation: −15 to +65° at 20°/s
Range:
anti-ship: 12.39 n miles (23 km)
anti-air: 15,000 m (49,000 ft)
Rate of fire: 16-20 rds/min
Ammunition weight: 31.75 kg (70 lb) (projectile)

Manufacturer/Contractor
United Defense, Armament Systems Division, Minneapolis, Minnesota, USA.

Hughes Mk 15 CIWS Phalanx
Both Australian and New Zealand ships are fitted for but not with Mk 15 CIWS.

M2HB 12.7 mm (0.50 in) machine guns
Two M2HB 12.7 mm machine guns are carried and can be mounted on flexible mounts.

Specifications
Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rds/min
Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-air: 1,380 m (4,500 ft)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-Thorn EMI Sceptre A ESM system
The Sceptre A system was developed specially for the ANZAC frigate and is reported to be virtually identical to the British Navy's Outfit UAT. The limited information available suggests that the system is intended to measure all radar parameters with a 'significantly increased sensitivity' over current systems and will provide threat lethality classification with a high signal sorting capability. It consists of three major components; an eight-element antenna array, a receiver/processor and an operator's console, and is integrated with the ship's command system. The receiver is a channelised type developed originally by the Philips Research Laboratory. Processing is undertaken by a system based on transputers which are configured in a neural network type of architecture. An integrated receiver system is employed and software control is used across the entire system.

Manufacturer/Contractor
Racal-Thorn EMI Electronics Ltd, Sensors Group, Crawley, UK.

Telegon 10 radio communications direction-finder
The Telegon 10, type PGS 1720, DF equipment is a communications direction-finder covering the frequency range 10 kHz to 1,000 MHz. It uses the Watson-Watt method and is able to obtain a bearing on signals with a duration as low as 1 ms, which is of particular value when targeting burst signals and frequency hoppers.

Specifications
Frequency range: 10 kHz to 1,000 MHz
Frequency resolution: 10 Hz
Equipment error: <1°
Operational modes: A1A, A2A, A3E, F2A, F3E, J3E

Manufacturer/Contractor
Daimler-Benz Aerospace, Sensor Systems Division, Ulm, Germany.

DECOYS

G & D Aircraft GD 36 Mod 1 chaff launchers
Australian ships only. These ships use four Australian-designed GD 36 Mod 1 launchers for standard Mk 36 SRBOC rounds.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Mk 36 SRBOC
New Zealand ships only. The New Zealand ships mount two Loral Hycor Mk 36 SRBOC launchers.

Ammunition. Both Australian and New Zealand ships use the standard SRBOC rounds.

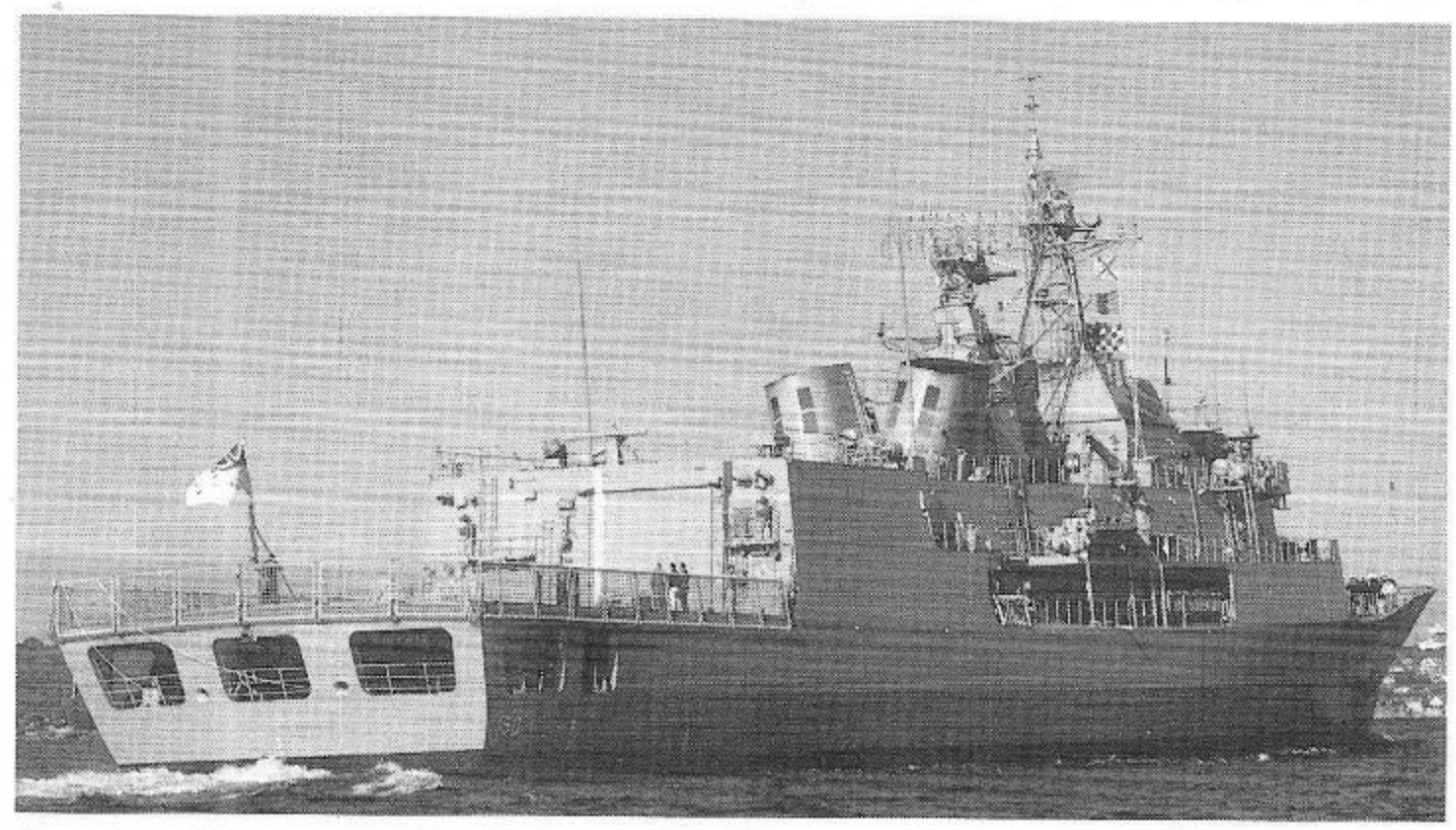
Specifications
Rounds (Mk 36 SRBOC)
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

AWADI Nulka expendable rocket-launched hovering decoy system
Both Australian and New Zealand ships carry four Nulka launchers. This is an expendable, active decoy, providing all-weather self-protection for naval vessels against anti-ship missiles and is designed for use either as part of a multilayer defence system or for stand-alone ship protection. The Winnin rocket is held in a hermetically sealed canister which acts both as storage container and launch tube. Control of the decoy's hovering flight is achieved by a thrust-control mechanism, which acts on the motor's efflux, and a spin-control unit mounted on top of the decoy. The combination of thrust- and flight-control enables successful launches to be made in severe sea states and high winds. Once launched, the decoy operates autonomously and follows its stored flight demands, moving away from the ship at its programmed height and speed to present an alternative and more attractive target to incoming missiles.

Manufacturers/Contractors
AWA Defence Industries (AWADI) Pty Ltd (System).
Sippican, USA (Payload).

Aerojet AN/SLQ-25A Nixie noisemaker
One AN/SLQ-25A Nixie electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm long (3.10 ft), 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.



Stern view of Anzac *(150). Flight deck and hangar will be used by a Sikorsky S-70B(RAN). The ship is equipped with a Canadian Indal RAST system to control the helicopter on the flight deck and to move it to and from the hangar* (Jane's/H M Steele).

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

CelsiusTech 9LV 453 Mk 3 command and weapon control system

CelsiusTech's 9LV 453 Mk 3 command system has a fully distributed architecture based upon a 32-bit computer using Motorola 68020 and 68040 microprocessors and Ada-language software, screen Multi Function Consoles and Ethernet IEEE 802.3 standard local area networks. The functions of the C2 system are:

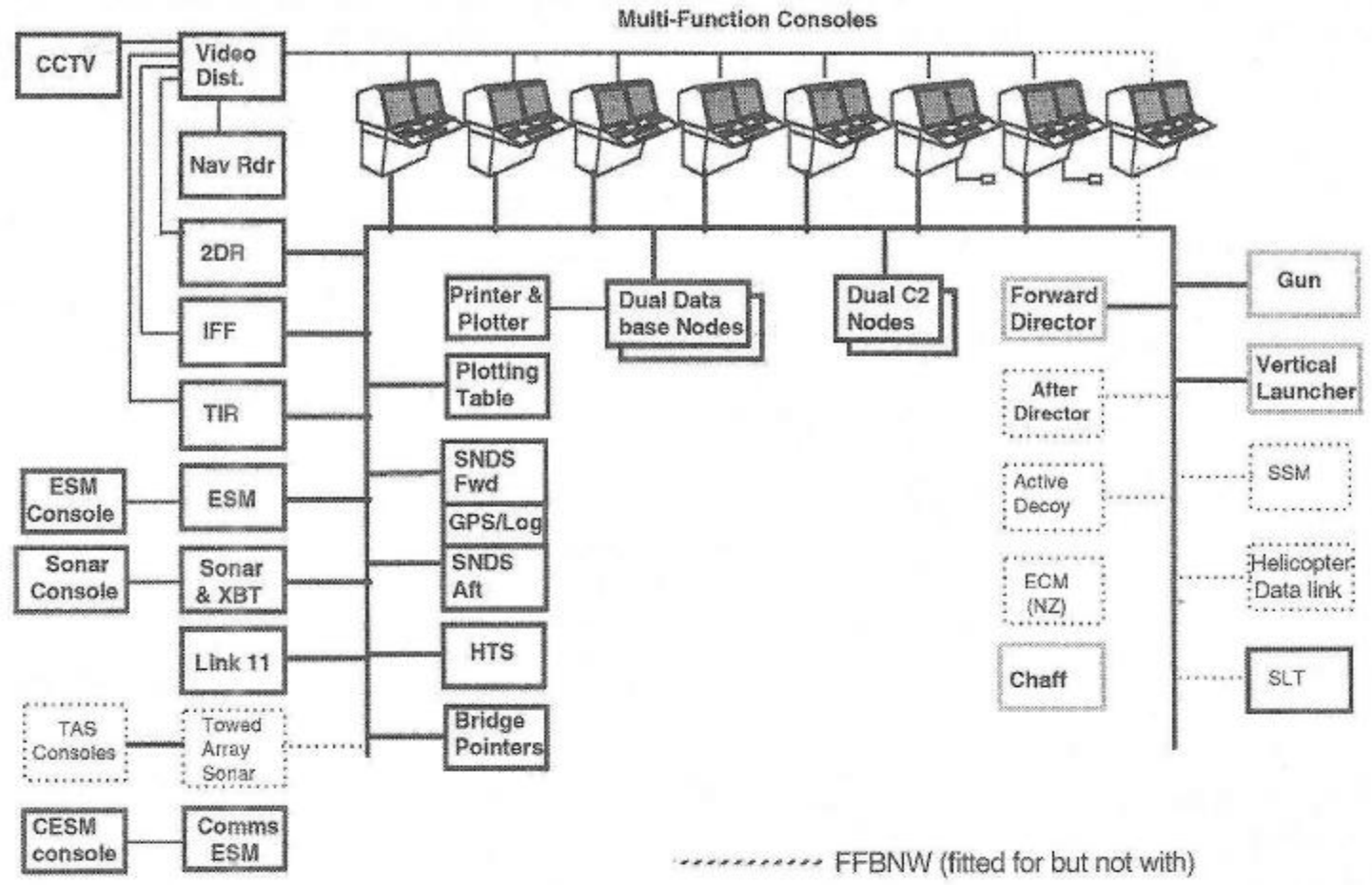
- **Surveillance.** Receive data from and control all sensors (Raytheon SPS-49(v)8, CelsiusTech Target Indication Radar, Cossor AIMS Mk XII IFF, MEL Sceptre ESM, Thomson Spherion B Sonar)
- **Command and Control.** Tactical picture compilation, data fusion, threat evaluation, weapon assignment, tactical planning, Link 11
- **Engagement.** Control the radar/electro-optic director, UDS Mk 41 Vertical Launch system and Sea Sparrow Missiles. Control of FMC 5/54 Mk 45 gun.
- **Support.** Navigation, tactical and technical recording and onboard training. On-line C2 and combat system diagnostics.

Surveillance is centrally managed by the system and track data (consisting of position, identity, type, name and so on) is correlated from each of the most accurate sensors to produce an unambiguous, coloured tactical display. Link 11 is fully integrated as is a helicopter telebriefing system (New Zealand ships only). Ship manoeuvre, navigation planning and automatic surveillance are all managed by the C2 system.

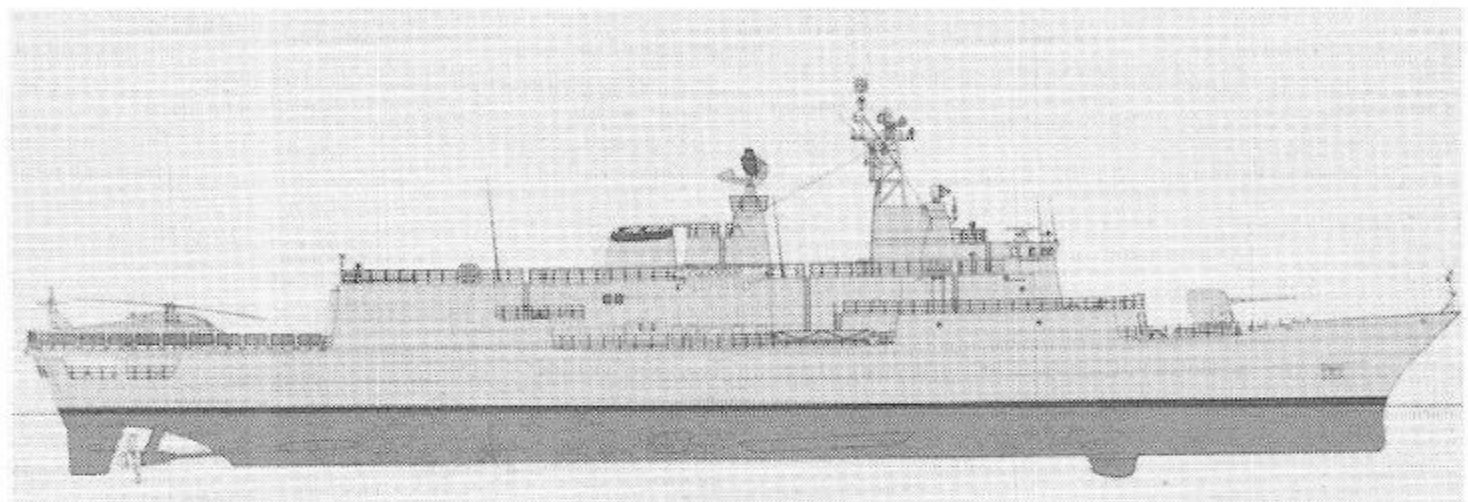
Memory consists of 4 MByte RAM and 256 k of EPROM. The hardware is used to create nodes which may be workstations, processing or interface nodes with a network interface, one or more processing units, power supply, local PROM, and appropriate interfaces. Memory management is by means of the Motorola 68851 while the floating-point processor is the Motorola 68881. All software programs run independently but communicate through an Inter-Program Communication 2000 (IPC2000) mechanism. The basic system has about 500,000 lines of code but this is usually more than doubled to meet added requirements.

The dual-redundant local area network interfaces with all sensors, weapon systems and workstations and the system is supported by two processor units (one redundant) which provide command, communications and control as well as a database. The system is capable of acting as a data handling system compiling the tactical situation, conducting threat evaluation and target designation, as well as providing navigation and offboard sensor data (the latter via a datalink) while recording and providing a simulation capability.

The Mk 3 system retains the horizontal tactical situation compilation display used in the Mk 1/2 system although with improved electronics and its own secondary database. However, the prime MMI consists of workstations, either the CelsiusTech SCL 85 or Terma Standard Consoles.



CelsiusTech 9LV 453 Mk 3



The 'ANZAC' class incorporates four Weapon Modules, eight Electronic Modules, four Pallet Modules, two Mast Modules and nine Ventilation Modules (Blohn & Voss)

The launch of Te Kaha *(F77), the first MEKO 200 ANZAC for New Zealand, at the Transfield yard in July 1995* (Transfield)

Manufacturer/Contractor
CelsiusTech AB, Sweden.

CEROS 200 Fire Control Director

The CEROS 200 Fire Control Director is a high accuracy, lightweight, combined radar and electro-optical director. It uses a small (1 m diameter) Cassegrain antenna and a very wideband TWT radar operating in the J band to achieve high-quality radar tracking for air and surface gunfire control. The antenna also provides an I band feed for the Continuous Wave Illuminator for NATO Sea Sparrow missiles. Three tracking modes provide a range of options to counter all combinations of environmental and manmade (ECM) clutter.

A daylight TV, an Infra-Red imager and a Laser range-finder ensure reliable electro-optical tracking under all but the most extreme conditions. The radar data can be used in conjunction with data from three electro-optical sensors to provide even better track quality; especially against very low-level targets. Together with the radar they provide many combinations of active and passive range and angle tracking of targets, giving the operator a choice of modes which are best suited to the tactical conditions.

The integrated fire-control system provides a variety of weapons functions such as pre-action calibration and fall of shot spotting corrections for surface gunnery and shore bombardment. Weapon safety is strictly maintained and IFF interrogation prior to engagement is also supported.

The CelsiusTech director's details are shown below:

- **Radar.** Spread spectrum Ku band transmitter with monopulse receiver. 1.5 kW peak power, Cassegrain antenna with 1.5° beamwidth. Pulse Doppler, MTI and frequency agile modes.
- **TV.** 2.3-23° field of view, 10-30,000 cd/m² luminance.
- **IR Thermal Imager.** 8-12 µm with option for 3-5 µm
- **Laser.** Nd-YAG type (1.06 or 1.54 µm wavelength). Peak power 4 MW (1.06) or 1.5 MW (1.54)

RADARS

	SPS-49(V)8 ANZ	9600 ARPA
Manufacturer	Raytheon	STN Atlas
Role	2D air search	Navigation
Band	C/D (0.5-2 GHz)	I
Beam	3.4° × 9°	1.5°/ 0.95° × >20°
Peak Power	360 kW	25 kW
Gain	28.5 dB	
Pulsewidth	125 µs/2 µs	
PRF	280/800/1,000 pps	
Scan rate	6/12 rpm	23 rpm
Typical range	250 n miles (475 km)	

CelsiusTech 9LV 453 TIR (Target Indication Radar)

The ship's high-definition target indication radar is based on the Ericsson Sea Giraffe but is fitted with a CelsiusTech antenna system. It is a G band radar using TWT technology with good MTI and a very high data rate (60 Hz) suitable for fire-control systems. There are separate air and surface channels with automatic detection (air only) and tracking. The lightweight air porous antenna has very low sidelobes and high gain. The Threat Evaluation and Weapon Assignment function uses the high data rate to continually replan engagements to cater for manoeuvring and pop-up targets.

SONARS

Spherion B (TSM-2633) hull-mounted sonar

Spherion B is a hull-mounted, long-range active sonar for ASW surface combatants. It comprises a spherical hull-mounted array with an electronic processing system that allows for real-time computation in transmission and reception modes; three-dimensional stabilisation to compensate for pitch, roll and yaw in the parent vessel; and a beam-tilting capability to counter adverse sound velocity profiles and strong reverberation. The transmitter is omnidirectional, with sectoral transmissions in CW and FM modes, various modes including TRDT. The receiver has 36 preformed beams stabilised in azimuth and elevation, and advanced processing with replica correlator in FM and spectrum analysis (FFT) in CW.

Specifications
Acoustic array: Spherical with 160 individual transducers
Frequency: 7 kHz (approx)

Manufacturer/Contractor
Thomson Sintra Activités Sous-Marines, Sophia Antipolis Cedex, Paris.

Towed arrays

Provision is made in both Australian and New Zealand ships for a towed array to be fitted in due course. In the Australian ships this is likely to be the Australian-developed Kariwara, but the RNZN has yet to select a system for its ships.

COMMUNICATIONS AND DATALINKS

Data-link

Link 11
Communications: SHF Satcom (believed to be receive only)
Interrogator: Cossor Electronics IFF Mk XII

Vesta-VC helicopter transponder/datalink system

Vesta consists of a helicopter-mounted transponder which transmits a VHF signal when the aircraft is illuminated by the ship's search radar. This reply is picked up by the Vesta shipborne component to produce and tag a clear echo on the ship's radar screen.

The helicopter is equipped with two spherical antennas for reception of the ship's search radar signals. The transponder generates a VHF reply containing a number of code pulses for identification purposes. On board the ship there are two simple rod antennas to receive the transponder signals, which are then routed via the receiver (and extractor unit) to the ship's radar display. The Vesta system is controlled by either a control unit and a radar indicator, or a data handling system.

The Vesta system can indicate unambiguously any number of Vesta-equipped helicopters on the ship's radar display. A limited number of helicopters can be identified by means of preselected codes.

Specifications
Transmission frequency: VHF
Radar reception frequency: 1-10 GHz
Transmission power: 10 W
Pulse length: 2 µs
PRF (helicopter part): 20 kHz without code
Sensitivity (ship part): −78 dBm
Range: 0-124 n miles (230 km)
Number of codes: 5 (optionally 64)
Number of co-operating radar systems: 4

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Navigation system

Sperry Mk 49 SINS.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 24.42 × 14.8 m (80 × 48 ft)
Hangar: 1, single hangar
Landing aid: The Canadian Indal RAST system is fitted

Sikorsky S-70B-2(RAN) Seahawk

Specifications
Dimensions:
main rotor diameter: 16.36 m (53.66 ft)
tail rotor diameter: 3.35 m (11.00 ft)
length overall: 15.26 m (50.0 ft)
height (top of rotor head): 3.79 m (12.43 ft)
Weights:
empty: 6,191 kg (13,648 lb)
mission gross weight: 9,182 kg (20,244 lb)
Performance:
max at 1,525 m (5,000 ft): 126 kts (234 km/h)
vertical rate of climb: 213 m (700 ft)/min
Power plant: 2 General Electric T700-GE-401C turboshafts rated at 1,417 kW (1,900 shp); transmission rating 2,535 kW (3,400 shp)
Accommodation: 3 (Pilot and airborne tactical officer/back-up pilot in cockpit, sensor operator in specially equipped station in cabin)
Communications: Collins AN/ARC-159(V)2 UHF, Collins AN/ARC-174(V)2 HF, Hazeltine AN/APX-76A(V) and Bendix/King AN/APX-100(V)1 IFF transponders, TSEC/KG-45(E-1) communications security set, TSEC/KY-75 voice security set, Telephonics OK-374/ASC communications system control group
Radar: Thomson Thorn SuperSearcher
Mission: Sikorsky sonobuoy launcher, Edmac AN/ARR-84; CAE AN/ASQ-504(V) internal MAD; Raymond MU-670/ASQ magnetic tape memory unit, Astronautics IO-2177/ASQ altitude indicator, Fairchild AN/ASQ-164 control indicator set, Fairchild AN/ASQ-165 armament control indicator set, Computing Devices UYS-503 and CV-3252/A converter display, Control Data AN/AYK-14 (XN-1A) digital computer, Raytheon AN/ALQ-142 ESM, Rockwell Collins DHS-901 datalink and telemetry. AN/AAQ-16 FLIR was fitted in Gulf War.
Self-defence: AN/ALE-47 chaff/flare dispensers and AN/AAR-47 missile detectors during Gulf War
Armament: 2 Mk 46 torpedoes

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 General Electric LM2500-30 gas turbine; 22.5 MW (30,172 hp) sustained; 2 MTU 12V 11634 TB83 diesels; 6.5 MW (8,840 hp(m)) sustained
Shafts: 2
Propellers: cp
Auxiliary power: 4 MTU 8V 396 TE54 diesel generator sets; 1,160 kW each

FURTHER INFORMATION

PROGRAMME

After many years of buying British warships, the Australian Navy switched in the 1960s to US ships, purchasing, first, three 'Charles F Adams' class destroyers between 1962 and 1967 ('Perth' class), followed by six 'Oliver Hazard Perry' class frigates between 1977 and 1993 ('Adelaide' class). When, therefore, there was a competition in the late 1980s for a new class of frigate it came as a considerable surprise that the winner was Blohm + Voss with a variant of the MEKO 200 design. The RNZN also found itself needing to find replacements for its ageing British-built 'Leander' class frigates and joined with the RAN in a joint programme.

The contract was signed with the (then) Australian Marine Engineering Consolidated (Amecon), now Transfield Shipbuilding, Melbourne, Victoria, on 10 November 1989 to build eight Blohm + Voss-designed MEKO 200 ANZ frigates for Australia and two for New Zealand, which has an option for two more.

Construction of the first ship started on 27 March 1992, with modules being constructed at Newcastle and Whangarei, and then shipped to Melbourne for assembly. Ships one and three are for the Australian Navy, while the second and fourth are for New Zealand. The remaining six ships of the current order are for Australia; known as 'Batch 2' they will be fitted with Evolved Sea Sparrow.

The total contract runs for 15 years and is the largest defence contract ever signed in Australia. The fixed-price contract was worth $3.8 billion in 1988 dollars.

DESIGN

The design is known as MEKO 200 ANZAC and is based on the Portuguese variant MEKO 200PN. Perhaps the most unusual feature is the propulsion system, which is unlike that of any other MEKO variant, with two MTU diesels but only one LM 2500 gas turbine, giving a lower maximum speed of 27 knots (compared to 30+ for the others), but a very considerable increase in range.

It was originally planned to install a 76 mm gun, but the army insisted on 127 mm for increased terminal effects in the shore bombardment role.

One of the more surprising aspects of the ships is the number of weapons and sensors which they are 'fitted for but not with' (FFBNW). This category includes eight Harpoon SSMs, two Phalanx CIWS, a second Sea Sparrow launcher, the after fire-control radar and a towed-array sonar.

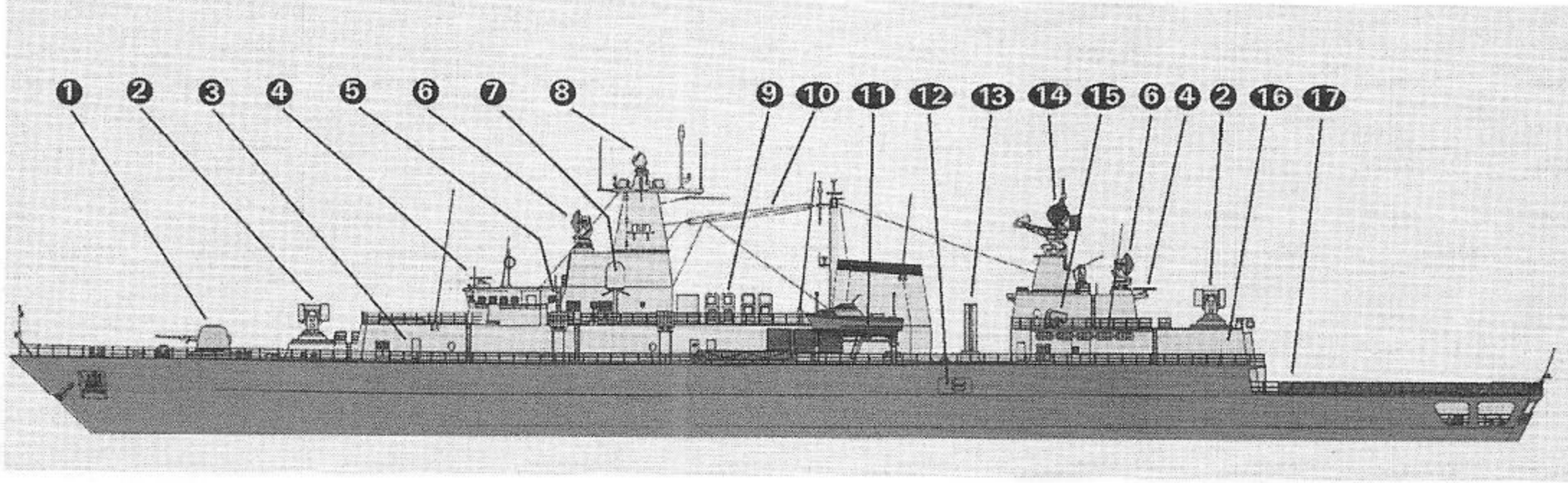
Various sensible economies are being achieved by transferring equipment from older ships. Thus, for the Australian ship, fin stabilisers and Mk 32 torpedo tubes are being transferred from the 'River' class frigates.

THE FUTURE

It is reported that the Australian Navy is conducting a reassessment of the ships' 'war-fighting' capabilities, and it could well be that this will concentrate on the current absence of a long-range anti-ship missile, which may be alleviated by the possible purchase of long-range anti-ship missiles for the shipboard helicopter. Another area of concern must be the lack of a close in weapons system. The outcome of such a study could be incorporated into a possible stretched version of this class, which is being considered as a replacement for the 'Perth' class DDGs.

The New Zealand Navy is very keen to convert its options for two further hulls into an actual order. To this end, stringent economies are being applied elsewhere in the navy programme in an endeavour to create the necessary financial 'head-room'.

BRANDENBURG



Brandenburg
1 *76 mm/62 cal OTO Melara Compact gun* **2** *RAM missile launcher* **3** *Mk 41 Mod 3 vertical launcher for NATO Sea Sparrow missiles* **4** *Raytheon Raypath navigation radar* **5** *Single Rheinmetall Rh-202 20 mm cannon (one per side)* **6** *HSA STIR-180 fire-control radar* **7** *Matra-Marconi Satcom antenna (one per side)* **8** *HSA SMART-S targeting radar* **9** *Four launchers for anti-ship missiles* **10** *HF antennas* **11** *Launch (two per side)* **13** *Gantry for use during replenishment at sea* **14** *HSA LW-08 early-warning radar* **15** *Breda SCLAR decoy launcher (one per side)* **16** *Twin hangars for Mk 88 Lynx or NH-90 helicopters* **17** *Flight deck*

GENERAL SPECIFICATIONS

Operator: Germany
Type: Type 123

Class: BRANDENBURG

Building: 0
Active: 4

Displacement:
standard: 3,660 t
full load: 4,700 t

Dimensions
Length: 138.85 m (455.54 ft) (oa); 126.9 m (416.3 ft) (wl)

Beam: 16.70 m (54.8 ft) (oa); 15.74 m (51.64 ft)
Draught: 4.35 m (14.27 ft)

Speed: 29 kts (gas turbines); 18 kts (diesels)
Range: 4,000 n miles at 18 kts

Endurance: 21 days
Complement: 199 plus 19 aircrew

SHIPS

BRANDENBURG (F 215)

Builder	Blohm + Voss, Hamburg, Germany
Laid down	11 Feb 1992
Launched	28 Aug 1992
Commissioned	14 Oct 1994

SCHLESWIG-HOLSTEIN (F 216)

Builder	Howaldtswerke, Kiel, Germany
Laid down	1 Jul 1993
Launched	8 Jun 1994
Commissioned	1 Dec 1995

BAYERN (F 217)

Builder	Thyssen Nordseewerke, Emden, Germany
Laid down	16 Dec 1993
Launched	30 Jun 1994
Commissioned	May 1996

MECKLENBURG-VORPOMMERN (F 218)

Builder	Bremer Vulkan, Bremen, Germany
Laid down	23 Nov 1993
Launched	Feb 1995
Commissioned	Nov 1996

WEAPONS SYSTEMS

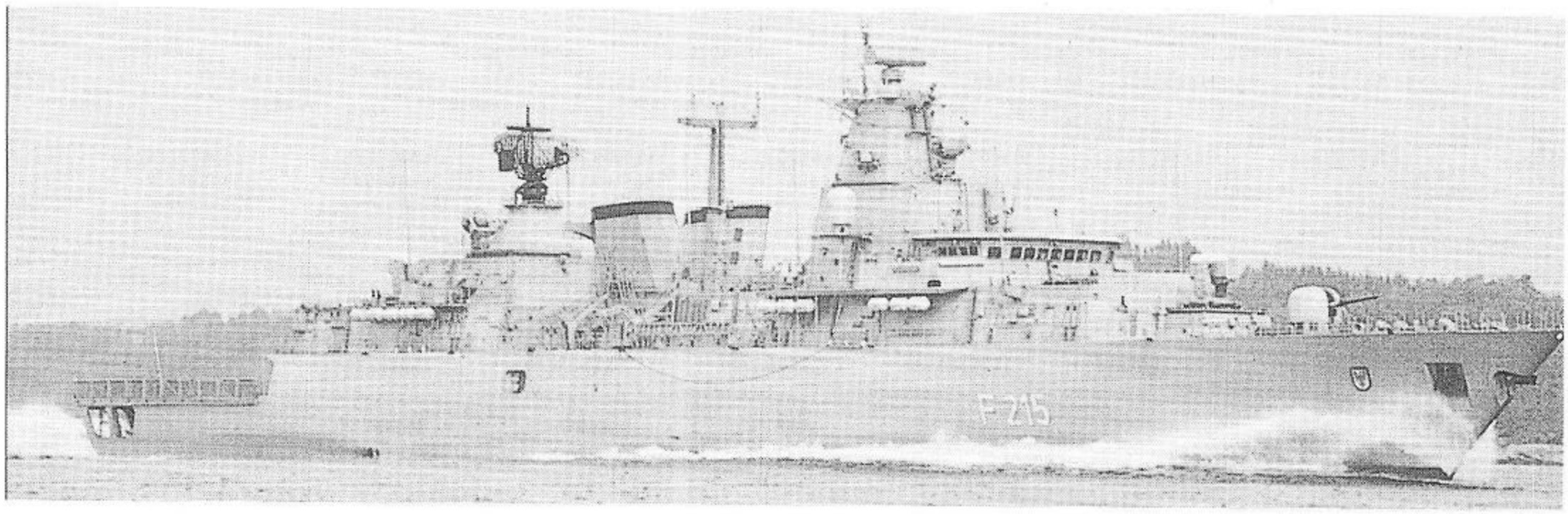
SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 38 medium-range anti-ship missile

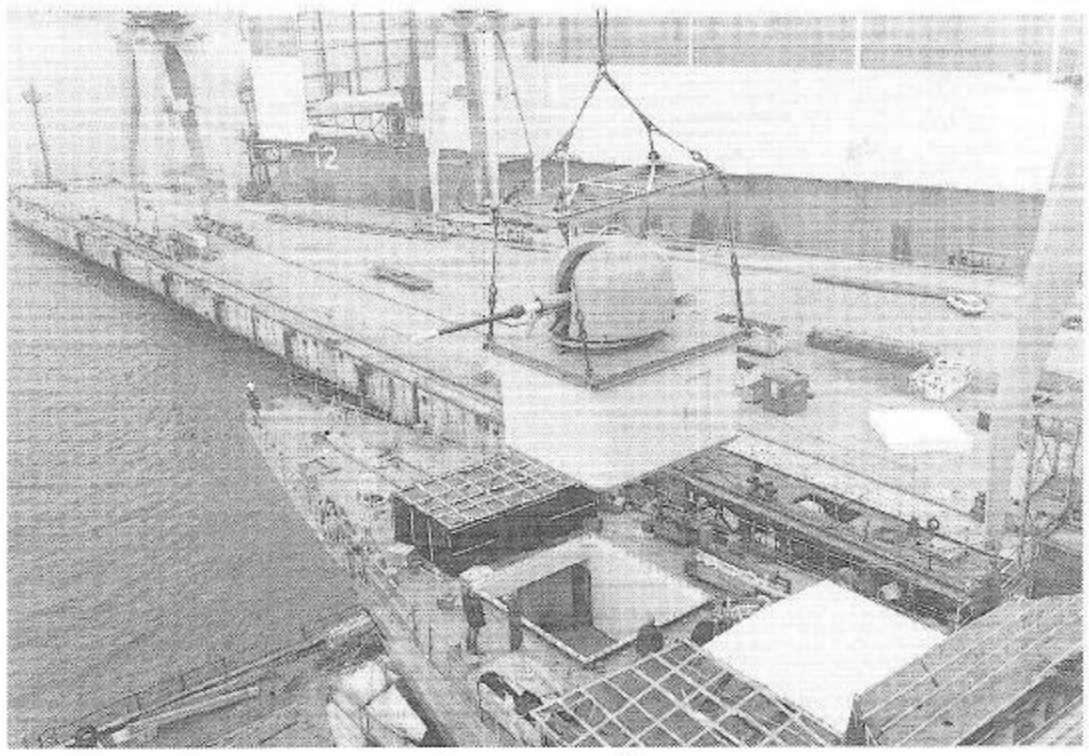
Four Aerospatiale MM 38 Exocets are mounted between the foremast and the stacks in two pairs of individual ITS *(Installation de Tir Standard)* launcher-containers, which point across the ship and are inclined at an angle of 12° to the horizontal. Targets are acquired by the ship's search radar and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence. This involves turning on the thermal battery, releasing the mechanical safety locks, igniting the booster, and, finally, breaking the umbilical cord; the total process takes some 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change of course during its flight. A salvo may be fired in 12-20 seconds.

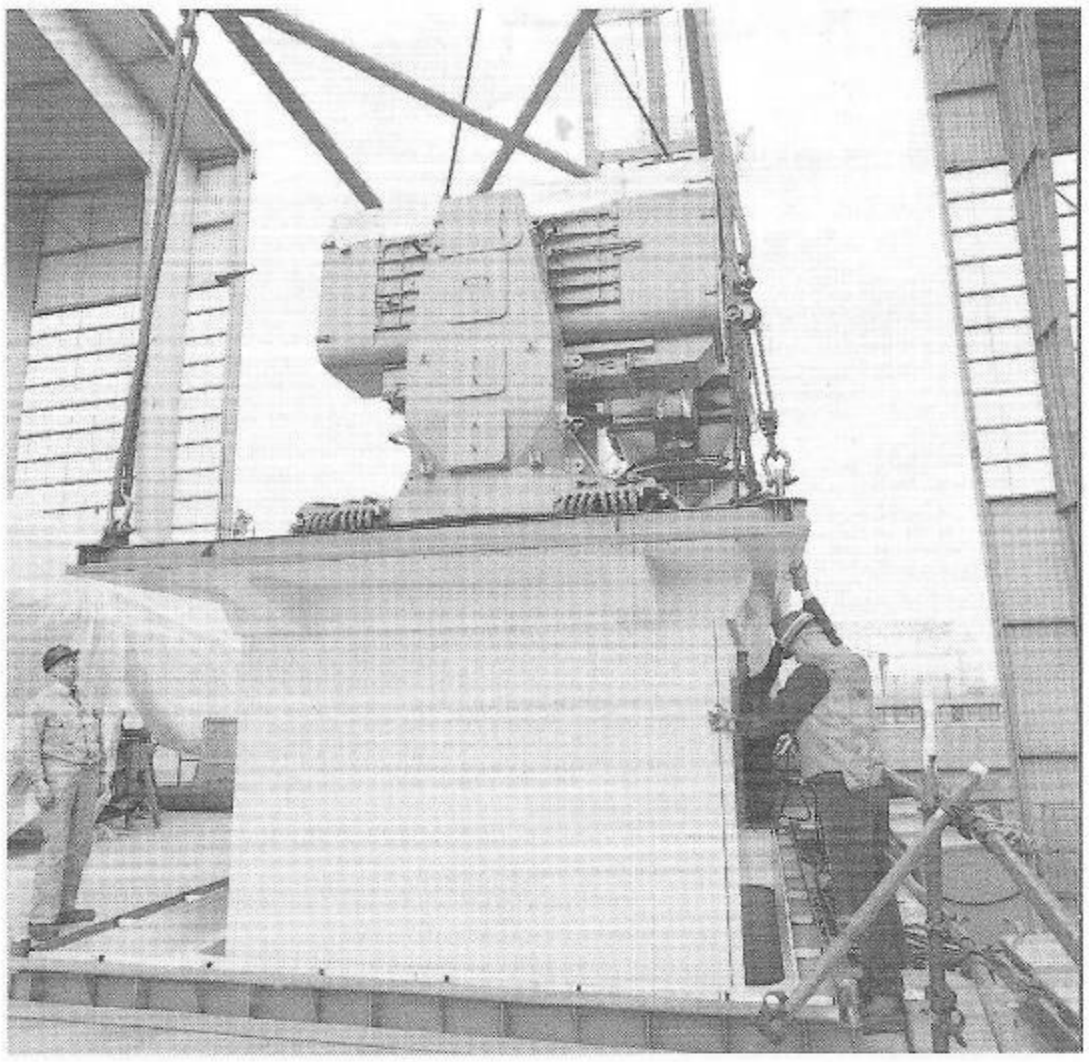
The attack consists of three phases:

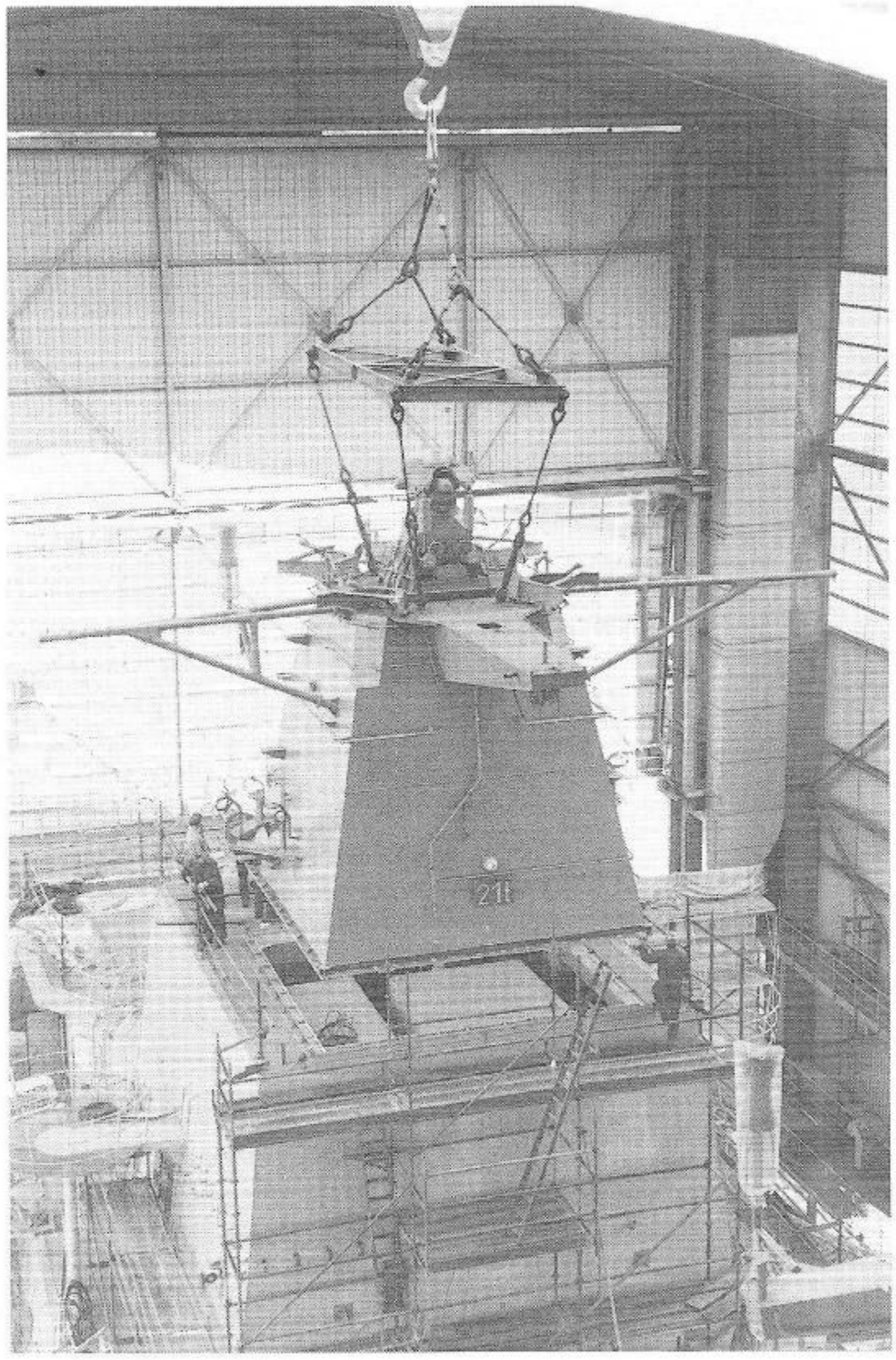
Cruise phase. As soon as the missile clears the container powered by the sustainer motor, it flies towards the general location of the target at a height of about 100 m (328 ft), which is low enough to reduce the chance of detection but adequate for target acquisition. This leg, which can be as long as 22 km, ends when the

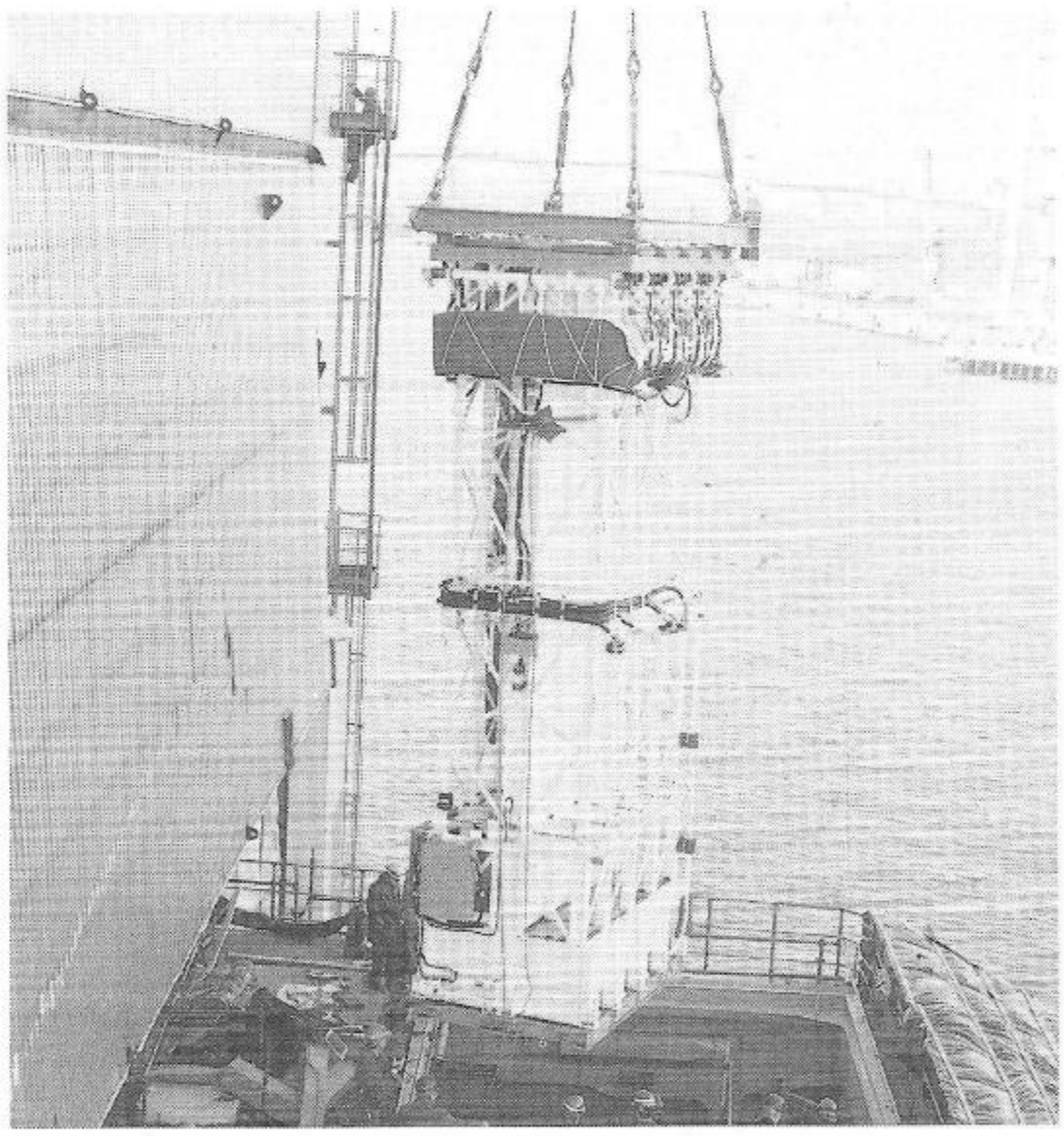


Brandenburg *(F 215), nameship of the class. Four have been built for the Federal German Navy and the design is also being used as the basis for the Type 124 air defence ships* (FGS Brandenburg)









The Brandenburg is not a MEKO design as such, but it uses the modular system developed by Blohm + Voss for the MEKO ships. This series of pictures shows various items being installed, including, clockwise, from top left: the 76 mm gun module (1); the RAM launcher module (2); the eight cell NATO SeaSparrow ULS module (3); and the mast module (4)

seeker acquires the target. This seeker is a Dassault Electronique ADAC (Auto Directeur Anti-Clutter) active monopulse radar, working in the I band (8-10 GHz), which has a typical range of 13 n miles (24 km) against a target such as an FAC.

Approach phase. On detecting the target the missile descends to 9-15 m (29.5-49.2 ft).

Terminal phase. During this final phase the missile descends to 8 m (26.2 ft) (2-5 m (6.5-16.4 ft) in a calm sea) for a sea-skimming run in to the target.

The MM 38s for these four frigates were taken from the Type 101A 'Hamburg' class, which they replaced. The launch frames are easily adaptable and could take Harpoon or the new supersonic Franco-German ANNG *(anti-navire, nouvelle génération)* anti-ship missile, currently under development.

Specifications

MM 38

Length: 5.21 m (17.1 ft)
Diameter: 35 cm (13.8 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s
Booster: 100 kg (220 lb) SNPE Epervier boost motor, weight 100 kg (220 lb), burn time of 2.4 s
Warhead: Luchaire 165 kg (363.7 lb) fragmentation warhead
Fuzes: Delayed impact fuze and autopilot-controlled proximity fuze

Manufacturer/Contractor

Aerospatiale Tactical Missiles, Chatillon Cedex, France.

SURFACE-TO-AIR MISSILES (SAM)

GMVLS Mk 41 Mod 3 Vertical Launch System

The 'Brandenburg' class frigates are equipped with a Guided-Missile Vertical Launch System (GMVLS) Mk 41 Mod 3 with 16 launch tubes. The launcher module is 6.86 m (22.5 ft) high and contains sixteen Mk 22 canisters which are 5.79 m (19 ft) deep and weigh 1,503 kg (3,313 lb) (complete with missile). The current installation consists of two sub-modules of eight tubes each, but there is ample space, both above and below decks, for another two eight-cell launchers.

Raytheon Sea Sparrow point-defence missile system

Sixteen RIM-7P Sea Sparrow missiles are carried and the system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast/fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications

RIM-7P

Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 231.5 kg (510 lb)

There are two large torpedo rooms at the 01 deck level, either side of the main internal passageway. The tubes are fixed and angled outwards, their muzzles pointing through a rectangular aperture in the ship's side (directly below the LW-08 radar antenna in the picture)

Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors

Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

RIM-116A RAM close in system

There are two 21-cell Mk 49 launchers for the Rolling-Airframe Missile (RAM): one on the foredeck, the other aft on the roof of the twin hangars. RAM is a lightweight, close in, quick-reaction, anti-missile defence system, the RIM-116 missile being based on the Sidewinder air-to-air missile, but with significant modifications, enabling it to be used as a fire-and-forget system. There is an infra-red, terminal guidance seeker in the nose (taken from the Stinger man-portable surface-to-air missile), behind which is a new dual-mode passive radio frequency seeker for mid-course guidance. Most of the rear of the missile is based upon Sidewinder components. Missiles are stored in sealed launcher containers, which are manually loaded into the 21-cell Mk 49 RAM Standard Launchers.

Radar and electro-optical sensors provide details of target location, distance and speed, while the ship's ESM system inputs data on the target's radar frequency, as well as correlating radar data on location. On launch, the missile is spun-up by a rifling band as it is driven down the launch tube, and then as it leaves the launcher the four tail fins deploy which maintain the spin. Aerodynamic control is provided by the two canard surfaces, which also deploy after launch. The autopilot and control system maintain the initial line of sight course towards the target and then the RF seeker is activated and once this acquires the target it takes control of the guidance system and makes the appropriate course alterations. The IR seeker is also activated and when a sufficient signal-to-noise ratio is achieved this takes over guidance control for the terminal phase. The missile is capable of manoeuvres up to 20 *g* in any direction. The system can only be fired automatically at the moment, but manual control will become possible with Block 2 missiles.

Specifications

Mk 49 RAM Standard launcher
Traverse: 360°
Elevation: −25 to +80°
Turning circle: 3.27 m (10.73 ft)

RIM-116 missile
Length: 2.79 m (9.1 ft)
Diameter: 12.7 cm (5 in)
Wing span: 43.4 cm (17.1 in)
Weight: 73.6 kg (162 lb)
Speed: Mach 2
Range: 5.17 n miles (9.6 km)
Warhead: 9.09 kg fragmentation blast WDU-17B
Motor: Hercules/Aerojet Mk 36 solid propellant rocket

Manufacturer/Contractor

RAM Systems GmbH, D-85521 Riemerling, Germany.

TUBES

Four 324 mm US Mk 32 Mod 9 (two twin) torpedo tubes are mounted within the superstructure, immediately below the RAS station.

The spacious torpedo compartments are sited either side of the main corridor on the main deck level and house a number of reloads and reloading gear. The tubes launch the torpedoes through permanently open apertures in the ship's side at a forward angle of 45° to the ship's centreline.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 324 mm torpedoes

Specifications

Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 232 kg (511.5 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Monopropellant
Speed: 45 kts
Range: 4.5 n miles (8.33 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Mk 75 Compact

There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck, which is mounted in a MEKO-type module on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air-defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission. In the anti-surface role, the 76 mm gun can be controlled either from the CIC or by a new target designation sight, two of which are installed, one on each bridge wing. This sight is based on that used in the Type 122, but has been improved, as a result of the FGN's experiences in the Adriatic, by the addition of a firing button, enabling the 76 mm gun to be fired from the bridge under full visual control.

Specifications

Calibre: 76.2 mm (3.0 in)
Barrel length: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

Rheinmetall Rh-202 20 mm cannon

One of the lessons of Gulf deployments is the need for a light, short-range gun. Therefore, the Type 123 ships mount two Rheinmetall Rh-202 20 mm cannon, which were taken from decommissioned Klasse 520 landing craft. These are mounted in the bridge wings, abaft the target designation sights.

Manufactuer/Contractor

Rheinmetall, Germany.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

DASA FL 1800S Stage II

The FL 1800S Stage II ESM/ECM suite is based on the earlier FL-1800S, but with considerable improvements in the areas of signal processing, analysis, MMIC and ECM. A new channelised receiver with nine sub-bands provides extremely accurate frequency measurement and CW resistance. Two fully integrated superheterodyne receivers have been incorporated for special analysis of pulses and for later upgrade to fit in a 'fingerprinting' system. Expanded capacity threat libraries are provided, which include onboard reprogrammable modules for use in out-of-area missions. The system handles several threats simultaneously, regardless of frequency or direction of arrival.

The ECM system consists of a tracking processor for tracking ECM emitters and to control the timing of both synchronous and asynchronous ECM, modulators for generating ECM modes (ECM-RF), and multibeam array ECM antennas for simultaneous generation of countermeasures, even against multiple threats. A different collection of ECM modes is used to counter each threat, with a look-through mode employed to verify the effectiveness of jamming, and to update the ESM situation in general. The effective radiated power of the jamming is such that it is sufficient to cover the ship's radar cross-section.

Specifications

Frequency range: 2-18 GHz
Azimuth coverage: 360°
Elevation coverage: −10 to +60°
Polarisation: 45° linear for receiving channel; circular for DF
DF accuracy: 5° typical RMS

Manufacturer/Contractor

Daimler-Benz Aerospace AG, Sensor Systems Division, Ulm, Germany.

DECOYS

OTOBREDA 105 mm Rocket Launcher (SCLAR)

The SCLAR 105 mm rocket launcher system provides defence against radar and IR homing missiles, confuses enemy radars, and provides illumination for visual fire control at night. Different types of rockets can be loaded in various arrangements (long-range chaff, medium-range chaff, illuminating) to permit mixed salvos. The remote fire-control unit is used to select the number and types of rockets to be loaded and to set the fuzes and carry out the launch sequence. There are two 20-tube launchers trained and elevated by remote control. The control unit is linked to the ship's radar and a control panel in the ECM compartment to provide the necessary operating signals. The data needed to stabilise the two launchers against pitch and roll is provided by the ship's gyrocompass.

There are four types of rocket, all of which have double-base propellant motors, folding fins and electronic fuzes.

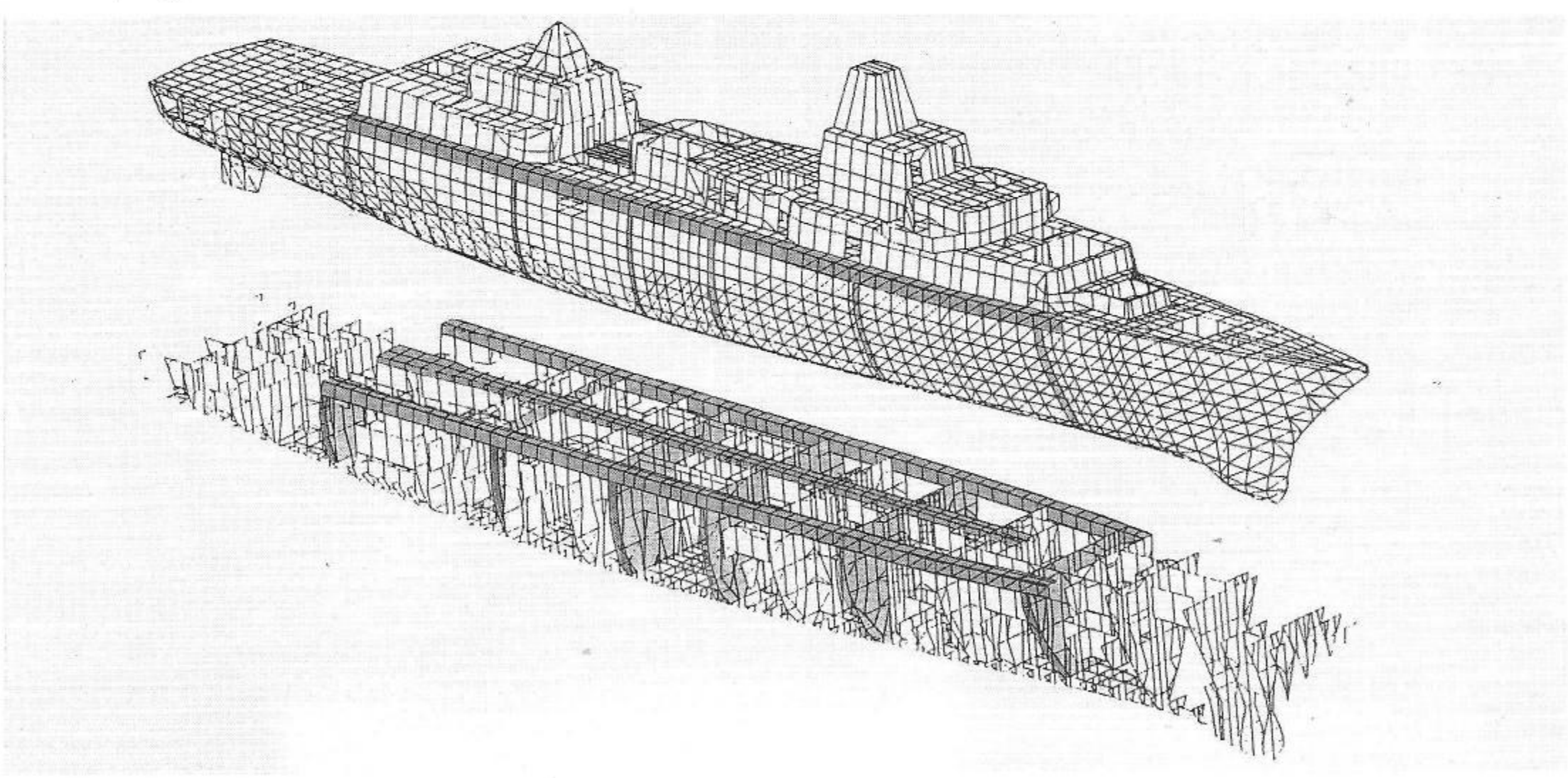
Specifications

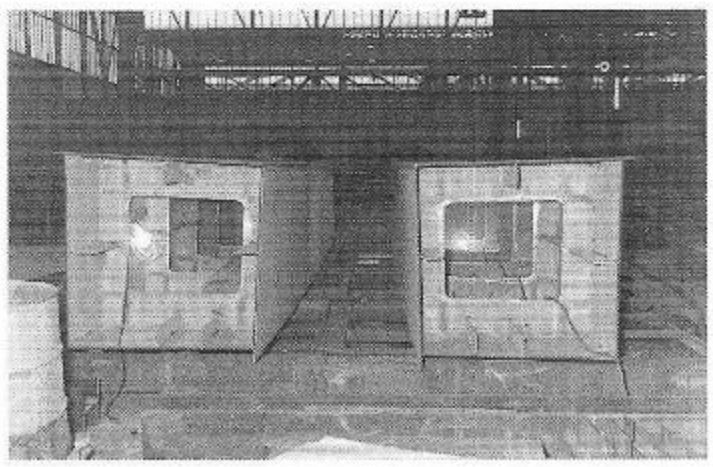
Launcher
Traverse: 300° at 60°/s
Elevation: −5 to +60° at 30°/s
Number of tubes: 20
Diameter: 105 mm
Rate of fire: 1 rd/s (approx)

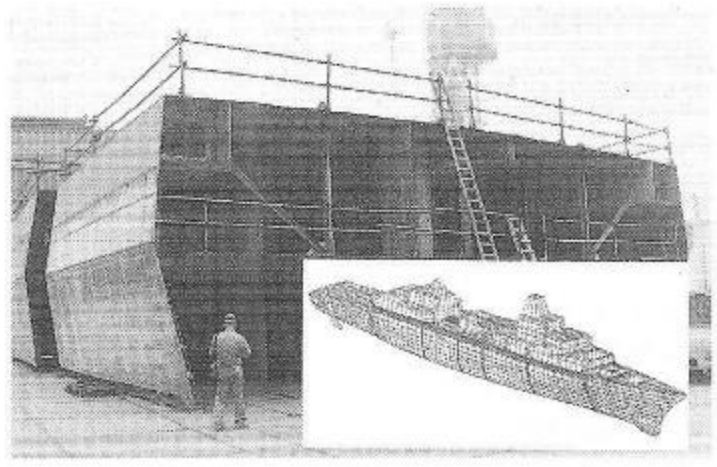
These rockets are:

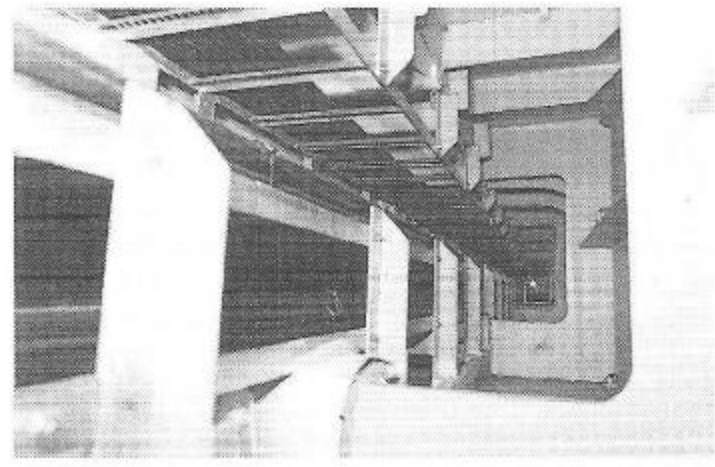
Rockets

Rocket	Role	Range	Length	Weight of complete round	Payload
SNIA 105 LR-C	Chaff distraction	12,000 m (13,120 yd)	1.85 m (6.07 ft)	27 kg (60 lb)	10.2 kg (22.5 lb)
SNIA 105 MR-C	Chaff seduction	4,700 m (5,140 yd)	1.83 m (6.0 ft)	29 kg (64 lb)	17.4 kg (38.4 lb)
SNIA 105 MR-IR	Infra-red seduction	5,000 m (5,470 yd)	1.83 m (6.0 ft)	29 kg (64 lb)	10.2 kg (22.5 lb)
SNIA LR-I	Illuminating	4,000 m (4,370 yd)	1.85 m (6.07 ft)	27 kg (60 lb)	10.2 kg (22.5 lb)









All three girders are constructed from 16 mm thick steel plate, the two outer girders being 1.2 m square (above left), while the central girder has slightly different dimensions (1.5 × 0.6 m) to give adequate headroom in the central passageway running below it at the 02 deck level (top, lower graphic). There are also six double-skinned bulkheads, which both support the longitudinal girders after damage and also provide subdivisions within the ship (top, top graphic). Individually, these girders have a high intrinsic buckling strength and will not themselves be degraded by blast or fragment damage. Taken together, however, they give immense strength to the entire structure, providing a very stiff backbone, with a high ultimate bending moment. The outer girders are also used as highly survivable carriers of certain of the ship's services, such as power distribution cabling (above, right) (All pictures and diagrams: Blohm & Voss)

Frigate Bayern *(F 217) at St Petersburg in July 1996. Although classified as frigates, these four ships are as large as pre-war light cruisers and they are very spacious* (H & L van Ginderen Collection)

Manufacturers/Contractors

OTOBREDA, Rome, Italy (launcher).
SNIA BPD (rockets).

AN/SLQ-25 Nixie noisemaker

One AN/SLQ-25 Nixie (Phase 1), a solid-state, modular design electroacoustic countermeasures decoy system is mounted on the port side of the quarterdeck. It protects the ship from acoustic homing torpedoes and consists of a remote-control unit; a countermeasures transmitter which generates and amplifies the signals; a power-operated double-drum winch for streaming/recovering the towed bodies; and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them, while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located on the quarterdeck, with the towed bodies deployed through the transom. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm long (3.10 ft), 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor

Aerojet ElectroSystems, Sacramento, California, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SATIR F 123 tactical data handling system

SATIR *(System zur Auswertung Taktischer Informationen auf Raketenzerstoerren)* is a command and weapon control system *(Führungs und Waffeneinsatzsystem* (FüWes)) with the hardware and software integrated by the Bundesamt für Wehrtechnik und Beschaffung (BWB) and the Kommando Marine Führungssystems (KdoMFüSys) and then interfaced with sensor and weapon systems. The original SATIR system was fitted in the three 'Lütjens' class destroyers and entered service in March 1969, but there have since been two development programmes, the first for the F 122 frigates (SATIR Z103B) and subsequently the SATIR F 123 system for 'Brandenburg' class frigates.

SATIR F 123 is a mainframe architecture system using BWB software in the CMS-2Y language running on a 32-bit Unisys AN/UYK-43 computer, which has a 2.56 M memory and an operating speed of between 3 and 4.9 Mips. The system acquires data from a variety of sensors, and processes and displays them to ensure effective engagement of airborne, surface and subsurface targets. The CIC is one deck below the bridge, with four banks of consoles grouped by function, with ASW and helicopter management to port, information management and link control forward, weapon control to starboard, and command and control to the rear overlooking the other three groups. Normal CIC occupancy is approximately 20, increasing to 30 at action stations. All visual information is colour.

A modular software structure was adopted and four packages were produced for operations, maintenance, support and administration. All operational software is run on the UYK-43 computer but basic software is run on twelve Atlas Elektronik BM 802-52 consoles designated by the German Navy Querschnittskonsole Marine or QKM (Cross-section Naval Consoles). In the event of the computer failing these consoles can continue to provide a minimum level of functionality. The commanding officer does not have his own console but uses that of either the tactical action officer or the executive officer. Radar video data is transmitted both directly to the display consoles and, via the video extractor, to the central computer and there is partial integration of the IFF system.

Manufacturers/Contractors

BWB, D-56057 Koblenz, Germany (prime).
Unisys, Great Neck, New York, USA (subcontractor 1).
STN Atlas, Bremen, Germany (subcontractor 2).

COMMUNICATIONS AND DATALINKS

NATO Link 11
NATO Link 14 (fitted for but not with (FFBNW)).
SCOT antennas. Two Matra Marconi SCOT 1A Satcom.

RADARS

Set	LW 08	SMART	STIR 180 (two)	Raypath (AN/SPS-64(V)) (two)
Company	Signaal	Signaal	Signaal	Raytheon
Role	Air search	Air/surface search 3D	Fire control (SAM)	Navigation
Band	D	F	I/J/K	I/J (9,375-9,420 MHz)
Range	2-130 km for 0.1 m² target	45 km for 0.1 m² target	76 n miles (140 km)	18.3-118.5 n miles
Beam	2.2 × cosec² to 40°	2° × 90°	1.4°	1.25 × 22°
Peak power	150 kW	150 kW	220 kW	50 kW
Gain	30 dB		—	28 dB
Pulsewidth		0.6 µs (compressed)	0.29 µs	0.06/0/5/ 1.0 µs
PRF	1,000/500 pps		1,800/3,600 pps	3600/1800/900 pps
Scan rate	7.5/15 rpm	27 rpm	—	33 rpm

Brandenburg *(F 215). The 76 mm gun and RAM launcher can be seen clearly, but the eight cell vertical launcher for Sea Sparrow immediately before the bridge is completely hidden from view* (H & L van Ginderen Collection)

SONAR

STN Atlas DSQS 23BZ (AS 96)

The F 123 frigates are fitted with the DSQS-23BZ hull-mounted, low-frequency sonar, which has the STN Atlas company designation ASO 96. DSQS-23BZ is designed for computer-aided detection, localisation and classification over the entire 360° azimuth and is of a modular design enabling it to provide underwater telephone; automatic target tracking; classification; ray trace; intercept; torpedo warning; vertical stabilisation; simulation; interface to 'own ship's' fire-control system; underwater survey display and torpedo command functions, together with, if one is fitted, interface to a towed array sonar. The hull-mounted transducer is 2.5 m (8.2 ft) in diameter and 1 m (3.28 ft) high. The system is designed to transfer data on up to 10 targets automatically into the SATIR system. No decision on fitting a towed array has been made, although the relevant space and facilities are incorporated in the ships as built.

Manufacturer/Contractor

STN Atlas Elektronik GmbH, Bremen, Germany.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 25.4 × 16.7 m (83 × 55 ft)

Hangar: There is a large, laterally split hangar, which accommodates 2 helicopters

HELICOPTERS

The current type is the Westland Mk 88 Lynx ASW helicopter. Under current plans this will be replaced by the Eurocopter NH-90s sometime after 2000.

Specifications

Dimensions

main rotor diameter: 12.80 m (42.00 ft)

tail rotor diameter: 2.21 m (7.25 ft)

length overall (rotors turning): 15.165 m (49.75 ft)

Weights

empty: 2,740 kg (6,040 lb)

empty, equipped (ASW): 3,343 kg (7,370 lb)

Performance:

cruising speed: 125 kts (232 km/h)

speed for max endurance: 70 kts (130 km/h)

max rate of climb: 661 m (2,170 ft)/min

time on station (ASW) 50 n miles (93 km) radius: 2 h

max range: 320 n miles (593 km)

max endurance: 2 h 50 min

Power plant: 2 Rolls-Royce Gem 42-1 with max contingency rating of 835 kW (1,120 shp)

Crew: 2 (pilot and co-pilot/observer)

Radar: Ferranti Sea Spray Mk 1 lightweight search and tracking radar

Mission: Bendix AN/AQS-18 dipping sonar

Navigation: Racal RNS 252 GPS-aided INS; Doppler 91

ASW armament: 2 Mk 46 homing torpedoes; depth charges; possibly DM 4A1 torpedoes and/or anti-ship missiles in future

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)

Main machinery: 2 General Electric GE-7LM2500 9A-ML gas turbines; 38 MW (51,600 shp) sustained; 2 MTU 20V 956 TB92 diesels; 8.14 MW (11,400 bhp) sustained

Shafts: 2

Propellers: cp

Auxiliary power: 4—750kW MWM TBD-602-V16K diesel generators

FURTHER INFORMATION

PROGRAMME

The order for four Type 123s was placed on 28 June 1989, with one being built by each of the four major German shipyards The design, selected in October 1989, was by Blohm + Voss. The class was originally known as the 'Deutschland' class.

DESIGN

German analysis of the Falklands (Malvinas) war concluded that while every effort must be made to detect and destroy incoming missiles, some hits, particularly in a mass attack, are inevitable; therefore, ships must be very strong, with emphasis on survivability after a missile hit.

One of the principle means of achieving this is the use of three large, continuous box girders at the strength-deck level, stretching from the forward end of the superstructure to the after end of the hangar. Laterally, the ship's hull and superstructure are divided by bulkheads into 12 separate and independent compartments, each of which is fitted with its own ventilation module containing all the necessary electrical equipment and its own NBC filter station. Main ventilation ducts are situated near the centreline of each compartment and are made of steel, while the ducting is networked so that each air unit can supply fresh air to either of the two adjacent modules. The ducting is also designed to clear the smoke out of a compartment after a fire has been extinguished.

Type 123 is not a MEKO design, not least because it displaces some 1,000 t more than the largest MEKO, but it employs the MEKO modular principle, with 14 modules, each easily removable and shockmounted, containing outfits such as communications, sonar equipment and weapons.

The design is spacious, with sufficient volume, electrical power and 270 t available for growth during the ships' planned 30-year lives. Such growth could include a further 16 vertical launch tubes, a towed sonar array, a heavier gun or increased data processing capacity.

DAMAGE CONTROL

There is a single damage control (DC) headquarters (DCHQ), with a reserve DCHQ and four DC section bases, one in each of the four DC zones. DC systems essential for survival are remotely controlled from DCHQ, but should DCHQ be lost, these systems can be

controlled from the reserve DCHQ or, in the last resort, from the section bases. There are numerous near-vertical staircases, giving excellent mobility to the DC teams without breaching the integrity of the module. The sea-water firefighting system is also arranged on a compartment basis with twelve firefighting pumps, ten electrically driven and two diesel driven, all with their own rising pipes, one per compartment. Other survivability features include widespread provision of breathing apparatus, drain-down pipes to dispose of water used in fighting fires (a lesson from the *Stark* incident in the Gulf) and the use throughout the ship of special heat-resistant paint.

Each compartment has its own electrical power distribution panel and, to enhance survivability, all main power supply cable runs are contained in the port and starboard box girders. Outside such well-protected areas, cabling of all types is mounted clear of the walls to protect against heat and, in addition, all sheathing uses fire- and fume-proof materials.

STEALTH

Superstructure and hull are carefully angled, which, in combination with certain classified measures, is claimed to reduce radar cross-section (RCS) by about 90 per cent compared to the Type 122. Infra-red suppression is being worked on, especially 'glint' from the ship's sides, which is due to reflection, rather than from internal heat sources and is a problem by no means unique to the Type 123.

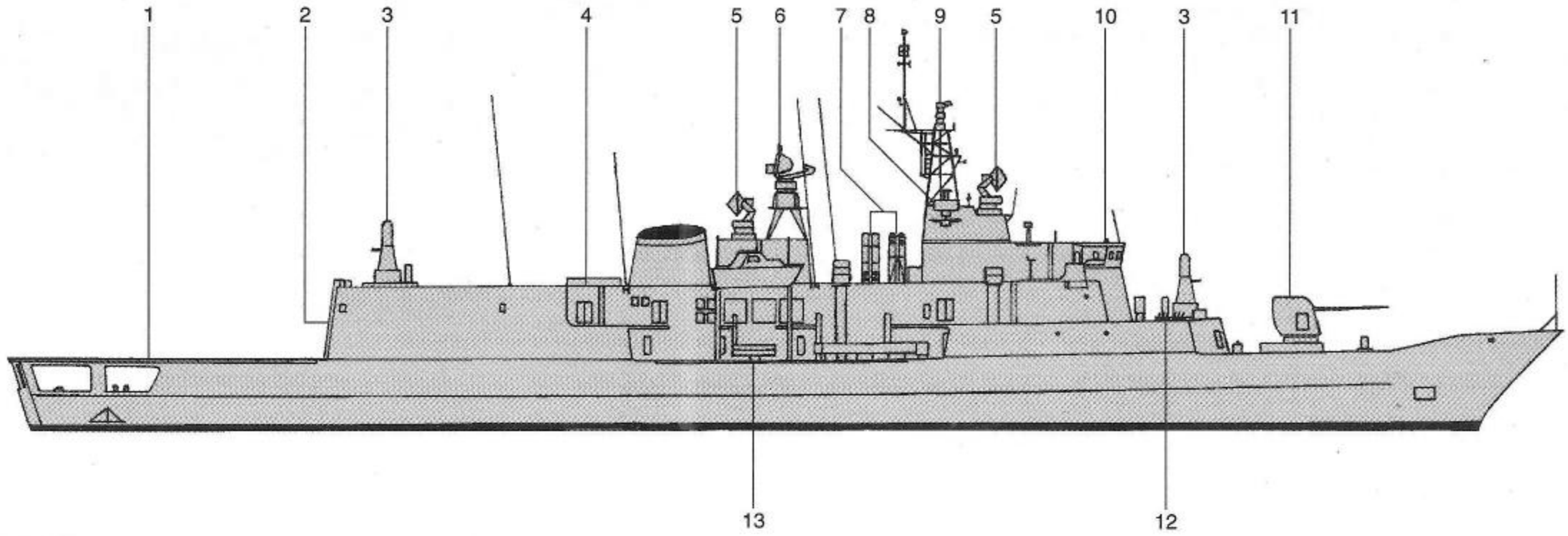
Type 123 also accommodates a CTG (commander task group) and a staff of ten. They have been allocated a large room on the starboard side, separate from the bridge and ship CIC, with a DASA message handling system and a central control console to ensure that they can operate independently of the CIC.

NAMES

These four frigates were originally to have been known as the 'Deutschland' class. This was changed to the names of four *Länder* (states). These are a careful balance of two former Federal Republic Länder — *Schleswig-Holstein* (F 216) and *Bayern* (F 217) and two from the erstwhile Demokratik (sic) Republik — *Brandenburg* (F 215) and *Mecklenburg-Vorpommern* (F 218).

Brandenburg *(F 215). Note the large flight deck, twin hangars, RAM launcher on the hangar roof, Signaal STIR fire director and LW-08 air search radar*

HYDRA (MEKO 200HN)



Hydra (Ian Sturton)
1 *Flight deck for Sikorsky S-70B-6 helicopter* **2** *Hangar* **3** *Hughes Mk 15 20mm CIWS* **4** *Mk 48 Mod 2 vertical launch system for NATO Sea Sparrow SAM (16 missiles)* **5** *Signaal STIR fire direction radar* **6** *Signaal MW 08 3D air search radar* **7** *McDonnell Douglas Harpoon anti-ship missiles (eight)* **8** *Argo AR-700/APECS II intercept/Jammer* **9** *Signaal/Magnavox DA 08* **10** *Racal-Decca 2690 BT navigation radar* **11** *United Defense 127 mm (5in)/54 Mk 45 Mod 2A gun* **12** *Mk 36 Mod 2 SRBOC* **13** *US 324 mm Mk 32 triple torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Greece
Type: MEKO 200HN

Class: HYDRA

Built: 2
Active: 2

Displacement:
light: 2,710 t
full load: 3,200 t

Dimensions
Length: 117 m (383.9 ft) (oa); 109 m (357.6 ft) (wl)
Beam: 14.8 m (48.6 ft)
Draught: 4.1 m (13.5 ft)

Speed: 31 kts (gas turbines); 20 kts (diesels)
Range: 4,100 n miles at 16 kts

Complement: 173 (22 officers) plus 16 Flag staff

SHIPS

HYDRA (F 452)

Builder	Blohm + Voss, Hamburg, Germany
Laid down	17 Dec 1990
Launched	25 June 1991
Commissioned	12 Nov 1992

SPETSAI (F 453)

Builder	Blohm + Voss/Hellenic Shipyards, Skaramanga, Greece
Laid down	11 Aug 1992
Launched	9 Dec 1993
Commissioned	June 1996

PSARA (F 454)

Builder	Hellenic Shipyards, Skaramanga, Greece
Laid down	12 Dec 1993
Launched	20 Dec 1994
Commissioned	Mar 1997

SALAMIS (F 455)

Builder	Hellenic Shipyards, Skaramanga, Greece
Laid down	20 Dec 1994
Launched	Oct 1995
Commissioned	Dec 1997

Greek frigate Hydra *(F 452). This heavily armed ship carries a single 127 mm (5 in) gun, two Mk 15 CIWS, eight Harpoon anti-ship missiles, and 16 vertical launch tubes for Sea Sparrow SAM inset in the forward end of the hangar roof. ASW systems include a Sikorsky S-70B-6 and two triple 324 mm torpedo tubes* (R Neth Navy)

WEAPONS SYTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas UGM-84B Harpoon

Eight Harpoon anti-ship missile canisters are mounted amidships; there are two groups of four launchers each, with one group pointing to either beam. The missiles are the Block 1C version with additional options, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

GMVLS Mk 48 Mod 2A missile launching system
The two Guided Missile Vertical Launch Systems (GMVLS) Mk 48 Mod 2A are mounted at the forward end of the hangar, with one set of eight launch tubes on either side of the ship. Each system consists of two sets, each of four pairs of Mk 164 vertical launcher groups, a Mk 220 missile launch controller and a Mk 63 shipboard mounting interface-electrical (SMI-E). The Mk 164 launcher group consists of pairs of aluminium honeycomb launcher canisters, each 3.97 m (13.0 ft) long, attached to an aluminium framework, with each container having its own vertical efflux system with the exhaust gases vented up pipes running alongside the containers. The Greek Mod 2 system is mounted inside the superstructure in four lines of four canisters with vertical efflux pipes in pairs between canisters. There is one Mk 220 launch-controller for every 16 missiles and one bulkhead-mounted Mk 62 SMI-E for every four missiles.

The Greek version has no provision for underway replenishment, the only version to have this facility being fitted in Japanese Maritime Self-Defense Force ships.

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime).
NEA-Lindberg, Denmark (SMI-E).
EBCO, Canada (SMI-M).
Bronswerk, Belgium (Mk 20 canister).
MBLE, Netherlands (Mk 220 missile launch-controller).

Raytheon Sea Sparrow point-defence missile system
The SAM is the RIM-7M Sea Sparrow missile. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast/fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications
RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited in the waist immediately below the main mast.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

Mk 45 Mod 2A single 127 mm (5 in) L/54 gun mounting
One United Defense single 127 mm (5 in) Mk 45 Mod 2A gun is mounted forward, firing semi-fixed ammunition with point detonating, proximity (variable time or infra-red), mechanical time and electronically set fuzes. The theoretical rate of fire is 20 rds/min and a gun crew of six is required, all below decks, of which four are ammunition handlers. The Mod 2 incorporates a number of improvements over previous versions.

Specifications
Calibre: 127 mm (5 in)
Length of barrel: 54 calibres
Muzzle velocity: 807.72 m/s (new barrel), 762 m/s (mid-life)
Crew: 6 (1 mount captain, 1 panel operator, 4 ammunition handlers)
Traverse: 340° at 30°/s
Elevation: −15 to +65° at 20°/s
Range:
anti-ship: 12.39 n miles (23 km)
anti-air: 15,000 m (49,000 ft)
Rate of fire: 16-20 rds/min
Ammunition weight: 31.75 kg (projectile)

Manufacturer/Contractor
United Defense, Armament Systems Division, Minneapolis, Minnesota, USA.

Hughes Mk 15 CIWS Phalanx
There are two Hughes Mk 15 CIWS Phalanx close in weapons systems (CIWS). One is situated immediately before the bridge, the other at the after end of the hangar roof on the port side. The mount consists of a 20 mm M61A1, six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA (system).

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

TELEGON 10 radio communications direction-finder
The Telegon 10, type PGS 1720, DF equipment is a communications direction-finder covering the frequency range 10 kHz to 1,000 MHz. It uses the Watson-Watt method and is able to obtain a bearing on signals with a duration as low as 1 ms, which is of particular value when targeting burst signals and frequency hoppers.

Specifications
Frequency range: 10 kHz to 1,000 MHz
Frequency resolution: 10 Hz
Equipment error: <1°
Operational modes: A1A, A2A, A3E, F2A, F3E, J3E

Manufacturer/Contractor
Daimler-Benz Aerospace, Sensor Systems Division, Ulm, Germany.

Hydra (F 452). Built on the MEKO principle, the ship includes four weapon modules, ten electronic modules, ten pallet modules, two mast modules and nine ventilation modules. (Blohm + Voss)

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

APECS II/AR-700 ECM/ESM suite

APECS II is an advanced modular ESM/ECM suite covering frequencies from 0.5 to 18 GHz, which is designed to counter most known radar threats. The Argo 700 is the IFM receiver part of the system, providing surveillance and radar warning over 2-18 GHz band. APECS II can be operated fully automatically, semi-automatically (that is, with manual intervention) or manually. The ECM part of the system jams threat emitters, with high-speed switching enabling up to 16 threats to be jammed simultaneously. The antenna array consists of a mast-mounted ESM antenna assembly with two DF arrays, one omnidirectional unit and two monopulse units; system processing equipment; operator's console and two ECM transmitters (port and starboard) with their antenna systems located inside the transmitter units.

Specifications

ESM role (AR-700)
Frequency coverage: 0.5-18 GHz
High sensitivity: Up to −67 dBm
Detection range: 200 n miles ships; 50 n miles aircraft
DF accuracy: 4° RMS; 2° RMS fine DF
Automatic tracking: 500 active signals in dense signal environment
Signal identification speed: <1s

ECM role
Azimuth coverage: 360° using a 60-beam jammer (one beam per 6° azimuth sector)
Radiated power: 180 kW nominal mid-band
Frequency coverage: 7.5-18 GHz

Manufacturer/Contractor

ARGOSystems Inc, Sunnyvale, California., USA

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are four Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units, two mounted on either side of the forward Phalanx CIWS.

Specifications

Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

AN/SLQ-25 Nixie noisemaker

One AN/SLQ-25 Nixie solid-state, electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter to generate and amplify the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed over the transom. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. The winch streams and recovers the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed body, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, is 95 cm long (3.10 ft), 15.24 cm (6 in) in diameter and weighs 18 kg (40 lb). It receives amplifier outputs, converts them into acoustic signals and projects them.

Manufacturer/Contractor

Aerojet ElectroSystems, Sacramento, California, USA.

COMMAND AND CONTROL SYSTEMS

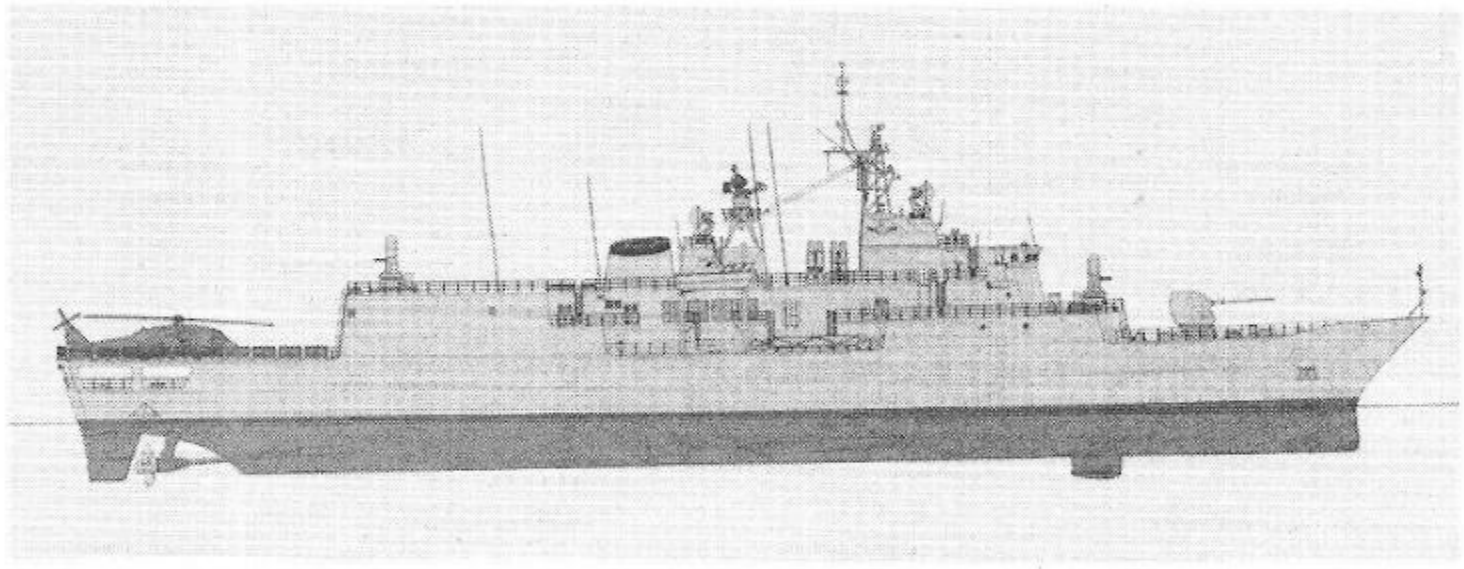
COMBAT DATA SYSTEMS

Signaal STACOS Mod III command and weapon control system

The Greek MEKO frigates are fitted with the Signaal STACOS (Signaal TActical COmmand System) Mod III system. STACOS Mod III presents raw and/or processed sensor data from search and fire-control radars together with IFF, sonar, electronic warfare and electro-optic systems to create a picture of the tactical situation, with data from offboard systems being added via Link 11. The data may also be used to designate targets to weapon systems and to assist in operations with auxiliary functions such as ASW helicopter direction and tactical navigation. STACOS Mod III uses Signaal SMR-4 computers and software is written in RTL-2 with Assembler used for high-speed data processing. All export packages are produced by Signaal at its own software development facility.

Hardware includes sensor data distribution units, primary and secondary video extractors, plot history generators for automatic initiation and tracking of targets, a display system and a Defence Equipment Systems Ltd (DES) electronic plotting table. STACOS Mod III uses the SIGHT family of workstations including the Multifunctional Operator Consoles (MOC), which feature high-resolution colour, and have complete local intelligence to support the distributed processing architecture with their integrated SigMA nodes. The latest Silicon Graphics graphics engine is specifically tailored and redesigned for the MOC. In addition the MOC has autonomous MMI including dedicated and programmable keyboards, screen boundary keys, a joystick, rollerball and hand wheels. Optional features include light pens and touch-input devices. To facilitate the man-machine interface, sets of operational system tasks are defined as 'system functions' each of which can be independently assessed from any workstation (MOC). There is a data communication network including high-speed buses and/or direct connections and/or intelligent communications handling packages; COMPASS for federated and SPLICE for the fully distributed systems. Through duplication of critical elements the system possesses both fail-safe and 'soft degradation' capabilities. There is an Ethernet standard LAN linking all the subsystems. This has a capacity of 40 Mbits/s with a coaxial bus for raw video data.

For fire-control purposes the system operates with the STIR (Separate Tracking and Illumination Radar), a dual-frequency (I/K-band) system capable of automatically acquiring and tracking targets. It can also provide simultaneous J-band CW illumination for guiding semi-active homing missiles. The radar tracker has a cassegrain antenna, usually of 1.8 m (5.9 ft) diameter, which has a maximum speed of 170°/s in azimuth and 115°/s in elevation. There is usually one fire-control radar console per tracker. Each tracker may also be fitted with a television camera as a back-up system for use in conditions of high ECCM activity.



Meko 200HN (Blohm + Voss)

RADARS

Set	MW 08	DA 08	STIR (two)	2690 BT ARPA
Company	Signaal	Signaal	Signaal	Plessey
Role	Air search	Surface search/ target indication	Fire control (SAM)	Navigation
Band	F/G	F	I/J/K	I
Range		92 n miles	76 n miles (140 km)	Typical range: 48 n miles
Beam	2 × 9°	1.5 × csc² to 40°	1.4°	1.2°
Peak Power	150 kW	145 kW	220 kW	25 kW
Gain	23 dB	33 dB	—	30 dB
Pulsewidth	0.6 µs	35/69 µs	0.29 µs	0.05/0.25/1.0 µs
PRF	3,800 pps	1,000/500 pps	1,800/3,600 pps	
Scan rate	27 rpm	10/20 rpm	—	28 rpm

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

COMMUNICATIONS AND DATALINKS

Link 11
Link 14
IFF: Mk XII Mod 4.

WEAPONS CONTROL

Spar AN/SAR-8

The AN/SAR-8 is an infra-red search and target designator (IRSTD), which uses passive means to detect and track both airborne and surface targets.

Manufacturer/Contractor
Spar Aerospace, Mississauga, Ontario, Canada.

Vesta-VC helicopter datalink system

The Vesta-VC (VC = voice channel) is a supplementary facility to the Vesta helicopter-mounted transponder system in which a VHF signal is automatically transmitted when the aircraft is illuminated by the parent ship's search radar. This reply is picked up by the Vesta shipborne component to produce and tag a clear echo on the ship's radar screen.

The helicopter is equipped with two spherical antennas for reception of the ship's search radar signals. The transponder generates a VHF reply containing a number of code pulses for identification purposes. On board the ship there are two simple rod antennas to receive the transponder signals, which are then routed via the receiver (and extractor unit) to the ship's radar display. The Vesta system is controlled by either a control unit and a radar indicator, or a data handling system.

The Vesta system can indicate unambiguously any number of Vesta-equipped helicopters on the ship's radar display. A limited number of helicopters can be identified by means of preselected codes.

VESTA-VC provides an additional facility which extends the ship's radar horizon by enabling the pilot to transmit information (target range, bearing and speed) from the helicopter's radar back to the parent ship over an existing voice channel. All necessary information is contained in a pulse train lasting about 0.9 seconds and containing 50 words of 32 bits. The system works with any radio and any radar, using interfaces produced by Signaal. The effect of this system is to extend the parent ship's radar horizon.

Specifications
VESTA
Transmission frequency: VHF
Radar reception frequency: 1-10 GHz
Transmission power: 10 W
Pulse length: 2 µs
PRF (helicopter part): 20 kHz without code
Sensitivity (ship part): −78 dBm
Range: 0-124 n miles (230 km)
Number of codes: 5 (optionally 64)
Number of co-operating radar systems: 4

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

AN/SWG-1A Harpoon Launch Control System (LCS)

SWG-1A is the Harpoon Launch Control System, which activates the missile, selects the flight pattern and sets seeker search modes (with small-, medium- or large-acquisition windows), as well as providing target range and bearing data. Alternatively, the missile can simply be launched along the bearing of the target, with the seeker activated early to scan a 90° sector; if, after a set time, no target has been acquired the missile commences a preset search pattern. SWG-1A takes account of other ships in the general target area and generates indirect flight plans for the missile, including waypoints to optimise angles of approach which will achieve the highest possibility of success while minimising the chances of the missile being destroyed by hostile fire. It can also be used to compute flight plans in a multiple attack so that several missiles, from either the same or different ships, arrive on target simultaneously, thus swamping the defences.

The Combat Information Centre (CIC) aboard Hydra *(F 452). The system is Signaal STACOS Mod 1. The workstations are Multifunction Operator Consoles (MOC) from the SIGHT range* (Signaal)

SONAR

Raytheon AN/SQS-56 hull-mounted sonar

The AN/SQS-56 hull-mounted sonar, which was originally developed for the US Navy's 'Oliver Hazard Perry' (FFG 7) class frigates, has been provided by the US Navy to various foreign navies, including that of Turkey, via the FMS programme. (Note that sets exported via the FMS are designated AN/SQS-56; those exported as a commercial sale from Raytheon are designated DE 1160.) Digital implementation allows packaging of the complete multifunction active and passive sonar in five medium-size electronics cabinets and one operator's console. System control uses a built-in mini-computer

and an advanced display system. The sonar is an active/passive, preformed beam, digital sonar providing panoramic echo ranging and panoramic (DIMUS) passive surveillance. All signal processing, except transducer-received signal amplification and linear transducer transmit drive, is accomplished in digital hardware, most of which is implemented using US Navy SEMP (Standard Electronic Module Programme) components in compact water-cooled cabinets small enough to allow installation through standard-size hatches.

The basic system includes the transducer array, transducer junction box, five electronics cabinets (array interface, transmitter(s), receiver and controller), operator console, sonar dome and control unit. Options in production include a loudspeaker/intercom, a water-cooling unit, a remote display and a performance prediction subsystem.

A single operator can search, track, classify and designate multiple targets from the active system while simultaneously maintaining anti-torpedo surveillance on the passive display.

Computer-assisted system control permits the operator to concentrate on the sonar data being displayed rather than on the system control. Operating frequencies are 5.6, 7.5 and 8.4 kHz.

Manufacturer/Contractor

Raytheon Company, Submarine Signal Division, Portsmouth, Rhode Island.

Hydra *(F 452). The Greek ships are the only MEKO frigates with two Mk 15 CIWS: one is in 'B' position (with the radome in the bridge sightline), the other on the port side of the hangar roof* (Blohm + Voss)

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 24.2 × 14.8 m (79.5 × 48.6 ft)
Hangar: 1
Helicopter: 1 Sikorsky S-70B-6 Seahawk. This is a hybrid SH-60B/F for the Greek Navy for operation from the new MEKO 200 frigates. Five (plus three options) were ordered on 17 August 1992 and the first two were delivered in the fourth quarter of 1994.

Sikorsky S-70B-6 Seahawk

Specifications

Dimensions:
main rotor diameter: 16.36 m (53.66 ft)
tail rotor diameter: 3.35 m (11.00 ft)
Length, fuselage: 15.26 m (50.0 ft)
Height to top of rotor head: 3.79 m (12.43 ft)
Weights:
empty: 6,191 kg (13,648 lb)
mission gross weight: 9,182 kg (20,244 lb)
Performance:
dash speed: 126 kts (234 km/h)
vertical rate of climb: 213 m (700 ft)/min
Power plant: 2 General Electric T700-GE-401C turboshafts rated at 1,417 kW (1,900 shp) Transmission rating 2,535 kW (3,400 shp)

Accommodation: 3 (pilot, airborne tactical officer, sensor operator)
Radar: Search radar AN/APS-143(V)3
Mission: AN/AQS-18(V)-3 dipping sonar, Texas Instruments AN/ASQ-81(V)2 towed MAD, Raymond MU-670/ASQ magnetic tape memory unit, Astronautics IO-2177/ASQ altitude indicator, Fairchild AN/ASQ-164 control indicator set, Fairchild AN/ASQ-165 armament control indicator set, IBM AN/UYS-1(V)2 Proteus acoustic processor and CV-3252/A converter display, Control Data AN/AYK-14 (XN-1A) digital computer, Raytheon AN/ALQ-142 ESM, Sierra Research AN/ARQ-44 datalink and telemetry; AN/ALR-66(V)-2 ESM.
Armament: 2 Mk 46 torpedoes or NFT Penguin ASMs.

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 General Electric LM-2500 gas turbines; 44.76 MW (60,000 hp sustained; 2 MTU 20V 956 TB82 diesels; 7.66 MW (10,420 hp(m)) sustained
Shafts: 2
Propellers: 2 Escher-Wyss, cp
Auxiliary power: 4 — 775 kVA diesel generator sets

FURTHER INFORMATION

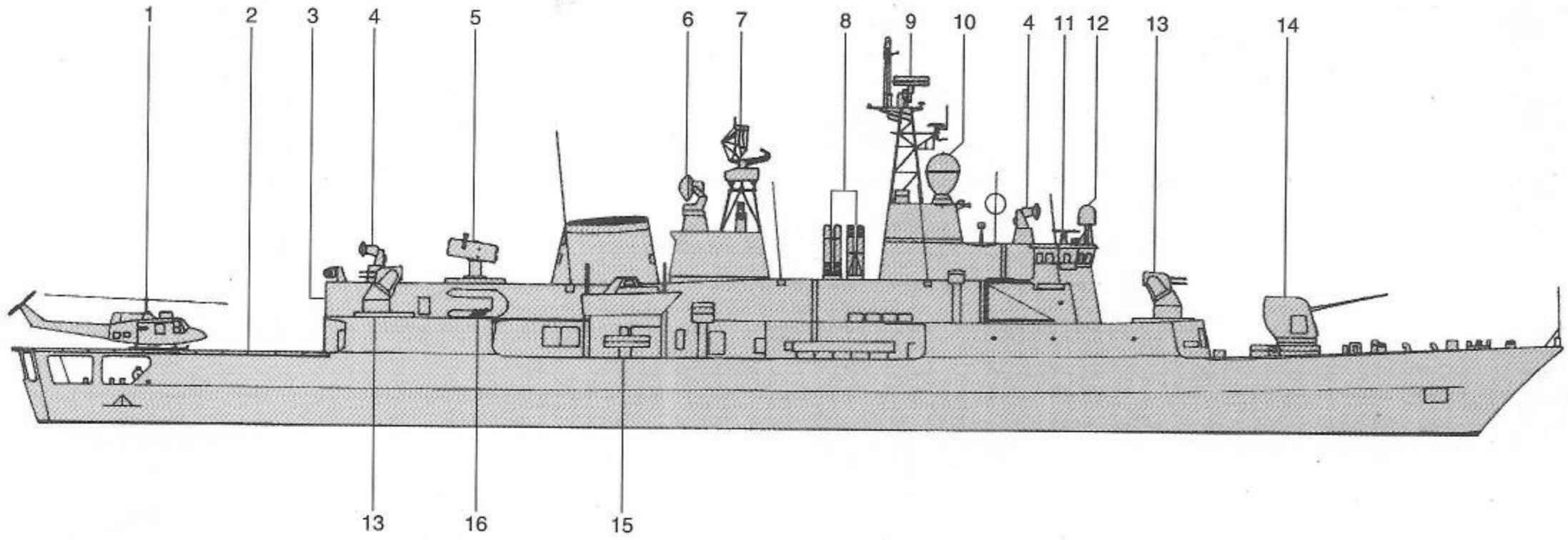
PROGRAMME

The decision to buy four MEKO 200 Mod 3HN was announced on 18 April 1988, in a somewhat complicated deal involving both HQNATO and seven individual members of the Alliance. There was a German Government 'offset' involving tanks and aircraft, while the electronics and some of the weapon systems were secured through US FMS credits. The first ship was ordered on 10 February 1989 and was built by Blohm + Voss, Hamburg, while the remainder was ordered on 10 May 1989 for construction at Hellenic Shipyards, Skaramanga, with German technical assistance. The programme was delayed by financial problems at Hellenic Shipyards in 1992 and some of the prefabrication of the first Greek-built ship, *Spetsai,* was done in Hamburg.

DESIGN

The design follows that of the Portuguese 'Vasco da Gama' class, but with a single hangar and a prominent bulwark around the bows. The Greek ships are the only MEKO 200s to have two Phalanx CIWS mountings, the forward mount being in the 'B' position immediately forward of the bridge, which results in the top of the radome coming above the window level of the bridge.

YAVUZ (MEKO 200 TN Track 1)



Yavuz (Ian Sturton)
1 *AB 212ASW helicopter* **2** *Flight deck* **3** *Hangar***4** *Contraves Sea Guard fire director* **5** *Mk 29 Mod 1 eight-cell launcher for Aspide missiles* **6** *Signaal STIR* **7** *Signaal DA 08 air search radar* **8** *McDonnell Douglas Harpoon anti-ship missiles (eight launchers)* **9** *Plessey AWS-6 Dolphin air/surface search radar* **10** *Signaal WM 25 fire direction radar* **11** *Racal-Decca TM 1226 navigation radar* **12** *SATCOM* **13** *Oerlikon Contraves Sea Zenith 25 mm four-barrel CIWS* **14** *United Defense 127 mm (5 in) Mk 45 Mod 1 gun* **15** six 324 mm Mk 32 (2 triple) tubes **16** Loral Hycor six-tube fixed Mk 36 Mod 1 SRBOC

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Turkey
Type: MEKO 200 TN Track I

Class: YAVUZ

Built: 4
Active: 4

Displacement:
standard: 2,500 t
full load: 2,784 t

Dimensions
Length: 110.5 m (362.5 ft) (oa); 102.0 m (334.6 ft) (wl)
Beam: 14.80 m (48.56 ft)

Design draught: 4.10 m (13.45 ft)

Speed: 27 kts
Range: 4,100 n miles at 18 kts

Complement: 180 (24 officers)

SHIPS

YAVUZ (F 240)
Builder Blohm + Voss, Hamburg, Germany
Laid down 30 May 1985
Launched 7 Nov 1985
Commissioned 17 Jul 1987

TURGUTREIS (F 241)
Builder Howaldtswerke, Kiel, Germany
Laid down 20 May 1985
Launched 30 May 1986
Commissioned 4 Feb 1988

FATIH (F 242)
Builder Golcuk, Izmit, Turkey
Laid down 1 Jan 1986
Launched 24 Apr 1987
Commissioned 28 Aug 1988

YILDIRIM (F 243)
Builder Golcuk, Izmit, Turkey
Laid down 24 Apr 1987
Launched 22 Jul 1988
Commissioned 17 Nov 1989

Yildirim *(F 243), last of the Turkish Navy's four 'Track 1' ships. The ship's AB-212ASW helicopter is on the flight deck* (Selim San)

Yavuz *(F 240). This Turkish ship is armed with eight Harpoon anti-ship missiles (abaft the mast), one eight cell Mk 29 launcher for Sea Sparrow missiles and three Oerlikon-Contraves Sea Zenith CIWS (two either side of the hangar and one before the bridge). There is a 127 mm (5 in) gun on the foredeck and two triple Mk 32 torpedo tubes in the waist* (Blohm + Voss)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas UGM-84B Harpoon

Eight Harpoon anti-ship missile canisters are mounted amidships; there are two groups of four launchers each, with one group pointing to either beam. The missiles are the Block 1C version with additional options, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications

Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

GMLS Mk 29 Mod 1 missile handling and launching system

There is one Guided Missile Launching System (GMLS) Mk 29 Mod 1, with the launcher atop the hangar roof. The system consists of a launcher, a launcher-control, power supply unit, launcher loader, and a maintenance/interconnecting cabinet. The launcher itself consists of eight watertight cells in two box mountings on either side of the pedestal, each cell having a heater and two frangible covers (front and rear). The reloading system consists of two loading installations on the port and starboard sides and a control panel. Each installation consists of two rows of missiles, each supported by two blocks, in a frame carried by four air springs to reduce the chances of shock or vibration damage. The installation also has a loading arm suspended from a vertical and horizontal transport unit in the ceiling and a hydraulically operated hatch in the front. When the launch cell or cells require reloading they are turned to a fore-and-aft position and inclined at an angle of 5° to bring them into line with the loading system.

Specifications

Operators: 1
Associated fire-control system: Mk 91
Training limits: 360°
Elevation limits: −5 to +85°
Firing rate: 3 missiles/min

Manufacturer/Contractor

Raytheon Company, Equipment Division.

Raytheon Sea Sparrow point-defence missile system

The SAM used is the RIM-7 NATO Sea Sparrow system. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast/fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications

RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors

Raytheon Company, Equipment Division (prime system contractor)
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited in the waist immediately below the main mast.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

Mk 45 Mod 1 single 127 mm (5 in) L/54 gun mounting

One United Defense single 127 mm (5 in) Mk 45 Mod 1 gun is mounted forward, firing semi-fixed ammunition with point detonating, proximity (variable time or infrared), mechanical time and electronically set fuzes. The theoretical rate of fire is 20 rds/min and a gun crew of six is required, all below decks, of which four are ammunition handlers.

Specifications
Calibre: 127 mm (5 in)
Length of barrel: 54 calibres
Muzzle velocity: 807.72 m/s (2,650 ft/s) (new barrel), 762 m/s (2,500 ft/s) (mid-life)
Crew: 6 (1 mount captain, 1 panel operator, 4 ammunition handlers)
Traverse: 340° at 30°/s
Elevation: −15 to +65° at 20°/s
Range:
anti-ship: 12.39 n miles (23 km)
anti-air: 15,000 m (49,000 ft)
Rate of fire: 16-20 rds/min
Ammunition weight: 31.75 kg (70.0 lb) (projectile)

Manufacturer/Contractor
United Defense, Armament Systems Division, Minneapolis, Minnesota, USA

Oerlikon Contraves GM25 Sea Zenith 25 mm mounting

The 'Yavuz' class was the first in the world to be fitted with the Oerlikon-Contraves Sea Zenith system, which was selected in preference to Phalanx. There are three mountings: one forward in 'B' position and two aft, on platform decks either side of the hangar. Sea Zenith is a four-barrelled 25 mm KBB gun mounting, which has been given its name because of its ability to bear on targets 'at the zenith' by virtue of a slewing two-axis mounting which is inclined at 35° to the horizontal. It is designed to destroy anti-ship missiles using special AMDS ammunition with a forged tungsten core designed to ensure that a single hit will be sufficient to destroy the target by exploding its warhead. It also has a capability against aircraft using more conventional ammunition.

The four 25 mm barrels have a combined rate of fire of 3,400 rds/min, each being independently fed from four 300-round ammunition drums. The ready-use supply of 1,660 rounds is sufficient for 18 normal engagements of missile targets. Reloading can be achieved during the firing cycle.

Specifications
Calibre: 25 mm
Length of barrel: 65 calibres
Traverse: 340° at 2.5 rad/s
Elevation: −10 to +122° at 2.5 rad/s
Mounting weight: 4,400 kg (9,702 lb) (with ammunition)
Muzzle velocity: 1,355 m/s (4,445 ft/s)
Crew: 0
Range: 1.07 n miles (2 km)
Ammunition: 625 g (TP-T); 615 g (APP-T, APDS-T); 625 g (HEI)

Manufacturer/Contractor
Oerlikon Contraves, Switzerland.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Signaal RAPIDS

RAPIDS (RAdar Passive IDentification System) is an automatic system for analysing and tracking radar signals, covering the frequencies between 2 and 18 GHz in four bands. There is a large radar and platform library, and it exchanges information with RAMSES.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Signaal RAMSES

RAMSES (ReprogrAmmable Multimode Shipborne ECM System) is a noise and deception jammer covering the I and J bands, which is triggered by the RAPIDS system (see above).

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

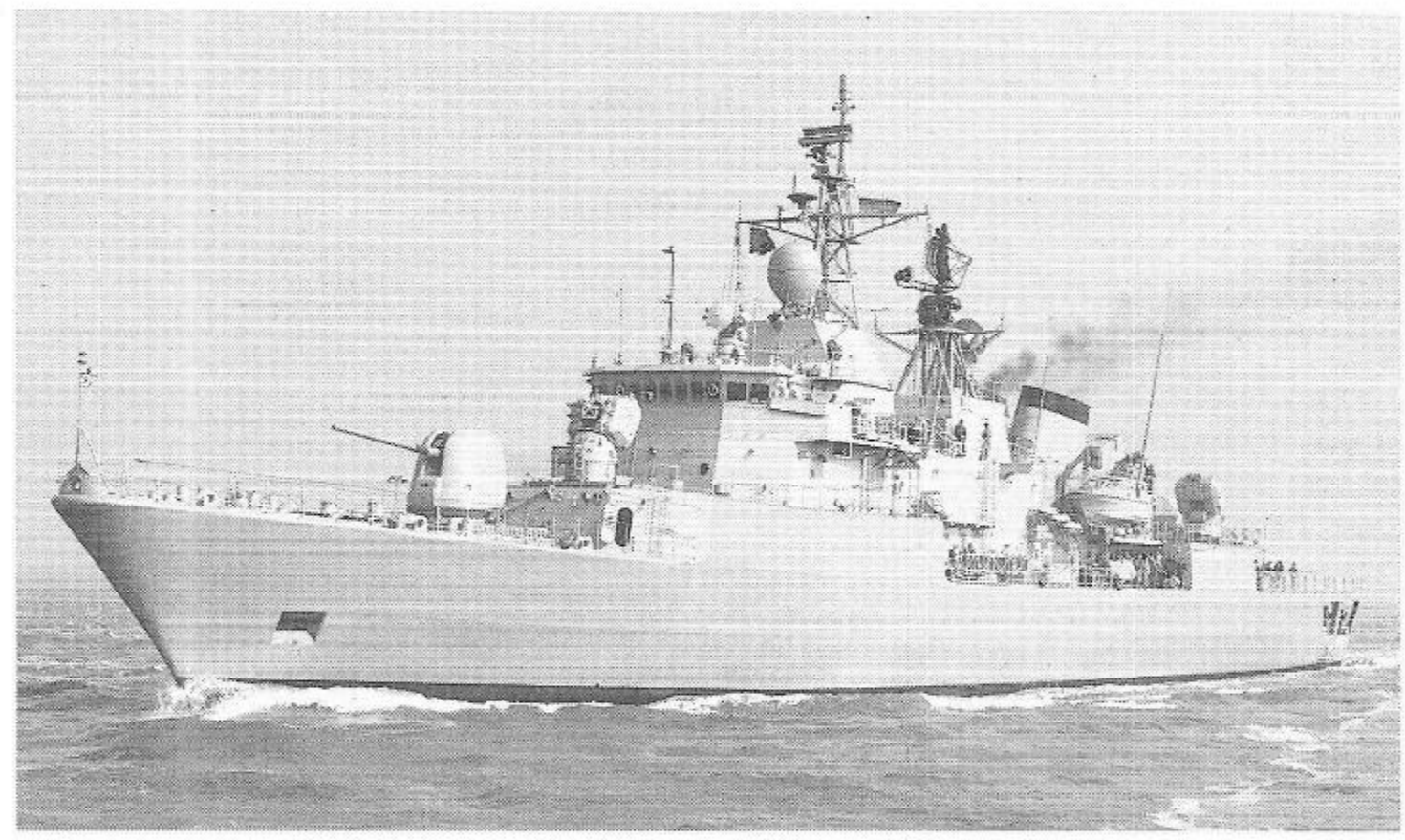
DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units. They are mounted on either side of the hangar, immediately below the Mk 29 launcher.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)



Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA

AN/SLQ-25 Nixie noisemaker

One AN/SLQ-25 Nixie solid-state, electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter to generate and amplify the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed over the transom. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. The winch streams and recovers the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed body, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, is 95 cm (3.10 ft) long, 15.24 cm (6 in) in diameter and weighs 18 kg (40 lb). It receives amplifier outputs, converts them into acoustic signals and projects them.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.

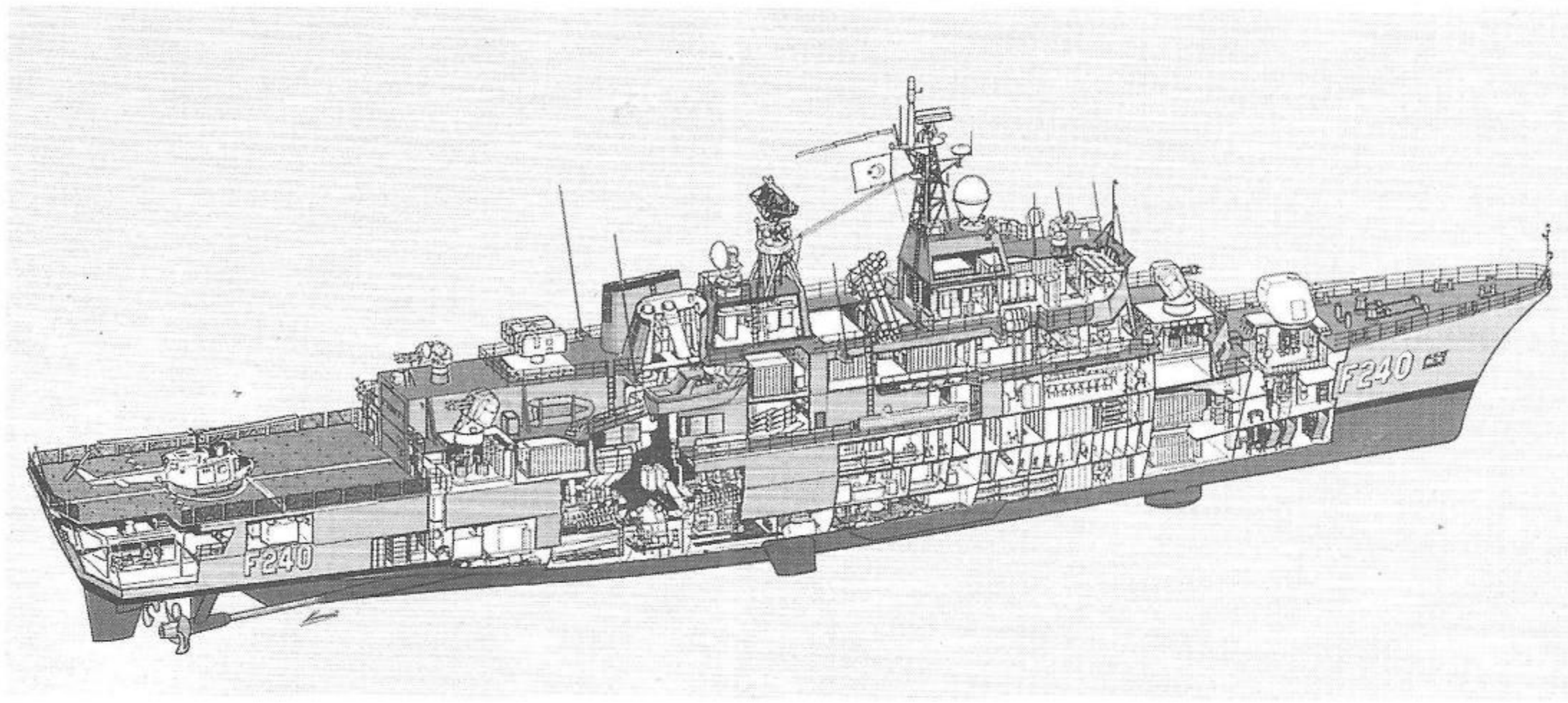
COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

STACOS Mod I

STACOS (Signaal TActical COmmand System) Mod I entered service in July 1987 with the Turkish frigate *Yavuz*. It is designed to present raw and/or processed sensor data from search and fire-control radars together with IFF, sonar, electronic warfare and electro-optic systems to create a picture of the tactical situation, using data from both on- and offboard sensors through a Link 11. The data may also be used to designate targets to weapon systems and to assist in operations with auxiliary functions such as ASW helicopter direction and tactical navigation.

The system features a mainframe architecture using three Signaal SMR-4 mainframe computers, programmed in the RTL-2 language, and using Assembler language for high-speed data processing. STACOS



Cutaway of Yavuz *(F 240)* (Blohm & Voss)

Mod I uses CIDIS (Combat Information Display System) which features software-driven Vertical Display Consoles (VDC) and Horizontal Display Consoles (HDC). (Note: Unlike later systems, STACOS Mod 1 does not use an Ethernet LAN.)

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

WEAPONS CONTROL

AN/SWG-1A Harpoon Launch Control System (LCS)

SWG-1A is the Harpoon Launch Control System, which activates the missile, selects the flight pattern and sets seeker search modes (with small-, medium- or large-acquisition windows), as well as providing target range and bearing data. Alternatively, the missile can simply be launched along the bearing of the target, with the seeker activated early to scan a 90° sector; if, after a set time, no target has been acquired the missile commences a preset search pattern. SWG-1A takes account of other ships in the general target area and generates indirect flight plans for the missile, including waypoints to optimise angles of approach which will achieve the highest possibility of success while minimising the chances of the missile being destroyed by hostile fire. It can also be used to compute flight plans in a multiple attack so that several missiles, from either the same or different ships, arrive on target simultaneously, thus swamping the defences.

COMMUNICATIONS AND DATALINKS

Datalink
Link 11

Tacan
URN 25

IFF
Mk XII

Vesta helicopter transponder/datalink system

Vesta consists of a helicopter-mounted transponder which transmits a VHF signal when the aircraft is illuminated by the ship's search radar. This reply is picked up by the Vesta shipborne component to produce and tag a clear echo on the ship's radar screen.

The helicopter is equipped with two spherical antennas for reception of the ship's search radar signals. The transponder generates a VHF reply containing a number of code pulses for identification purposes. On board the ship there are two simple rod antennas to receive the transponder signals, which are then routed via the receiver (and extractor unit) to the ship's radar display. The Vesta system is controlled by either a control unit and a radar indicator, or a data handling system.

The Vesta system can indicate unambiguously any number of Vesta-equipped helicopters on the ship's radar display. A limited number of helicopters can be identified by means of preselected codes.

Specifications

Transmission frequency: VHF
Radar reception frequency: 1-10 GHz
Transmission power: 10 W
Pulse length: 2 µs
PRF (helicopter part): 20 kHz without code
Sensitivity (ship part): −78 dBm
Range: 0-124 n miles (230 km)
Number of codes: 5 (optionally 64)
Number of co-operating radar systems: 4

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

AN/WSC-3(V)7

WSC-3 is the US Navy's standard UHF satellite terminal, but the (V)7 used in the Turkish ships is employed only as a terrestrial line of sight radio terminal.

RADARS

Set	DA 08	STIR	WM 25	AWS-6 (Dolphin)	TMK	TM 1226
Company	Signaal	Signaal	Signaal	Plessey	Siemens-Albis	Racal-Decca
Role	Surface search/target indication	Fire control (SAM)	Fire control (SSM/127 mm gun)	Air/surface search (Seaguard system)	Gun control (Seaguard system)	Navigation
Band	F	I/J/K	I/J	G	I/J	I
Range	92 n miles (168 km)	76 n miles (140 km)	25 n miles (46 km)	Height: 14,000 m (46,000 ft) Range: 19 n miles (35 km)	Missiles: 10 km Aircraft: 16 km	Typical range: 48 n miles
Beam	1.5 × csc^2 to 40°	1.4°	1.5 × 4/7° (search) 2.4° (track)	1.5°	19 mrad	1.2°
Peak Power	145 kW	220 kW	200 kW	50 kW	85 kW	25 kW
Gain	33 dB	—	33.5 dB	29 dB	—	30 dB
Pulsewidth	35/69 µs	0.29 µs	0.22/4.5 µs	0.1/4.3 µs	0.08 µs	0.05/0.25/1.0 µs
PRF	1,000/500 pps	1,800/3,600 pps	3,600/1,800 pps	—	—	—
Scan rate	10/20 rpm	—	60 rpm	30/60 rpm	—	28 rpm

SONAR

Raytheon AN/SQS-56 hull-mounted sonar

The AN/SQS-56 hull-mounted sonar, which was originally developed for the US Navy's 'Oliver Hazard Perry' (FFG 7) class frigates, has been provided by the US Navy to various foreign navies, including that of Turkey, via the FMS programme. (Note that sets exported via the FMS are designated AN/SQS-56; those exported as a commercial sale from Raytheon are designated DE 1160). Digital implementation allows packaging of the complete multifunction active and passive sonar in five medium-size electronics cabinets and one operator's console. System control uses a built-in mini-computer and an advanced display system. The sonar is an active/passive, preformed beam, digital sonar providing panoramic echo ranging and panoramic (DIMUS) passive surveillance. All signal processing, except transducer-received signal amplification and linear transducer transmit drive, is accomplished in digital hardware, most of which is implemented using US Navy SEMP (Standard Electronic Module Programme) components in compact water-cooled cabinets small enough to allow installation through standard size hatches.

The basic system includes the transducer array, transducer junction box, five electronics cabinets (array interface, transmitter(s), receiver and controller), operator console, sonar dome and control unit. Options in production include a loudspeaker/intercom, a water-cooling unit, a remote display and a performance prediction subsystem.

A single operator can search, track, classify and designate multiple targets from the active system while simultaneously maintaining anti-torpedo surveillance on the passive display.

Computer-assisted system control permits the operator to concentrate on the sonar data being displayed rather than on the system control. Operating frequencies are 5.6, 7.5 and 8.4 kHz.

Manufacturer/Contractor

Raytheon Company, Submarine Signal Division, Portsmouth, Rhode Island.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 21.5 × 14.8 m (70 × 49 ft)
Hangar: Hangar accommodates one helicopter
Helicopter: AB-212ASW

Agusta-Bell AB 212ASW

One Agusta-Bell AB 212ASW anti-submarine helicopter is normally embarked.

Specifications

Main rotor diameter: 14.63 m (48.0 ft)
Length overall (both rotors turning): 22.15 m (57.08 ft)
Fuselage length: 12.92 m (42.39 ft)
Height to rotor head: 3.91 m (12.82 ft)
Rotor disc area: 168.1 m² (1,809 sq ft)
Max take-off weight: 5,070 kg (11,177 lb)
Max speed (never exceed): 130 kts (240 km/h)
Typical cruising speed: 100 kts (185 km/h)
Hovering ceiling (out of ground effect): 396 m (1,300 ft)
Range with max standard fuel: 332 n miles (615 km)
Engine: 1 Pratt & Whitney Canada PT6T-6 Turbo Twin Pac rated at 1,398 kW (1,875 shp)
Role equipment: Sea Skua ASMs

PROPULSION

Specifications

System: Combined diesel and diesel (CODAD)
Main machinery: 4 MTU 20V 1163 TB93 diesels; 24.5 MW (33,300 hp(m)) sustained
Shafts: 2
Propellers: 2 KaMeWa, cp
Ship's services: 3 MTU/Siemens; 775 kVA at 1,800 rpm
Emergency generator: 1 KHD/Siemens; 250 kVA at 1,800 rpm

FURTHER INFORMATION

PROGRAMME

The Turkish Navy originally undertook negotiations in 1980 with the US Navy, with a view to building four 'Oliver Hazard Perry' (FFG 7) class frigates in Turkey, but the project was eventually abandoned on the grounds that it was 'too large'. The Turkish Navy then received bids from several yards to fill the gap and eventually the MEKO 200 design was accepted in January 1982, with the contract being signed on 29 December 1982.

The organisation required to realise this project was complicated, but worked very well. Prime contractorship for the project was exercised by a consortium of three German companies: Blohm + Voss (B+V); Howaldts Deutsche Werft (HDW); and Thyssen Rheinstahl Technik (TRT). This consortium had overall control of the entire project, was responsible for all financial aspects, and was the system integrator with particular concern for the US weapons and electronic systems supplied through the FMS programme. Three yards were involved in the construction of the four ships: Blohm + Voss built *Yavuz*; Howaldtswerke *Turgutreis*; and Golcük built the third and fourth ships. Finally, three navies were involved: the Turkish Navy as the customer and user; the Federal German Navy for operational training of the crews and the US Navy for training in US systems. Despite the complexity of these arrangements, the time taken from signing the contract to the commissioning of the fourth ship was just six years and four months.

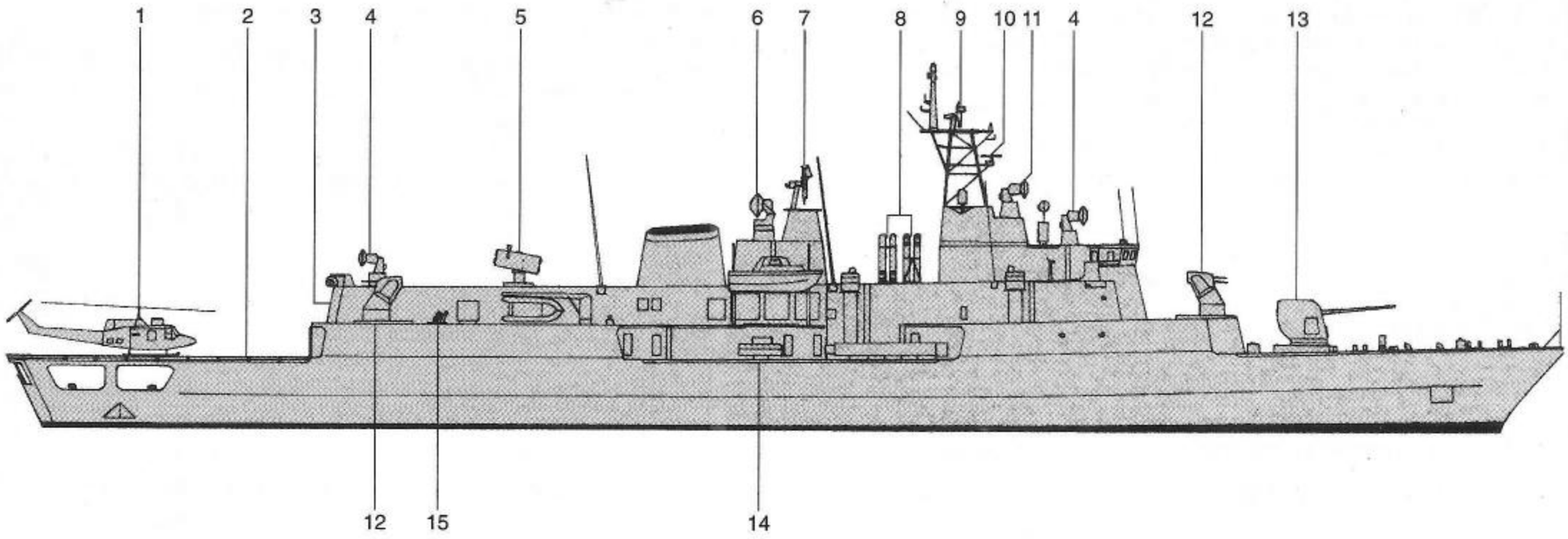
A further class of four MEKO 200s is under construction, but is sufficiently different to warrant a separate entry — see 'Barbaros' class (MEKO 200 TN Track II).

DESIGN

The Turkish Track 1 ship design is generally similar to other MEKO 200s, but with several important differences. The hulls are 17 m (55.8 ft) shorter at the waterline and the design displacement of 2,800 t is 400 t less than the others. Further, the propulsion system is unique in the class, since while all others use a CODAG arrangement, the Turkish ships have four diesels in a CODAD arrangement.

Despite these differences, the weapons systems and electronic fit of the Turkish ships is fully up to the standards of the other ships. Indeed, following a detailed appraisal by the Turkish naval staff of the Falklands (Malvinas) war, these ships have the heaviest close in air defence system with a Mk 29 SAM system with 24 Aspide missiles and three Oerlikon-Contraves Sea Zenith 25 mm gun systems, one forward and two aft.

BARBAROS (MEKO 200 TN Track II)



Barbaros (Ian Sturton)
1 *AB 212ASW helicopter* **2** *Flight deck* **3** *Hangar* **4** *Contraves Seaguard fire-control radar* **5** *Mk 29 Mod 1 launcher for NATO Sea Sparrow* **6** *Signaal STIR* **7** *Siemens-Plessey AWS-9 air search radar (UK Type 996)* **8** *McDonnell Douglas Harpoon anti-ship missiles (eight)* **9** *Siemens-Plessey AWS 6 Dolphin air/surface search radar* **10** *Racal-Decca 2690 BT ARPA navigation radar* **11** *Contraves TMX (fire control for SSM and 127 mm)* **12** *Contraves + Oerlikon Seaguard 25 mm CIWS* **13** *United Defense single 127 mm (5 in)/54 Mk 45 Mod 2 gun* **14** *US Mk 32 324 mm torpedo tubes* **15** *Loral Hycor Mk 36 Mod 1 SRBOC six-tube chaff/IR launcher*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Turkey
Type: MEKO 200 TN Flight II

Class: BARBAROS

Active: 2
Building: 2

Displacement:
design: 3,350 full load

Dimensions
Length: 116.90 m (383.50 ft) (oa); 109.00 m (357.60 ft) (wl)
Beam: 14.8 m (48.55 ft)
Draught: 4.10 m (13.45 ft)

Speed: 32 kts
Range: 4,100 n miles at 18 kts

Complement: 200 (24 officers)

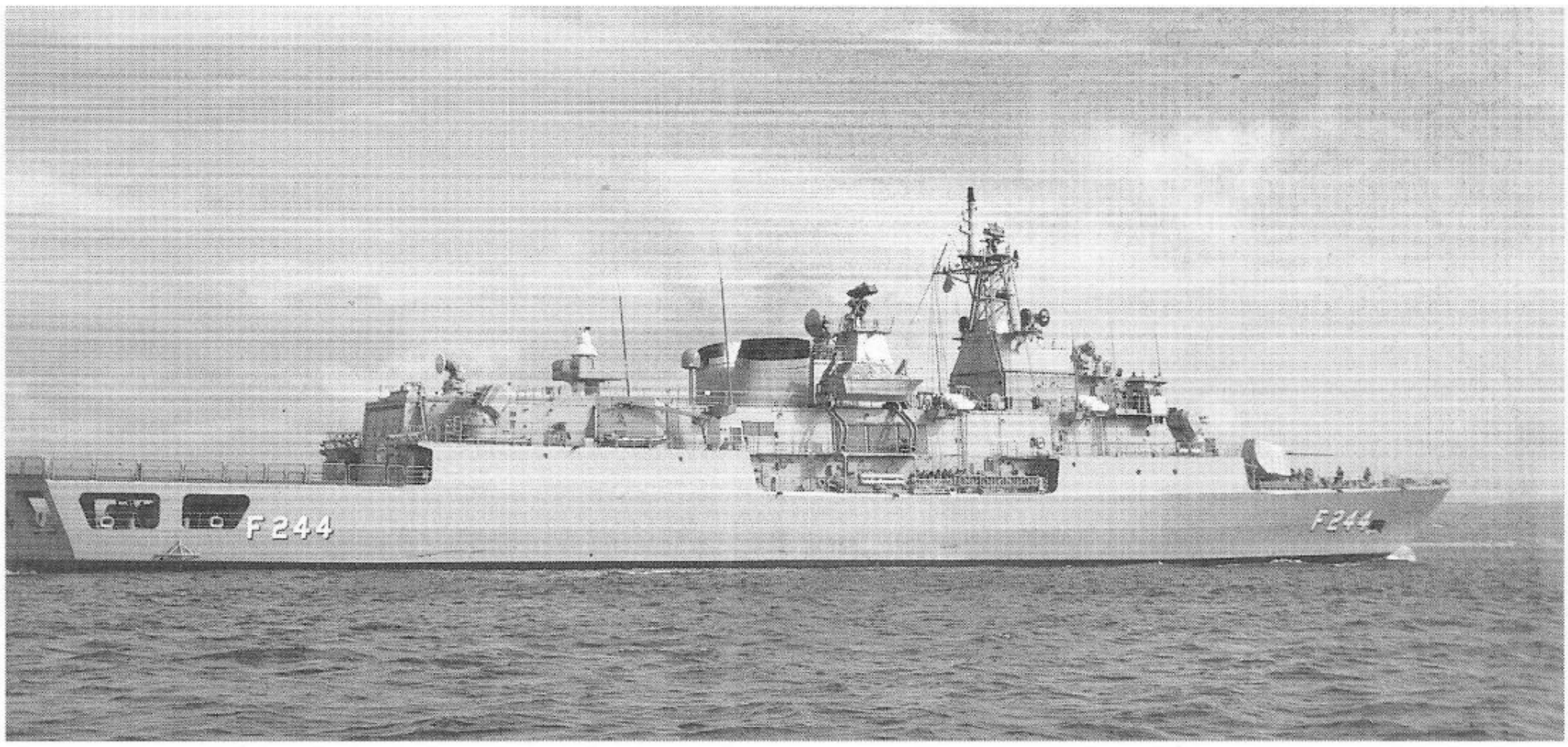
SHIPS

BARBAROS (F 244)
Builder Blohm + Voss, Hamburg, Germany
Laid down 18 Mar 1993
Launched 29 Sep 1993
Commissioned 16 Mar 1995

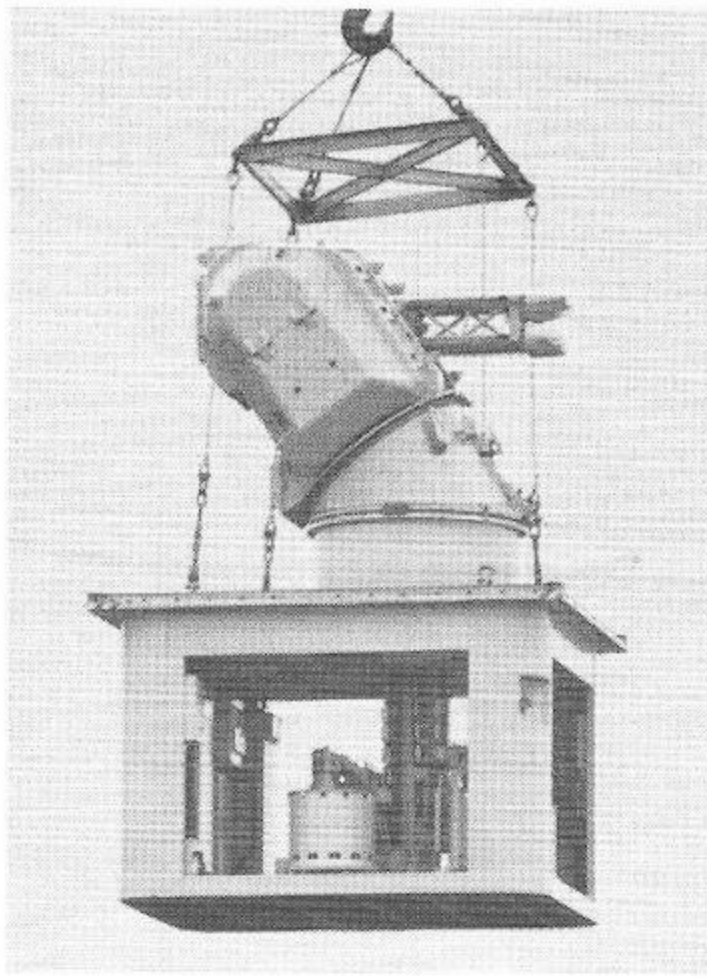
ORUCREIS (F 245)
Builder Gölcük, Kocaeli, Turkey
Laid down 15 Sep 1993
Launched 28 Jul 1994
Commissioned Mar 1996

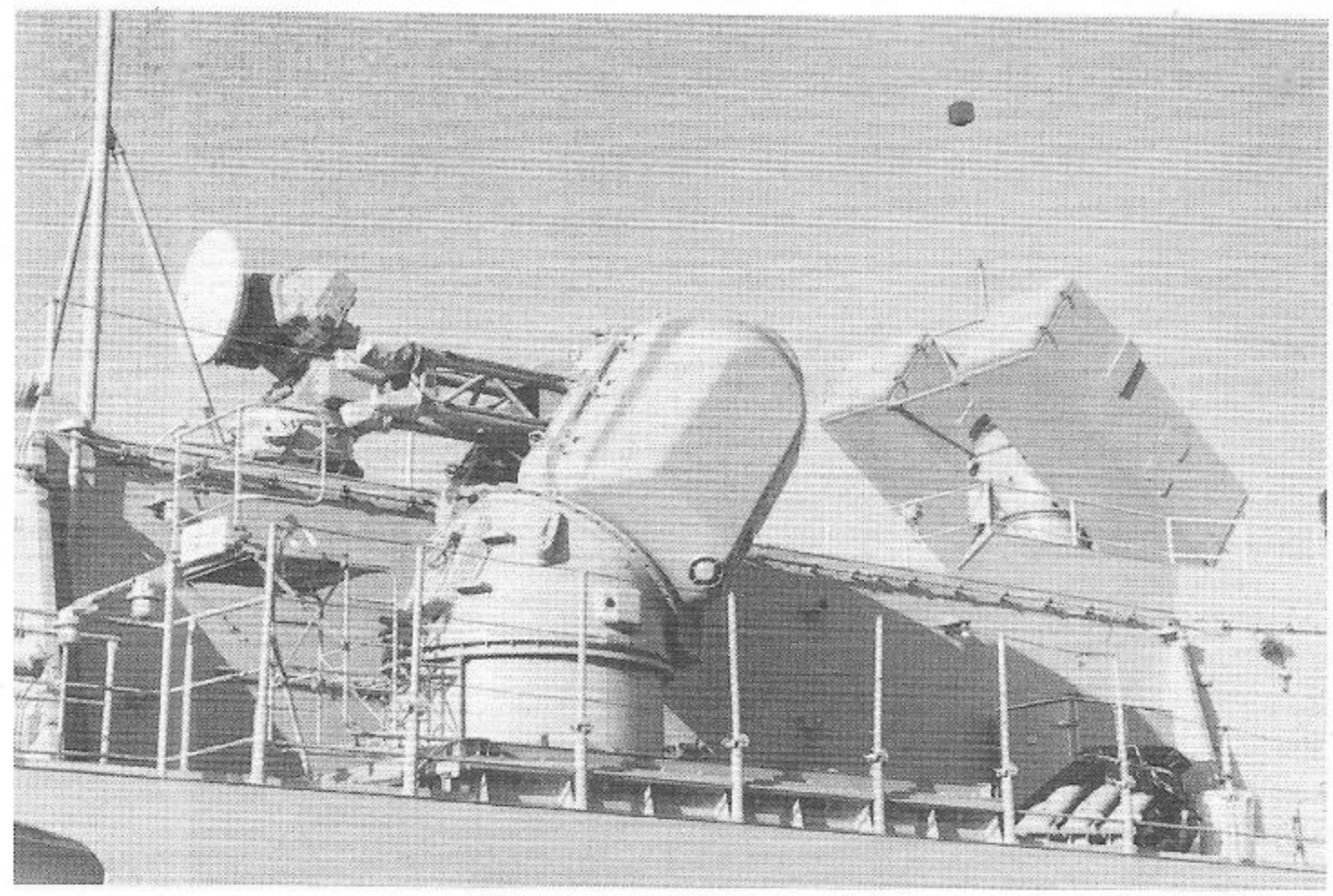
SALIHREIS (F 246)
Builder Blohm + Voss, Hamburg, Germany
Laid down 16 Mar 1995
Launched May 1997
Commissioned Nov 1998

KEMALREIS (F 247)
Builder Gölcük, Kocaeli, Turkey
Laid down 1996
Launched 1998
Commissioned 2000



First of the Track II ships, Barbaros *(F 244). These ships are longer than Track I and have CODOG, as opposed to CODAD propulsion. Armament includes a 127 mm gun, three 25 mm Sea Zenith CIWS and an eight-cell Sea Sparrow launcher* (Jane's/H M Steele)





The Turkish Navy is the main user of the Oerlikon-Contraves Sea Guard CIWS. The main element is the Sea Zenith gun mount which has a unique canted, two-axis system enabling the weapon to have a true 0 to 90° capability

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas UGM-84B Harpoon

Eight Harpoon anti-ship missile canisters are mounted amidships; there are two groups of four launchers each, with one group pointing to either beam. The missiles are the Block 1C version with additional options, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications

Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

GMLS Mk 29 Mod 1 missile handling and launching system

F 244 and F 245 each have one Guided Missile Launching System (GMLS) Mk 29 Mod 1, with the launcher atop the hangar roof. The system consists of a launcher, a launcher-control, power supply unit, launcher loader, and a maintenance/interconnecting cabinet. The launcher itself consists of eight watertight cells in two box mountings on either side of the pedestal, each cell having a heater and two frangible covers (front and rear). The reloading system consists of two loading installations on the port and starboard sides and a control panel. Each installation consists of two rows of missiles, each supported by two blocks, in a frame carried by four air springs to reduce the chances of shock or vibration damage. The installation also has a loading arm suspended from a vertical and horizontal transport unit in the ceiling and a hydraulically operated hatch in the front. When the launch cell or cells require reloading they are turned to a fore-and-aft position and inclined at an angle of 5° to bring them into line with the loading system.

Specifications

Operators: 1
Associated fire-control system: Mk 91
Training limits: 360°
Elevation limits: −5 to +85°
Firing rate: 3 missiles/min

Manufacturer/Contractor

Raytheon Company, Equipment Division.

Guided Missile Vertical Launch System (GMVLS) Mk 41

F 246 and F 247 are being built with the GMVLS Mk 41 system, which will subsequently be retrofitted to F 244 and F 245. GMVLS Mk 41 was developed specifically for launching the Sea Sparrow missile. The new launcher uses the same structural and electronic components as the other versions of the system but the module is 6.86 m (22.5 ft) high and an eight-cell unit weighs 24.36 t. The Sea Sparrows are housed in Mk 22 canisters which are 5.79 m (19.0 ft) deep and weigh 1,503 kg (3,314 lb) (complete with missile) and which actually reverts to the original design of canister before it was modified for the Tomahawk missile.

Raytheon Sea Sparrow point-defence missile system

The SAM used is the RIM-7 NATO Sea Sparrow system. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast/fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications

RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors

Raytheon Company, Equipment Division. (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited in the waist immediately below the main mast.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications

Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

Mk 45 Mod 2 single 127 mm (5 in) L/54 gun mounting

One United Defense single 127 mm (5 in) Mk 45 Mod 2 gun is mounted forward, firing semi-fixed ammunition with point detonating, proximity (variable time or infrared), mechanical time and electronically set fuzes. The theoretical rate of fire is 20 rds/min and a gun crew of six is required, all below decks, of which four are ammunition handlers. The Mod 2 incorporates a number of improvements over previous versions.

Specifications
Calibre: 127 mm (5 in)
Length of barrel: 54 calibres
Muzzle velocity: 807.72 m/s (new barrel), 762 m/s (mid-life)
Crew: 6 (1 mount captain, 1 panel operator, 4 ammunition handlers)
Traverse: 340° at 30°/s
Elevation: −15 to +65° at 20°/s
Range:
anti-ship: 12.39 n miles (23 km)
anti-air: 15,000 m (49,000 ft)
Rate of fire: 16-20 rds/min
Ammunition weight: 31.75 kg (70.0 lb) (projectile)

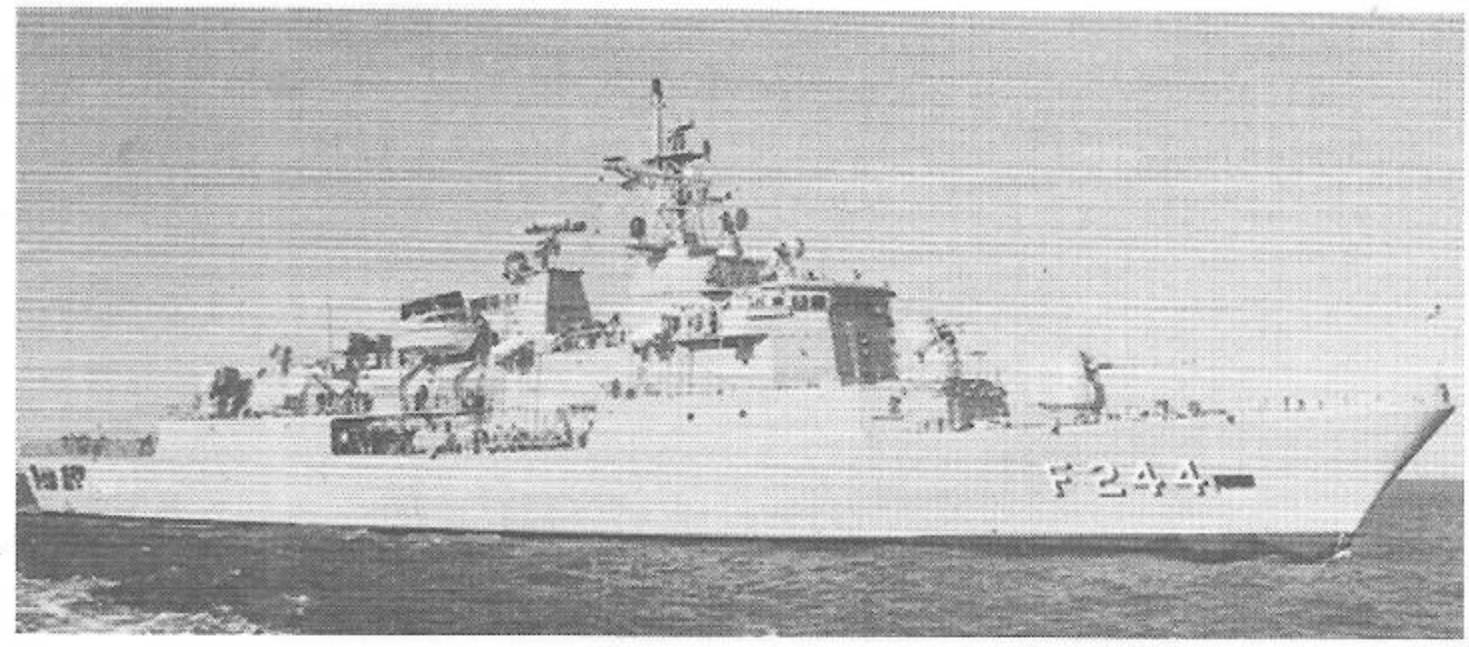
Manufacturer/Contractor
United Defense, Armament Systems Division, Minneapolis, Minnesota, USA.

Oerlikon Contraves GM25 Sea Zenith 25 mm mounting
These four ships are being fitted with the same Oerlikon-Contraves Sea Zenith system as in the Track I ships, which was selected in preference to Phalanx. There are three mountings: one forward in 'B' position and two aft, on platform decks either side of the hangar. Sea Zenith is a four-barrelled 25 mm KBB gun mounting, which has been given its name because of its ability to bear on targets 'at the zenith' by virtue of a slewing two-axis mounting which is inclined at 35° to the horizontal. It is designed to destroy anti-ship missiles using special AMDS ammunition with a forged tungsten core designed to ensure that a single hit will be sufficient to destroy the target by exploding its warhead. It also has a capability against aircraft using more conventional ammunition.

The four 25 mm barrels have a combined rate of fire of 3,400 rds/min, each being independently fed from four 300-round ammunition drums. The ready-use supply of 1,660 rounds is sufficient for 18 normal engagements of missile targets. Reloading can be achieved during the firing cycle.

Specifications
Calibre: 25 mm
Length of barrel: 65 calibres
Traverse: 340° at 2.5 rad/s
Elevation: −10 to +122° at 2.5 rad/s
Mounting weight: 4,400 kg (9,702 lb) (with ammunition)
Muzzle velocity: 1,355 m/s
Crew: 0
Range: 1.07 n miles (2 km)
Ammunition: 625 g (TP-T); 615 g (APP-T, APDS-T); 625 g (HEI)

Manufacturer/Contractor
Oerlikon Contraves.



The twin propeller CODOG propulsion system has two lineshafts, each with one MTU diesel (4335 kW), one General Electric LM-2500 gas turbine (23,700 kW), a reduction gearbox and a KaMeWa controllable pitch propeller. The main propulsion system is split between two adjacent watertight compartments (Blohm + Voss)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Cutlass B1 ESM system
Cutlass B1 is designed for operation in very dense signal environments, receiving signals in the 1 to 18 GHz frequency range, measuring their parameters, comparing these with those in the radar library which contains the parameters of 2,000 radars, and displaying the information — all within one second. The EW operator is presented with a tabular display for threat identity and threat evaluation, and a tactical display giving a pictorial representation of the RF environment. Selected digital outputs can be sent to other local systems, and hard copy printout of the intercepted radar is also available. The tabular display can indicate 150 intercepts, in the order of priority. Cutlass is wide open in both bearing and frequency: that is, it does not employ sweep techniques, giving a very high intercept probability (nearly 100 per cent). Cutlass B1 uses the Cutlass processor and an Instantaneous Frequency Measurement (IFM) receiver. It has a 32-element array antenna to provide bearing measurement by phase analysis techniques. This antenna also provides RF for the IFM. In both systems the processor is provided with fast and accurate information on incoming pulses.

Specifications
Frequency coverage: 2-18 GHz
Accuracy: 2° RMS in bearing
Coverage: 360° azimuth; +40 to −10° elevation
Pulse density capability: 500,000/s
Radar store capability: 2,000 modes

Manufacturer/Contractor
Racal Radar Defence Systems Ltd, Chessington, Surrey, UK.

ELECTRONIC COUNTERMEASURES (ECM)

Scorpion noise and deception jamming system
Scorpion jammers are designed to jam salvos of incoming sea-skimming missiles over a wide angle and a wide frequency range. Scorpion operates over a frequency range of 7.5 to 18 GHz and offers a range of countermeasures to confuse long-range search radars, target acquisition radars and missile radars operating

Barbaros *(F 244). These ships have a very extensive electronics fit* (Blohm + Voss)

in both their search and lock on modes. The ESM library contains a customer-defined ECM response code for each known threat. Threats are prioritised and segregated from the general signals environment by integral PRI tracking circuitry. Received pulse trains are de-interleaved to establish time-of-arrival data for use in the Scorpion's pulse-prediction circuits. The data is then fed through a techniques generator to a fast tuning voltage-controlled oscillator, whose output is fed to a high-power amplifier for transmission. Scorpion can generate ten types of jamming modulation, including continuous and burst noise, cover pulse noise, synchronised railing and false target generation. Overall, the system can handle up to eight threats simultaneously with each target being treated to a time domain managed mix of the ten jamming modulations. The jammer is stabilised in all three axes and houses a twin antenna array, providing a wide beam multiple target output and a narrowbeam capability for high ERP operations.

Ship's sonar is the Raytheon AN/SQS-56, an active/passive hull-mounted system with the hull-mounted transducer protected by a steel dome (right) and pallet-mounted operators' positions (Blohm + Voss)

Manufacturer/Contractor
Racal Radar Defence Systems Ltd, Chessington, Surrey, UK.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher
There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units. They are mounted on either side of the hangar, immediately below the Mk 29 launcher.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

AN/SLQ-25 Nixie noisemaker
One AN/SLQ-25 Nixie solid-state, electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter to generate and amplify the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed over the transom. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. The winch streams and recovers the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed body, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, is 95 cm (3.10 ft) long, 15.24 cm (6 in) in diameter and weighs 18 kg (40 lb). It receives amplifier outputs, converts them into acoustic signals and projects them.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.

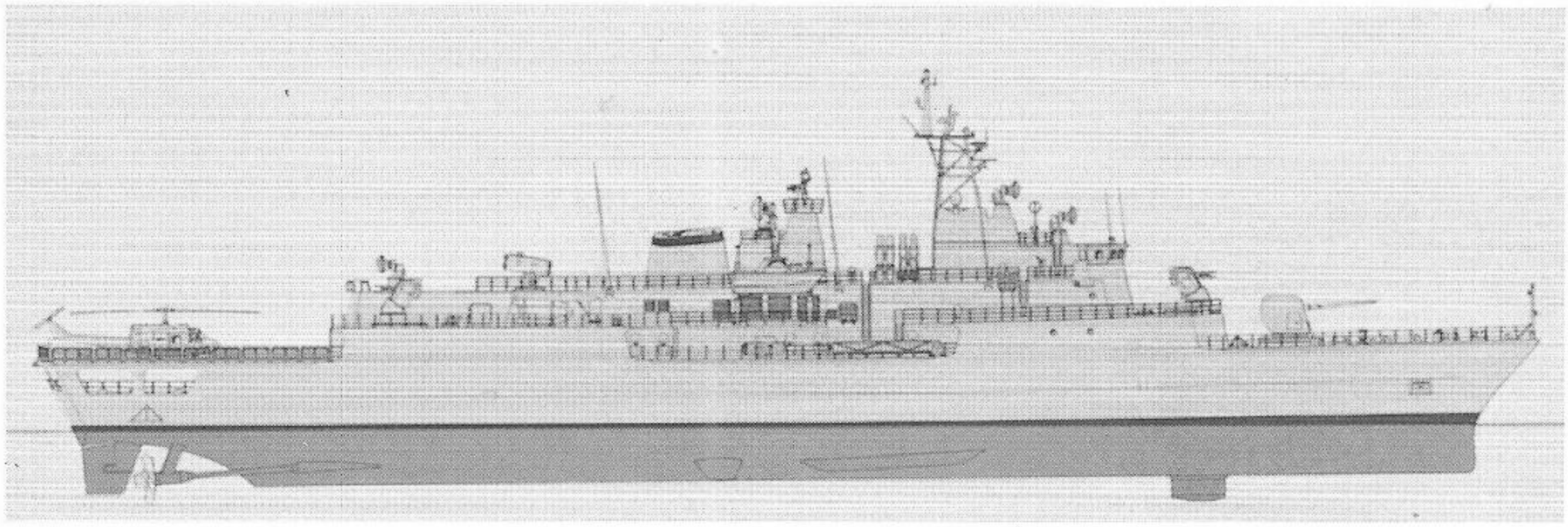
COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEM

Signaal SEWACO FD command and fire-control system
SEWACO FD (FD = Fully Distributed) is an automatic threat evaluation, weapon assignment and sensor allocation system, which can also be used as a planning aid through inputs of intelligence data and decision support facilities. SEWACO FD has been developed from the SEWACO system, with distributed processing power replacing the centralised computer complexes. The processing power is formed by SIGMA (SIGnaal Modular Architecture) nodes, one of which is built into every MOC (Multifunction Operator Console) and Bus Terminal Server (BTS). These SIGMA nodes consist of a number of SUN-1S type processor boards each with 16 Mbyte RAM and capable of 12.5 Mips.

The software package, (designated TACTICOS) is written in Ada but includes SPLICE (Subscription Paradigm for the Logical Interconnection of Concurrent Engines) distributed database and data communication modules, which operate alongside UNIX. The hardware is linked through a dual Ethernet (IEEE 802.3) standard LAN (local area network), with subsystems either linked directly to the LAN through a digital data interface bustap, or through a BTS interface. These BTS also have spare processing power which they bring into use automatically to compensate for failures in standard processor nodes.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.



Meko 200 TN Track II frigate (Blohm & Voss)

COMMUNICATIONS AND DATALINKS

AN/WSC-3(V)7

WSC-3 is the US Navy's standard UHF satellite terminal, but the (V)7 used in the Turkish ships is employed only as a terrestrial line of sight radio terminal.

Link 11
Link 14

Tacan
URN 25

IFF
Mk XII

WEAPONS CONTROL

AN/SWG-1A Harpoon Launch Control System (LCS)

SWG-1A is the Harpoon Launch Control System, which activates the missile, selects the flight pattern and sets seeker search modes (with small-, medium- or large-acquisition windows), as well as providing target range and bearing data. Alternatively, the missile can simply be launched along the bearing of the target, with the seeker activated early to scan a 90° sector; if, after a set time, no target has been acquired the missile commences a preset search pattern. SWG-1A takes account of other ships in the general target area and generates indirect flight plans for the missile, including waypoints to optimise angles of approach which will achieve the highest possibility of success while minimising the chances of the missile being destroyed by hostile fire. It can also be used to compute flight plans in a multiple attack so that several missiles, from either the same or different ships, arrive on target simultaneously, thus swamping the defences.

Seaguard Weapon control system

Seaguard is the weapon control system for the 25 mm CIWS and is based upon four modules (Common Support Module; Search Radar Module (SRM); Tracking (and illumination) Module (TM); and the 25 mm Gun Module (GM 25)) which are all linked by a Seaguard databus. The Common Support Module interfaces all system elements and has a mainframe architecture based upon the Cora II MV computer, while the Search Radar Module is based upon the Dolphin version of the Siemens Plessey AWS-6 radar, a dual-beam radar which detects both sea-skimmers and high-altitude cruise/dive attack missiles. In the Turkish Track II ships the Tracking (and illumination) Module (designated TMX/Ka-CW) operates in I/J-band for continuous illumination of targets, the electronic sensor being supplemented by two Siemens/Albis electro-optic directors. The TMX/Ka-CW is based upon a Contraves Italiana I/J-band, fully coherent, pulse Doppler monopulse radar and is capable of tracking targets at distances from 37.75 n miles (70 km) to 300 m and in addition to automatic target tracking of both air and surface targets it features a track-on-jam capability.

Manufacturers/Contractors

Oerlikon-Contraves AG.
Siemens Plessey.

RADARS

Set	AWS 9 (Type 996)	STIR (F 244, F 245 — one; F 246, F 247 — two)	AWS-6 (Dolphin)	TMK/Ka-CW	2690 ARPA
Company	Plessey	Signaal	Plessey	Contraves Italiana	Racal-Decca
Role	3D air search	Fire control (SAM)	Air/surface search (Seaguard system)	Gun control (Seaguard system)	Navigation
Band	E/F	I/J/K	G	I/J (8.6-9.5 GHz)	I
Range	Air targets: 37.75 n miles (70 km) High diving missiles: 10.75 n miles (20 km)	76 n miles (140 km)	Height: 14,000 m Range: 35 km	37.75 n miles (70 km) to 300 m	Typical range: 48 n miles
Beam		1.4°	1.5°	30 mrad	1.2°
Peak Power	49 kW	220 kW	50 kW	4 kW	25 kW
Gain	—	—	29 dB	—	30 dB
Pulsewidth	0.1, 4.3 µs	0.29 µs	0.1/4.3 µs	0.53-4 µs	0.05/0.25/1.0 µs
PRF	—	1,800/3,600 pps	—	—	—
Scan rate	30 rpm	—	30/60 rpm	—	28 rpm

SONAR

Raytheon AN/SQS-56 hull-mounted sonar

The AN/SQS-56 hull-mounted sonar, which was originally developed for the US Navy's 'Oliver Hazard Perry' class frigates, has been provided by the US Navy to various foreign navies, including that of Turkey, via the FMS programme. (Note that sets exported via the FMS are designated AN/SQS-56; those exported as a commercial sale from Raytheon are designated DE 1160). Digital implementation allows packaging of the complete multifunction active and passive sonar in five medium-size electronics cabinets and one operator's console. System control uses a built-in mini-computer and an advanced display system. The sonar is an active/passive, preformed beam, digital sonar providing panoramic echo ranging and panoramic (DIMUS) passive surveillance. All signal processing, except transducer-received signal amplification and linear transducer transmit drive, is accomplished in digital hardware, most of which is implemented using US Navy SEMP (Standard Electronic Module Programme) components in compact water-cooled cabinets small enough to allow installation through standard size hatches.

The basic system includes the transducer array, transducer junction box, five electronics cabinets (array interface, transmitter(s), receiver and controller), operator console, sonar dome and control unit. Options in production include a loudspeaker/intercom, a water-cooling unit, a remote display and a performance prediction subsystem.

A single operator can search, track, classify and designate multiple targets from the active system while simultaneously maintaining anti-torpedo surveillance on the passive display.

Computer-assisted system control permits the operator to concentrate on the sonar data being displayed rather than on the system control. Operating frequencies are 5.6, 7.5 and 8.4 kHz.

Manufacturer/Contractor

Raytheon Company, Submarine Signal Division, Portsmouth, Rhode Island.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 23.16 × 14.8 m (76 × 49 ft)
Hangar: Hangar accommodates 1 helicopter

Agusta-Bell AB 212ASW

One Agusta-Bell AB 212ASW anti-submarine helicopter is normally embarked.

Specifications

Main rotor diameter: 14.63 m (48.0 ft)
Length overall (both rotors turning): 22.15 m (57.08 ft)
Fuselage length: 12.92 m (42.39 ft)
Height to rotor head: 3.91 m (12.82 ft)
Rotor disc area: 168.1 m² (1,809 sq ft)
Max take-off weight: 5,070 kg (11,177 lb)
Max speed (never exceed): 130 kts (240 km/h)
Typical cruising speed: 100 kts (185 km/h)
Hovering ceiling (out of ground effect): 396 m (1,300 ft)
Range with max standard fuel: 332 n miles (615 km)
Engine: 1 Pratt & Whitney Canada PT6T-6 Turbo Twin Pac rated at 1,398 kW (1,875 shp)
Role equipment: 2 Mk 46 or 244/S lightweight torpedoes, or 2 Sea Skua ASMs

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 General Electric LM-2500-30 gas turbine; 44.76 MW (60,000 hp) sustained; 2 MTU 16V 1163 TB83 diesels; 8.67 MW (11,780 hp(m)) sustained;
Shafts: 2
Propellers: 2 KaMeWa, cp
Ship's services: 4 MTU/Siemens diesel generators; 775 KVA at 1,800 rpm.

FURTHER INFORMATION

PROGRAMME

First contacts between the Turkish Navy and Blohm + Voss on the possibility of a second order started in May 1987. This led to a contract being signed on 19 January 1990 for what became known as the MEKO 200 TN (Turkish Navy) Track II. The first ship *(Barbaros)* was laid down at the Blohm + Voss yard in November 1992 and completed on 16 March 1995, with the first Turkish ship being laid down in September 1993 and completed in March 1996.

A total of four has been ordered to date. *Barbaros* (F 244) started running first of class sea trials in October 1994.

DESIGN

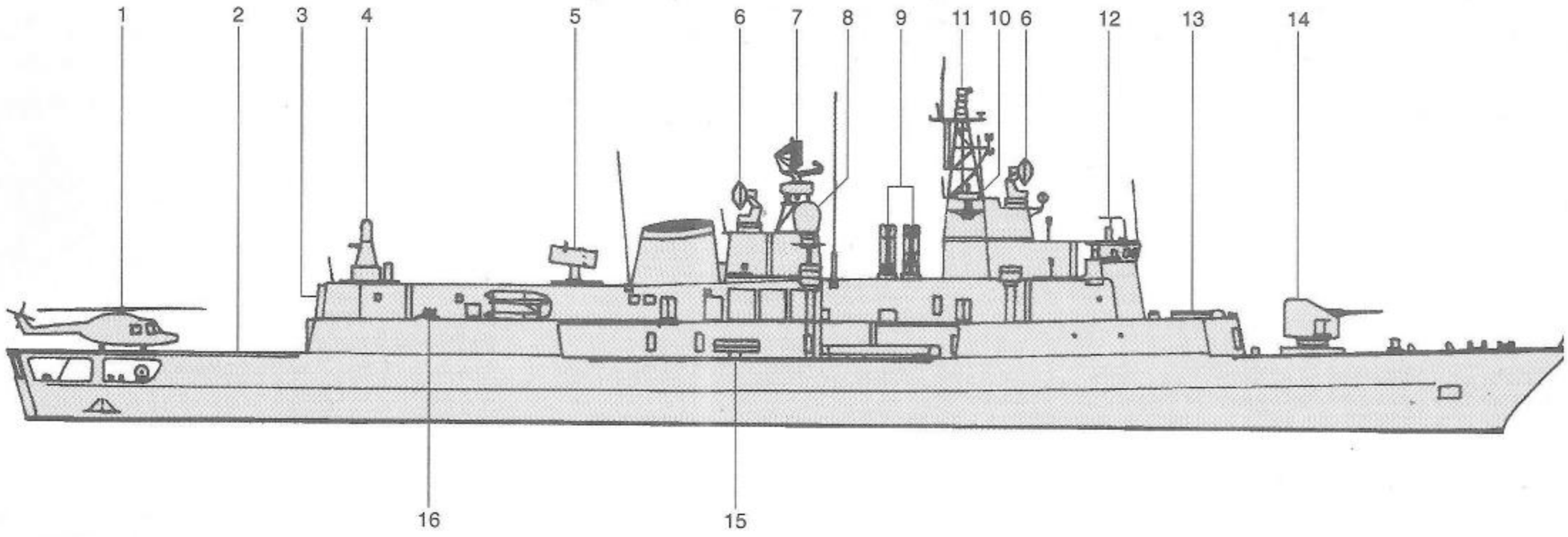
The MEKO 200 TN Track II ships are longer than the Track I ships but, in fact, this simply makes them the same length as the MEKO 200s built for Australia, Greece, New Zealand and Portugal. Unlike Track I, however, the Track II ships are being built to the latest MEKO Mod 3 standards, which includes the combat system databus (MICE/DAIL) in addition to the ship system databus and compartmental divisions (see 'Overview').

The CODAD propulsion system has also been changed to CODOG to improve the top speed. More up-to-date electronic systems are also being fitted, but it does, however, retain the Sea Zenith CIWS. Eight Harpoon launchers are fitted, as is the Sea Sparrow SAM system. The first pair have GMLS Mk 29 eight-cell launchers, but the second pair have GMVLS Mk 41 vertical launchers and these will be retrofitted to the first two in due course. A full command system is installed and, for the first time in a Turkish warship, there is an NBCD citadel. The complement is increased to 200.

DEPLOYMENT

F 244 and F 245 will normally be employed as Flagships.

VASCO DA GAMA (MEKO 200 PN)



Vasco da Gama (Ian Sturton)
1 *Westland Super Lynx Mk 95* **2** *Flight deck* **3** *Hangar* **4** *Hughes 20 mm Mk 15 CIWS* **5** *Mk 29 Mod 1 launcher for Raytheon Sea Sparrow SAM* **6** *Signaal STIR target indication radar* **7** *Signaal DA08 air/surface search* **8** *GEC-Marconi SCOT 3 SATCOM* **9** *McDonnell Douglas Harpoon anti-ship missile (eight)* **10** *Argo AR 700/APECS ESM/ECM system* **11** *Signaal MW 08* **12** *Kelvin Hughes Type 1007 navigation radar* **13** *Volume reserved for VLS Sea Sparrow* **14** *Creusot Loire 100 mm (3 in)/55 Modèle 68 CADAM Gun* **15** *US Mk 32 324 mm torpedo tubes* **16** *Loral Hycor Mk 36 SRBOC chaff/IR launchers*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Portugal
Type: MEKO 200PN

Class: VASCO DA GAMA

Built: 3
Active: 3

Displacement:
standard: 2,700 t
full load: 3,300 t

Dimensions
Length: 115.9 m (380.3 ft) (oa); 109 m (357.6 ft) (wl)
Beam: 14.8 m (48.7 ft)
Draught: 6.1 m (20 ft)

Speed: 32 (gas turbines); 20 kts (diesel)
Range: 4,900 n miles at 18 kts; 9,600 n miles at 12 kts

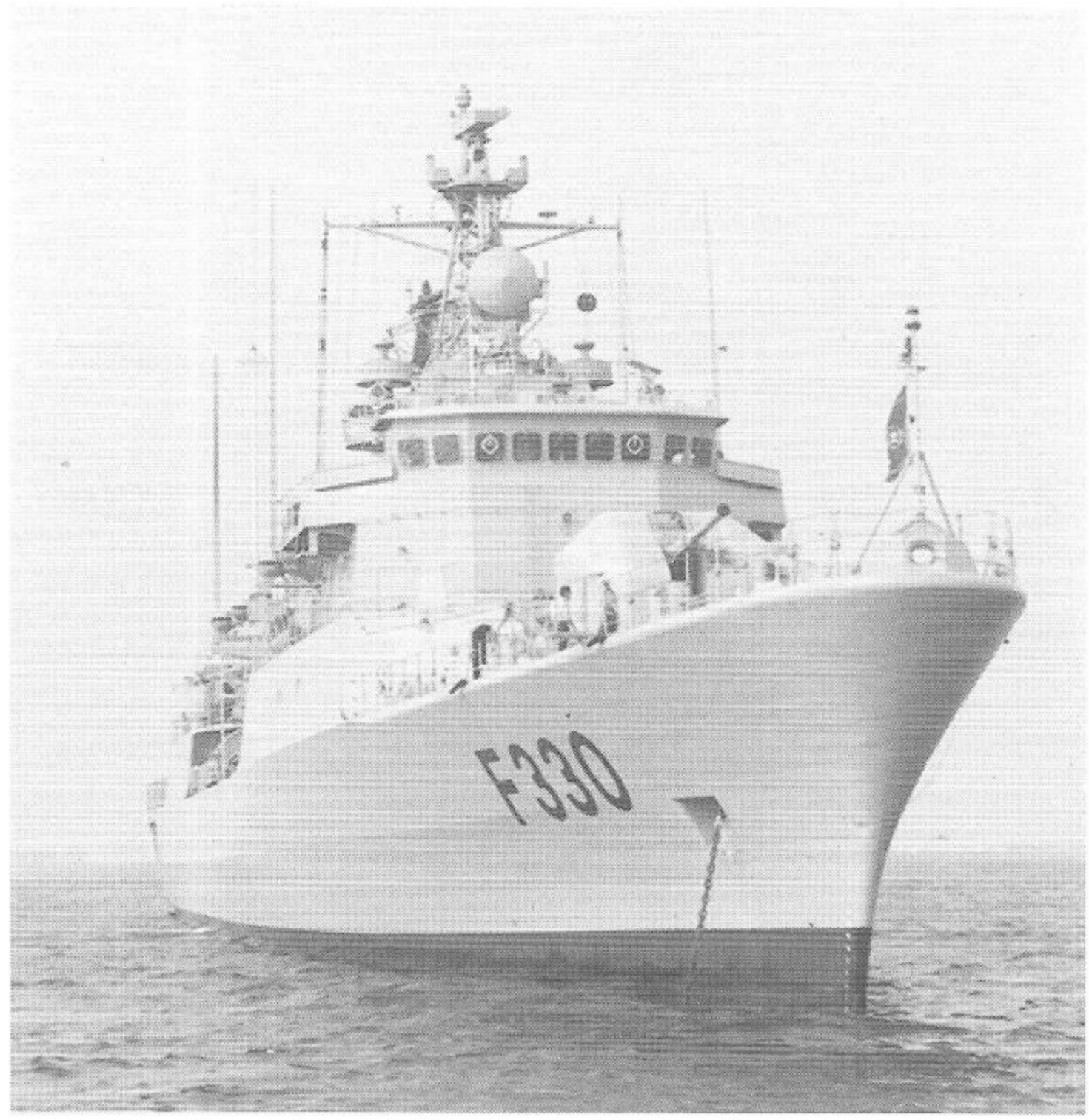
Complement:
ship's crew: 166 (19 officers)
air crew: 16 (4 officers)
Flag Staff: 16

SHIPS

VASCO DA GAMA (F 330)
Builder Blohm + Voss, Hamburg, Germany
Laid down 1 Feb 1989
Launched 26 Jun 1989
Commissioned 18 Jan 1991

ALVARES CABRAL (F 331)
Builder Howaldtswerke, Kiel, Germany
Laid down 2 Jun 1989
Launched 6 Jun 1990
Commissioned 24 May 1991

CORTE REAL (F 332)
Builder Howaldtswerke, Kiel, Germany
Laid down 24 Nov 1989
Launched 6 Jun 1990
Commissioned 22 Nov 1991



Vasco da Gama *(F 330). Above the bridge is the Signaal STIR fire-control radar, while either side of it are the drum-shaped arrays of the ArgoSystems APECS II ESM/ECM system. At the masthead is the Signaal MW08 radar antenna* (UK MoD)

WEAPONS SYSTEMS

SURFACE-TO SURFACE MISSILES (SSM)

McDonnell Douglas UGM-84B Harpoon

Eight Harpoon anti-ship missile canisters are mounted amidships; there are two groups of four launchers each, with one group pointing to either beam. The missiles are the Block 1C version with additional options, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications

Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile)
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

GMLS Mk 29 Mod 1 missile handling and launching system

There is one Guided Missile Launching System (GMLS) Mk 29 Mod 1, with the launcher atop the hangar roof. The system consists of a launcher, a launcher-control, power supply unit, launcher loader, and a maintenance/interconnecting cabinet. The launcher itself consists of eight watertight cells in two box mountings on either side of the pedestal, each cell having a heater and two frangible covers (front and rear). The reloading system consists of two loading installations on the port and starboard sides and a control panel. Each installation consists of two rows of missiles, each supported by two blocks, in a frame carried by four air springs to reduce the chances of shock or vibration damage. The installation also has a loading arm suspended from a vertical and horizontal transport unit in the ceiling and a hydraulically operated hatch in the front. When the launch cell or cells require reloading they are turned to a fore-and-aft position and inclined at an angle of 5° to bring them into line with the loading system. Space and weight have both been allocated for vertical launch Sea Sparrow.

Specifications

Operators: 1
Associated fire-control system: Mk 91
Training limits: 360°
Elevation limits: −5 to +85°
Firing rate: 3 missiles/min

Manufacturer/Contractor

Raytheon Company, Equipment Division.

Raytheon Sea Sparrow point-defence missile system

The SAM is the RIM-7M Sea Sparrow missile. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast/fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications

RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors

Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited in the waist immediately below the main mast.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

Vasco da Gama *(F330). These ships are the only MEKOs to be armed with the Creusot-Loire 100 mm Modèle 68 CADAM. The aperture in 'B' position is capped, but is reserved for VLS Sea Sparrow in due course* (Blohm + Voss)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications

Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

100 mm/55 Modèle 1968 CADAM

There is one single 100 mm/55 Modèle 1968-II CADAM dual-purpose mounting located on the foredeck. This is normally operated in the fully automatic remote mode with an unmanned turret, although there is a fall-back manual mode, which requires two men in the turret. The turrets have been taken from an old ship and upgraded to CADAM (CADence AMéliorée) standard with improved recoil and feed systems, raising the firing rate from 60 rds/min to 78 rds/min.

Specifications

Calibre: 100 mm
Length of barrel: 55 calibres
Muzzle velocity: 870 m/s (2,854 ft/s)
Traverse: 360° at 40°/s
Elevation: −15 to +80° at 25°/s
Mounting weight: 21 t
Crew: 2 (optional) and 2 loaders
Range:
anti-surface: 9.15 n miles (17 km)
anti-air: 8,000 m (26,000 ft)
Rate of fire: 78 rds/min
Ammunition: 13.5 kg (29.8 lb) (multipurpose projectile); 9.7 kg (21.4 lb) (charge)

Manufacturers/Contractors

Direction des Constructions Navales (DCN) (prime).
Mécanique Creusot-Loire, Marine Products (mountings).
DCN Ruelle (gun).
CSEE Défense (servo equipment).

Hughes Mk 15 CIWS Phalanx

A single Hughes Mk 15 CIWS Phalanx close in weapons system (CIWS) is mounted on the port side of the hangar roof to provide the innermost layer of defence against anti-ship missiles. The 20 mm M61A1, six-barrel, Gatling-principle gun has a cylindrical magazine with the feed mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA (system).

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

APECS II/AR-700 ECM/ESM suite

APECS II is an advanced modular ESM/ECM suite covering frequencies from 0.5 to 18 GHz, which is designed to counter most known radar threats. The Argo 700 is the IFM receiver part of the system, providing surveillance and radar warning over 2-18 GHz band. APECS II can be operated fully automatically, semi-automatically (that is, with manual intervention) or manually. The ECM part of the system jams threat emitters, with high-speed switching enabling up to 16 threats to be jammed simultaneously. The antenna array consists of a mast-mounted ESM antenna assembly with two DF arrays, one omnidirectional unit and two monopulse units; system processing equipment; operator's console and two ECM transmitters (port and starboard) with their antenna systems located inside the transmitter units.

Specifications

ESM role (AR-700)
Frequency coverage: 0.5-18 GHz
High sensitivity: Up to −67 dBm
Detection range: 200 n miles ships; 50 n miles aircraft
DF accuracy: 4° RMS; 2° RMS fine DF
Automatic tracking: 500 active signals in dense signal environment
Signal identification speed: <1s

ECM role
Azimuth coverage: 360° using a 60-beam jammer (one beam per 6° azimuth sector)
Radiated power: 180 kW nominal mid-band
Frequency coverage: 7.5-18 GHz

Manufacturer/Contractor

ARGOSystems Inc, Sunnyvale, California.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are two Mk 36 SRBOC (Super Rapid Bloom Off-board Countermeasures) units. They are mounted on either side of the hangar, immediately below the Mk 29 launcher.

Specifications

Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA

AN/SLQ-25 Nixie noisemaker

One AN/SLQ-25 Nixie solid-state, electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter to generate and amplify the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed over the transom. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. The winch streams and recovers the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed body, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, is 95 cm long (3.10 ft), 15.24 cm (6 in) in diameter and weighs 18 kg (40 lb). It receives amplifier outputs, converts them into acoustic signals and projects them.

Manufacturer/Contractor

Aerojet ElectroSystems, Sacramento, California, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Thomson-CSF/Signaal SEWACO command and fire-control system

The Portuguese ships are fitted with a Signaal SEWACO action data automation system, which is an automatic threat evaluation, weapon assignment and sensor allocation system, and which can also be used as a planning aid through inputs of intelligence data and decision support facilities. The software package, designated STACOS, is written in RTL-2.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

COMMUNICATIONS AND DATALINKS

Link 11
Link 14
Satcom (rotated between ships, as required)

WEAPONS CONTROL

AN/SWG-1A Harpoon Launch Control System (LCS)

SWG-1A is the Harpoon Launch Control System, which activates the missile, selects the flight pattern and sets seeker search modes (with small-, medium- or large-acquisition windows), as well as providing target range and bearing data. Alternatively, the missile can simply be launched along the bearing of the target, with the seeker activated early to scan a 90° sector; if, after a set time, no target has been acquired the missile commences a preset search pattern. SWG-1A takes account of other ships in the general target area and generates indirect flight plans for the missile, including waypoints to optimise angles of approach which will achieve the highest possibility of success while minimising the chances of the missile being destroyed by hostile fire. It can also be used to compute flight plans in a multiple attack so that several missiles, from either the same or different ships, arrive on target simultaneously, thus swamping the defences.

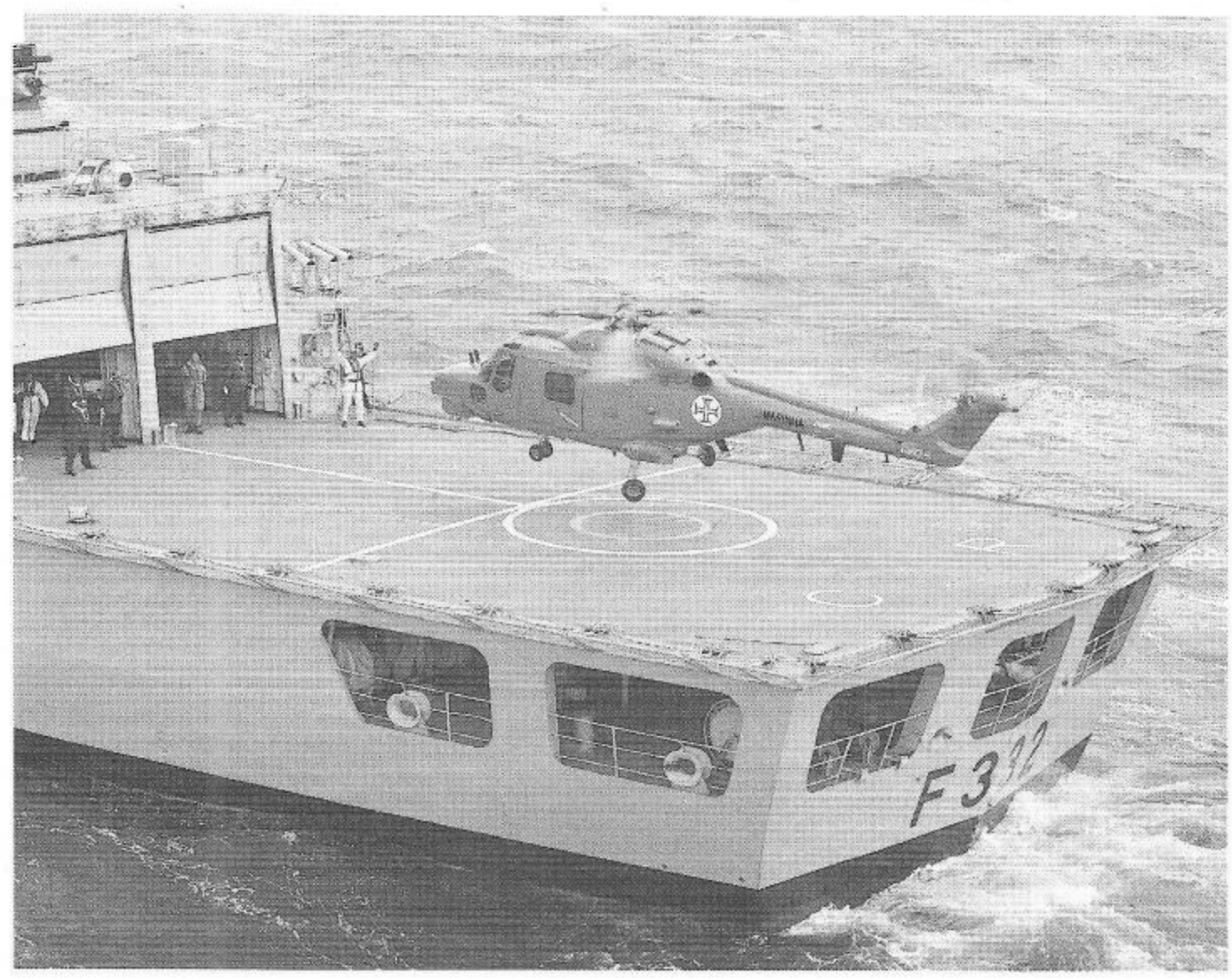
Vesta-VC helicopter datalink system

The Vesta-VC (VC = voice channel) is a supplementary facility to the Vesta helicopter-mounted transponder system in which a VHF signal is automatically transmitted when the aircraft is illuminated by the parent ship's search radar. This reply is picked up by the Vesta shipborne component to produce and tag a clear echo on the ship's radar screen.

The helicopter is equipped with two spherical antennas for reception of the ship's search radar signals. The transponder generates a VHF reply containing a number of code pulses for identification purposes. On board the ship there are two simple rod antennas to receive the transponder signals, which are then routed via the receiver (and extractor unit) to the ship's radar display. The Vesta system is controlled by either a control unit and a radar indicator, or a data handling system.

The Vesta system can indicate unambiguously any number of Vesta-equipped helicopters on the ship's radar display. A limited number of helicopters can be identified by means of preselected codes.

VESTA-VC provides an additional facility which extends the ship's radar horizon by enabling the pilot to transmit information (target range, bearing and speed) from the helicopter's radar back to the parent ship over an existing voice channel. All necessary information is contained in a pulse train lasting about 0.9 seconds and



Portuguese Navy Westland Super Lynx Mk 95 lands aboard the frigate Corte Real *(F 332). The ship normally carries two such helicopters* (Westland)

containing 50 words of 32 bits. The system works with any radio and any radar, using interfaces produced by Signaal. The effect of this system is to extend the parent ship's radar horizon.

Specifications
Vesta
Transmission frequency: VHF
Radar reception frequency: 1-10 GHz
Transmission power: 10 W
Pulse length: 2 µs
PRF (helicopter part): 20 kHz without code
Sensitivity (ship part): −78 dBm
Range: 0-124 n miles (230 km)
Number of codes: 5 (optionally 64)
Number of co-operating radar systems: 4

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

Set	MW 08	DA 08	STIR (two)	1007
Company	Signaal	Signaal	Signaal	Kelvin Hughes
Role	Air search	Surface search/ target indication	Fire control (SAM)	Navigation
Band	F/G	F	I/J/K	I
Range		92 n miles (168 km)	76 n miles (140 km)	64 n miles (117 km)
Beam	2 × 9°	1.5 × csc² to 40°	1.4°	1 × 18°/ 0.75 × 18°
Peak Power	150 kW	145 kW	220 kW	25 kW
Gain	23 dB	33 dB	—	31 dB/34 dB
Pulsewidth	0.6 µs	35/69 µs	0.29 µs	0.8 or 0.25 µs/ 0.75 µs
PRF	3,800 pps	1,000/500 pps	1,800/3,600 pps	1,600/800 pps
Scan rate	27 rpm	10/20 rpm	—	24 rpm

SONAR

AN/SQS-510 sonar
The Computing Devices of Canada (CDC) AN/SQS-510(V) is installed in these ships. AN/SQS-510 (V) is a development of the Canadian Westinghouse AN/SQS-505 sonar, combined with the AN/SQR-501 towed array. The hull-mounted element is a 7 kHz medium-size search and attack sonar, which can be used in direct communication with a digital computer, either for the transfer of range and bearing information, or it can give assistance to the operator in detection and tracking. It is a deep water, omnidirectional, surveillance system, but is also able to operate in a directional mode that can maintain search ability while tracking defined targets. Three selectable frequencies are available so that several ships can survey an area in close proximity without cross-talk. The 'wet end' is AN/SQR-501 (also known as the Canadian Towed Sonar Array (CANTASS), which is itself a combination of a US Navy AN/SQR-19 array and a Computing Devices of Canada signal processor.

Specifications
AN/SQS-501
Coverage: 360° (azimuth)
Range: 183-3,000 m (200-3,200 yd)
Doppler range: ±40 kts (7.2 kHz)
Doppler frequencies: 6.4, 7.2 and 8.0 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT
Power level: High and low (10 dB reduction)

Manufacturers/Contractors
Computing Devices, Ottawa, Canada (prime and software).
Westinghouse Canada Inc, Burlington, Ontario, 0 Canada (sonars).

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 22.25 × 14.8 m (73 × 46 ft)
Hangar: 2 hangars

Two Westland Super Lynx Mk 95

Specifications
Dimensions:
main rotor diameter: 12.80 m (42.00 ft)
tail rotor diameter: 2.21 m (7.25 ft)
length overall (rotors turning): 15.165 m (49.75 ft)
Weights:
empty: 2,740 kg (6,040 lb)
empty, equipped (ASW): 3,343 kg (7,370 lb)
Performance:
cruising speed: 125 kts (232 km/h)
speed for max endurance: 70 kts (130 km/h)
max rate of climb: 661 m (2,170 ft)/min
time on station (ASW) 50 n miles (93 km) radius: 2 h
max range: 320 n miles (593 km)
max endurance: 2 h 50 mins
Power plant: 2 Rolls-Royce Gem 42-1 with max contingency rating of 835 kW (1,120 shp).
Crew: 2 (pilot and co-pilot/observer)
Radar: Bendix/King RDR 1500 lightweight search and tracking radar
Mission: AN/AQS-18 sonar
Navigation: Racal RNS 252 GPS-aided INS; Doppler 91
ASW armament: 2 Mk 46 homing torpedoes

Corte Real *(F 332) with Westland Super Lynx Mk 95 overhead* (Westland)

PROPULSION

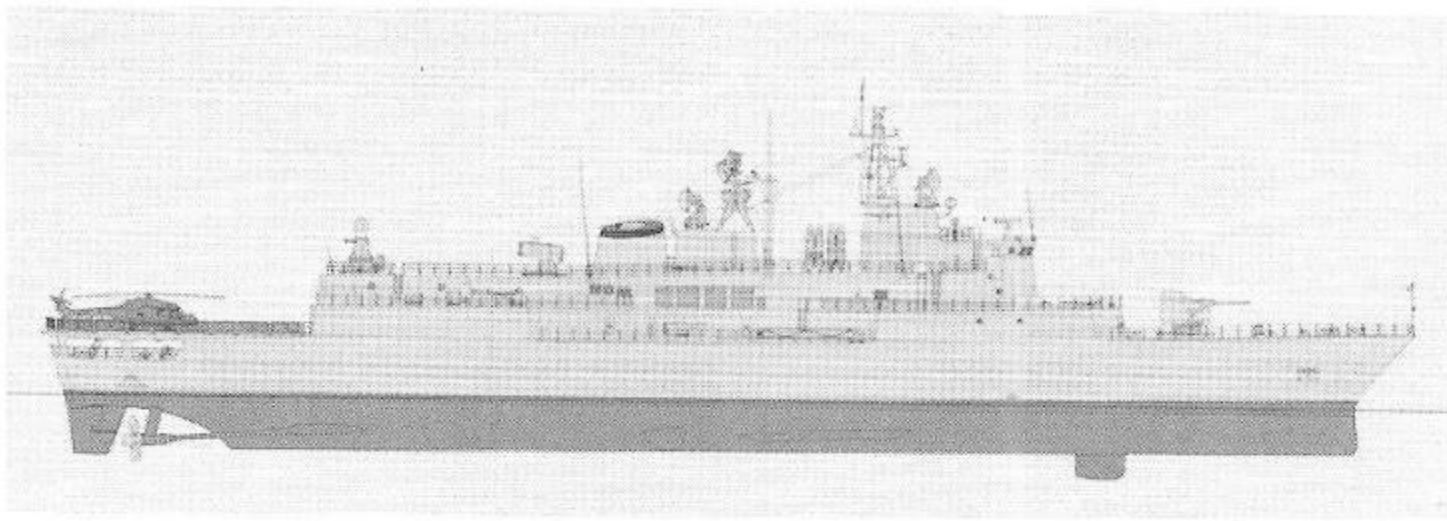
Specifications
System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 General Electric GE LM 2500-30 gas turbines; 39.5 MW (53,000 hp) sustained; 2 MTU 12V 1163 TB83 diesels; 6.5 MW (8,840 hp(m))
Shafts: 2
Propellers: 2, cp
Auxiliary generators: 4 — 775 kVA diesel-generator sets

FURTHER INFORMATION

PROGRAMME

The contract for all three was signed on 25 July 1986. The lead ship was built by Blohm + Voss and the other two by Howaldtswerke, with all three being commissioned in 1991.

Portugal met 40 per cent of the programme costs, with the balance coming from seven NATO partners: Canada, France, Germany, Luxembourg, Netherlands, Norway, and USA.



MEKO 200 PN. Sonar dome is for the Computing Devices (Canada) SQS-510 (V) active search and attack system

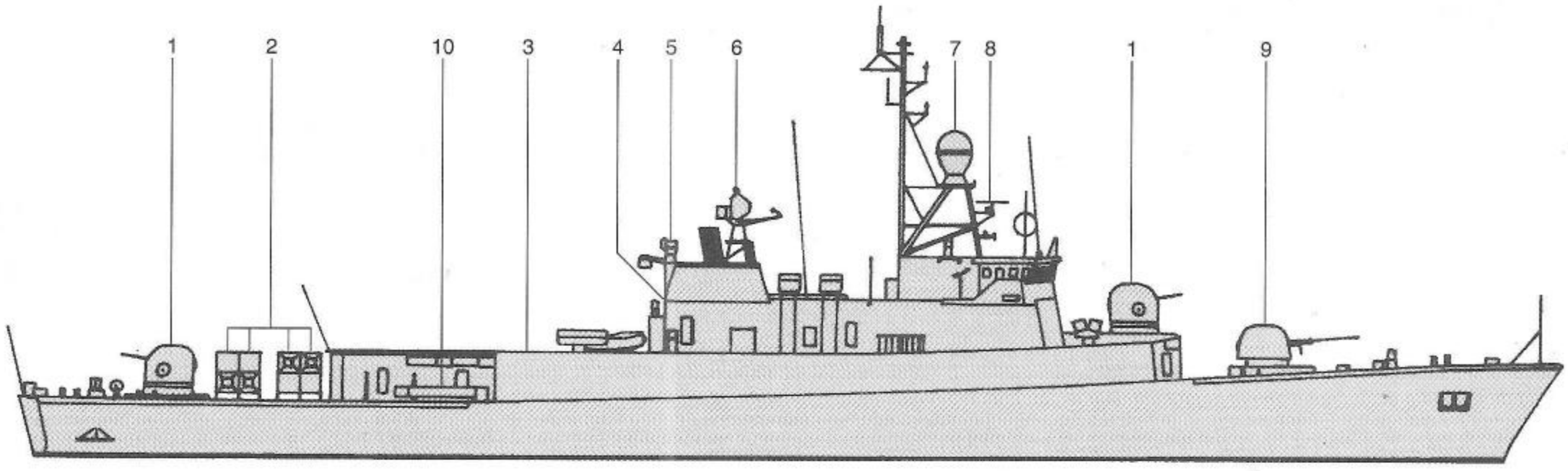
DESIGN

The MEKO 200PN was the first to incorporate the MEKO Mod 3 concepts such as compartmentalisation (see MEKO Introduction). As usual, the MEKO 200PN is designed to the normal MEKO standards, but with variations as required by the Portuguese customer. Such variations include facilities for two helicopters and a twin hangar, and a French 100 mm gun. There is only one Mk 15 CIWS Phalanx, which is located at the after port corner of the hangar roof.

The ships are designed primarily for the ASW mission, with the two Sea Lynx helicopters giving them a particularly strong capability.

These ships are fitted with stabilisers and have full RAS facilities. Space has been left for a sonar towed array and for VLS Sea Sparrow.

ESPORA (MEKO 140)



'Espora' (Ian Sturton)
1 *OTOBREDA 40 mm/70 twin mounting* **2** *Aerospatiale MM 38 anti-ship missiles* **3** *Flight deck (normal aircraft is SA 319B Alouette III)* **4** *Hangar* **5** *Signaal LIROD 8 electro-optic director* **6** *Signaal DA05 air/surface search radar* **7** *Signaal WM28 fire control* **8** *Racal-Decca TM 1226 navigation radar* **9** *OTOBREDA 76 mm (3 in)/62 single gun* **10** *USN Mk 32 324 mm anti-submarine torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Argentina
Type: MEKO 140

Class: ESPORA

Built: 4
Active: 4

Building: 2 (see 'Further Information')

Displacement:
standard: 1,470 t
full load: 1,790 t

Dimensions
Length: 91.2 m (299.1 ft)

Beam: 11.1 m (36.1 ft)
Draught: 3.33 m (10.9 ft)

Speed: 27 kts
Range: 4,000 n miles at 18 kts

Complement: 93 (11 officers)

SHIPS

ESPORA (41)
Builder AFNE, Rio Santiago, Argentina
Laid down 3 Oct 1980
Launched 23 Jan 1982
Commissioned 5 Jul 1985

ROSALES (42)
Builder AFNE, Rio Santiago, Argentina
Laid down 1 Jul 1981
Launched 4 Mar 1983
Commissioned 14 Nov 1986

SPIRO (43)
Builder AFNE, Rio Santiago, Argentina
Laid down 4 Jan 1982
Launched 24 Jun 1983
Commissioned 24 Nov 1987

PARKER (44)
Builder AFNE, Rio Santiago, Argentina
Laid down 2 Aug 1982
Launched 31 Mar 1984
Commissioned 17 Apr 1990

ROBINSON (45)
Builder AFNE, Rio Santiago, Argentina
Laid down 6 Jun 1983
Launched 15 Feb 1985
Commissioned: —*

GOMEZ ROCA (46)
Builder AFNE, Rio Santiago, Argentina
Laid down 1 Dec 1983
Launched 14 Nov 1986
Commissioned —*

*See 'Further Information'

An 'Espora' class ship at sea. Four are in service with the Argentine Navy, where they have proved a success, but no further international sales have been achieved. This ship is one of the first two to be built, as it lacks the telescopic hangar (Blohm + Voss)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 38 medium-range anti-ship missile

As built, all ships were armed with four MM 38 Exocet SSMs, which are located on the afterdeck, ahead of the twin 40 mm turret. It is, however, intended to convert all ships to take eight MM 40 Exocets, which will be in the same position. *Espora* was the trials ships for such an installation, and the other three are due to follow.

Specifications

MM 38
Length: 5.21 m (17.1 ft)
Diameter: 35 cm (13.78 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s
Booster: SNPE Epervier boost motor; burn time of 2.4 s
Warhead: Luchaire 165 kg (364 lb) fragmentation warhead
Fuzes: Delayed impact fuze and autopilot-controlled proximity fuze

Manufacturer/Contractor

Aerospatiale Tactical Missiles, Chatillon Cedex, France.

	MM 38	MM 40 Block 1	MM 40 Block 2
Length	5.21 m (17.1 ft)	5.78 m (18.96 ft)	5.80 m (19.0 ft)
Diameter	35 cm (13.78 in)	35 cm (13.78 in)	35 cm (13.78 in)
Wing span	1.00 m (3.28 ft)	1.13 m (3.7 ft)	1.13 m (3.7 ft)
Weight	735 kg (1,620 lb)	855 kg (1,884 lb)	870 kg (1,917 lb)
Speed	Mach 0.9	Mach 0.9	Mach 0.9
Range	2-22.5 n miles (4-42 km)	2-38 n miles (4-70 km)	2-40.5 n miles (4-75 km)
Guidance	Inertial and active radar	Inertial and active radar	Inertial and active radar
Warhead	Luchaire 165 kg (364 lb) fragmentation warhead	165 kg (364 lb) HE frag	155 kg (341 lb) HE frag
Fuzes	Delayed impact fuze and autopilot-controlled proximity fuze	Delay impact/proximity	Impact/proximity

TORPEDOES

B515/ILAS-3 anti-submarine torpedo launching system

There are two triple 324 mm torpedo launchers at the forward end of the flight deck. These are the B515 system (also known as ILAS-3), which consists of three 324 mm diameter torpedo tubes. The tubes are manually loaded and trained but remotely operated from the combat information centre, although emergency local operation is possible.

Specifications

Length: 3.4 m (11.15 ft)
Height: 1.2 m (3.94 ft)
Width: 1.285 m (4.22 ft)
Weight: 1,050 kg (2,315 lb) (unloaded)

Manufacturer/Contractor

Whitehead SpA, Division of Gilardini SpA.

A244/S lightweight anti-submarine weapon

The torpedo used by the 'Espora' class is the Whitehead A244/S. The A244/S uses the Alenia CIACIO-S which is capable of active, passive or mixed modes for closing on to its target and can discriminate between decoys and real targets in the presence of heavy reverberations by specially emitted pulses and signal processing. It also discriminates between target noise and reverberations, as well as having a series preset of programmable search patterns and tactical manoeuvres (including re-attack procedures). The seeker has a large search volume covered by multiple preformed beams following a number of self-adaptive search patterns and is reported capable of target detection at −5 dB in good acoustic conditions. The computerised homing system also provides for presettable combinations of signal processing, spatial filtering and tactical torpedo manoeuvring. The software may be reprogrammed by the customer to meet new tactical conditions. Upon launching the A244/S initially steers a straight course and, if the target is not detected, it then begins a search pattern which may be either a spiral between preselected depths or a helix pattern.

Specifications

Length: 2.7 m (8.86 ft)
Diameter: 324 mm (12.75 in)

Espora *(F-41) with an Aerospatiale SA 319B Alouette III on the flight deck*

Weight: 215 kg (474 lb) (warshot version)
Warhead: 34 kg (75 lb) shaped charge HBX-3 HE
Propulsion: Electric; silver/zinc batteries
Range: 3.5 n miles (6 km)
Speed: 30 kts
Guidance: Active/passive sonar, self-adaptive programmed patterns

Manufacturer/Contractor
Whitehead SpA, Salviano, Italy.

GUNS

OTOBREDA 76 mm (3 in)/62 Compact
There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles.

Specifications
Calibre: 76.2 mm (3.0 in)
Barrel length: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm L/70 Compact
There are two twin OTOBREDA 40 mm L/70 mountings. One is in 'B' position forward, the other in 'Y' position aft.

Specifications
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,025 m/s (3,362 ft/s) (PFHE), 1,350 m/s (4,430 ft/s) (APFSDS)
Traverse: 360°
Elevation: −13 to +85°
Traverse speed: 90°/s
Elevation speed: 60°/s
Range:
surface/surface: 6.75 n miles (12.5 km)
surface/air: 8,700 m (28,500 ft)
Rate of fire: 900 rds/min
Ammunition: 2.4 kg (5.3 lb) (PFHE), 2.5 kg (5.5 lb) (APFSDS)

Manufacturer/Contractor
OTOBREDA, I-25128 Brescia, Italy.

M2HB 12.7 mm machine guns

There are two mounts for M2HB 12.7 mm machine guns.

Specifications
Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rds/min
Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
against surface targets: 6,700 m (7,400 yd)
against airborne targets: 1,380 m (4,500 ft)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Elettronica INS-3 EW suite
The ships are equipped with the Elettronica INS-3 EW suite, comprising the RQN-3B radar warning set (covering frequencies 1-18 GHz) and the TQN-2X jammer.

DECOYS

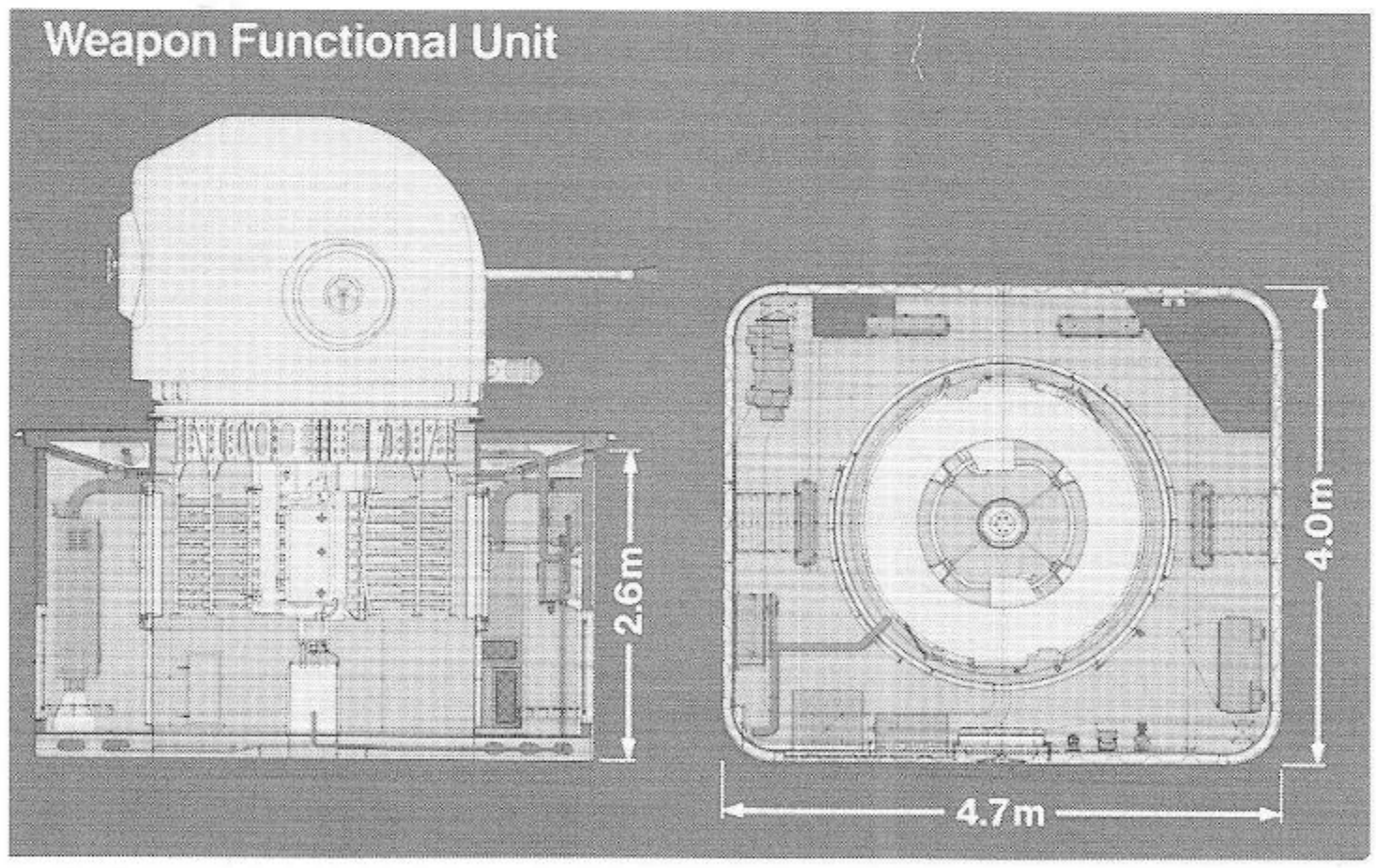
DAGAIE countermeasures system
There are two DAGAIE launchers, which can be loaded with either IR or chaff rockets, the firing sequence running automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, windspeed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises: (a) two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either 3-5 and 8-14 µm IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised fibreglass chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 µm bands.

Specifications
Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)
Container weight: 54 kg (119 lb)

Manufacturer/Contractor
CSEE Défense, Paris, France.



The OTOBREDA Fast Forty 40 mm/70 twin module as used in the 'Espora' class. This is a typical modular installation as used throughout the MEKO system (Blohm + Voss)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Signaal EASY-AR
EASY was derived from Signaal's DAISY (DAISY = Digital Action Information SYstem), which is used by the RNIN and is designed for corvette-sized ships, with the EASY-AR system being specifically tailored to suit the Argentine ships' requirements. The EASY C^2 system is designed to present raw and/or processed sensor data from search and fire-control radars together with IFF, sonar, electronic warfare and electro-optic systems to create a picture of the tactical situation. The data may also be used to designate targets to weapon systems and to assist in operations with auxiliary functions such as ASW helicopter direction and tactical navigation.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

COMMUNICATIONS AND DATALINKS

Integrated communications system: A comprehensive communications system is fitted, integrated by Hagenuk.

IFF: Mk 10

WEAPONS CONTROL

Signaal WM-28
The WM-28 is the fire-control system for the guns and is housed in the egg-shaped radome above the bridge. The radar operates in the I and J bands and has a range of some 25 n miles (46 km). It can track one air and one surface target and control the fire of two guns simultaneously.

Signaal LIROD 8 electro-optic director
One LIROD (Lightweight Radar Optronic Director) is mounted on the after end of the hangar roof. LIROD is a lightweight fire-control system based upon a K-band tracking radar and a TV camera, and is designed for simultaneous control of two dual-purpose guns while tracking one air and one surface target. The system reaction time from detection to the beginning of the engagement is about 4.5 seconds. It is based upon a 0.6 m (1.97 ft) diameter parabolic antenna with monopulse cluster. It has a very narrow pencil beam and is resistant to clutter through the application of pulse Doppler tracking combined with FFT techniques. There are also sophisticated ECCM facilities. The radar can track fighter-size targets up to 9.8 n miles (18 km) away and is capable of tracking targets with a maximum speed of 1,000 m/s (3,280 ft/s). In addition to the radar there is a militarised TV camera with CCIR standard video format, which can detect fighter-size targets at about

5.44 n miles (10 km) and large surface ships at about 10.9 n miles (20 km).

Specifications

Director
Traverse: 360° at 120°/s
Elevation: −25 to +150° at 80°/s
Radar: K-band
TV camera, field-of-view: 3-30° (2-20°)
IR camera. field-of-view: 3°

Laser rangefinder
Pulse length: 20 ns
Max repetition frequency: 10 Hz
Beam divergency: 1.2-1.5 mrad

Laser tracker
Max repetition frequency: 25 Hz
Beam divergency: 1.5 and 6 mrad

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

SONAR

STN Atlas ASO-4

The 'Espora' class is fitted with an STN Atlas ASO-4 hull-mounted, active search and attack, medium-frequency sonar.

Manufacturer/Contractor

STN Atlas Elektronik GMBH, Bremen, Germany.

RADARS

Type	DA 05	TM 1226	WM 28
Role	Air/surface search	Navigation	Fire control
Company	Signaal	Decca	Signaal
Band	E/F	I	I/J
Beam	1.5 × 8°	1.2°	Search: 1.5 × 4.7° Track: 2.4°
Peak Power	1,200 kW	25 kW	200 kW
Gain	32.2 dB	30 dB	33.5 dB
Pulsewidth	1.3/2.6 µs	0.05/0.25/ 1.0 µs	0.22/0.45 µs
PRF	1,000/500 pps	n/a	3,600/1,800 pps
Scan rate	10/20 rpm	28 rpm	60 rpm
Typical range	75 n miles (137 km) for 2 m² target	48 n miles (26 km)	25 n miles (46 km)

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 10.6 × 7.3 m (35 × 24 ft). It is reported that in at least two of the class the flight deck has been enlarged to enable them to operate Kaman SH-2F Seasprite or AS 550 helicopters
Hangar: As built, the first three ships had a flight deck but no hangar. A telescopic hangar was then successfully installed in *Parker* and the following ships and is to be retrofitted to the first three

HELICOPTERS

SA 319B Alouette III.

Specifications

Dimensions:
main rotor diameter: 11.02 m (36.15 ft)
length overall (rotor turning): 12.84 m (42.15 ft)
fuselage length: 10.17 m (33.7 ft)
height to rotor head: 3.00 m (9.84 ft)
Weights
empty: 1,143 kg (2,520 lb)
max take-off: 2,200 kg (4,850 lb)
Performance
max speed (never exceed): 113 kts (210 km/h)
max cruising speed: 100 kts (185 km/h)
service ceiling: 3,200 m (10,500 ft)
range with max standard fuel: 267 n miles (495 km)
Engines: 1—694 kW (870 shp) Turbomeca Artouste IIIB turboshaft derated to 425 kW (570 shp)
Accommodation: 7 (pilot plus six)
Weapons: In the ASW role the SA 319B can carry two lightweight torpedoes

PROPULSION

Specifications

System: Diesel
Main machinery: 2 SEMT-Pielstick 16 PC2-5V400 diesels; 19,360 kW sustained
Shafts: 2
Propellers: Fixed pitch
Auxiliary engines: 4 MTU/Siemens diesel-generator sets

'Espora' class MEKO 140 frigate (Blohm + Voss)

FURTHER INFORMATION

PROGRAMME

The larger MEKO designs have been remarkably successful, achieving numerous sales in an extremely competitive global market. It is, therefore, somewhat surprising that the MEKO 140 corvette has not done as well, achieving only six sales, all to Argentina. This contract was signed with Blohm + Voss on 1 August 1979 with all to be constructed at the AFNE yard at Rio Santiago in Argentina. The first ship was completed in 1985, followed by the second in 1986 and the third in 1987. There was then a considerable delay before the fourth was completed in April 1990 and work on the last pair then stopped due to lack of funds. Work restarted in July 1994, with the intention of finishing the ships in late 1995, but construction was then suspended again in early 1995. There have been repeated rumours of possible sales abroad, with Venezuela being mentioned as a potential customer, but nothing firm has been announced.

In late 1996 a new proposal emerged in which a Malaysian company would buy the two hulls 'as is', transport them to Malaysia and then finish them as patrol ships. They would then be sold to the Royal Malaysian Navy to meet part of its OPV requirement. It is not known whether this plan has official backing in Malaysia.

DESIGN

The design of the 'Espora' class was developed by Blohm + Voss as the corvette-sized hull in its MEKO series. The design uses the company's modular principles, with three weapons modules, six electronic modules and five pallet modules. Armament is relatively heavy for the size of hull, with one 76 mm gun and two twin 40 mm cannon, while ASW systems include a light helicopter and two triple torpedo tubes.

Parker was fitted with a telescopic hangar during construction, which was also included in *Robinson* and *Gomez Roca* (although neither of the latter two has been completed) and it is planned that similar hangars will be retrofitted in the first three. In addition, at least two of the class have flight deck extensions for SH-2F or AS 550 helicopters in due course.

All ships are fitted with roll dampers.

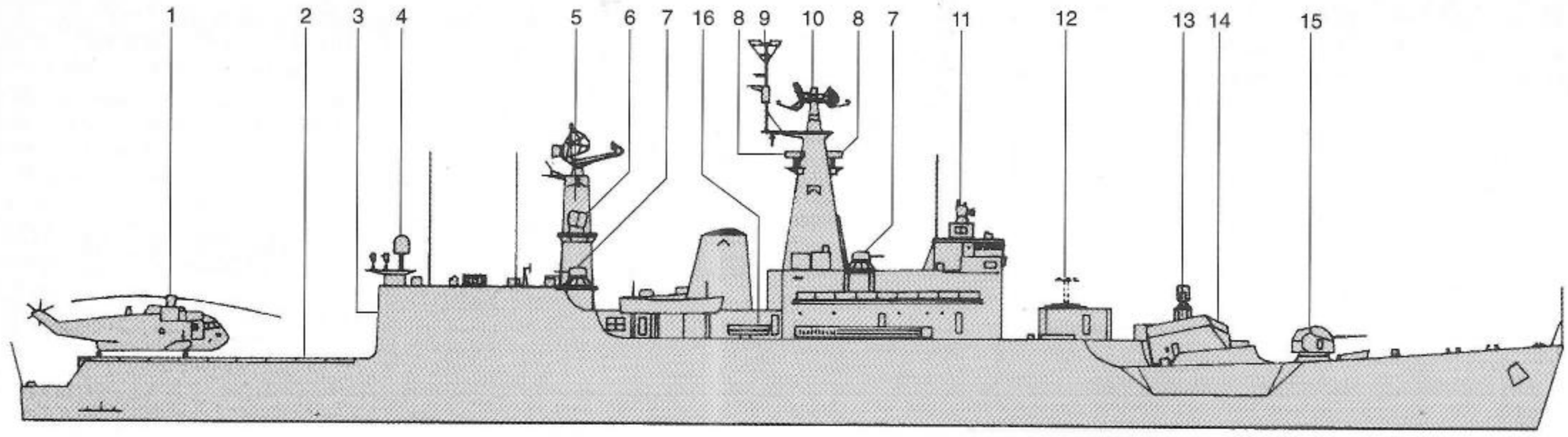
SURVIVABILITY AND DAMAGE CONTROL

The hull and superstructure are constructed of steel, and are shaped to give a low radar signature. The hull is divided into more than ten watertight compartments and three damage control zones, each with its own dedicated high-capacity salvage pump and fire pump. There are four auxiliary diesel-generator sets, of which one is in a separate compartment to ensure survivability.

DEPLOYMENT

The four ships in service are heavily used in economic zone patrol and fishery protection duties. However, *Spiro* (43) accompanied *Almirante Brown* (D 10) to the Gulf in 1990 and was later relieved by *Rosales* (42), forming a unique 'all-MEKO' national task group.

GODAVARI



Godavari (Ian Sturton)

1 *Westland Sea King Mk 42* **2** *Flight deck* **3** *Hangar* **4** *Inmarsat satellite communications* **5** *Signaal LW 08 air search radar* **6** *Drum Tilt fire control* **7** *AK 230 30 mm/65 twin mounting* **8** *Signaal ZW 06 radar (navigation/helicopter control)* **9** *Selenia INS-3 ESM/intercept/DF)* **10** *Head Net C air/surface search* **11** *Pop Group* **12** *SA-N-4 twin-arm SAM launcher* **13** *Muff Cob fire control (for 57 mm guns)* **14** *SS-N-20 Styx (four launchers)* **15** *Twin 57 mm/70 guns* **16** *B515 Triple 324 mm torpedo tubes (two)*

GENERAL SPECIFICATIONS

Operator: India
Type: Project 16 (F 20 to F 22); Project 16A (F 23 to F 25)

Class: GODAVARI

Built: 4
Active: 4
Building: 2

Displacement:
standard: 3,600 t (F 20 to F 22); 4,500 t (F 23 to F 25)
full load: 3,850 t (F 20 to F 22); 5,000 t (F 23 to F 25)

Dimensions
Length: 126.5 m (414.9 ft)
Beam: 14.5 m (47.6 ft)

Draught: 4.5 m (14.8 ft) (hull); 9 m (29.5 ft) (sonar)

Speed: 27 kts
Range: 4,500 n miles at 12 kts

Complement: 313 (40 officers including 13 aircrew)

SHIPS

GODAVARI (F 20)

Builder	Mazagon Dock Ltd, Bombay, India
Laid down	2 Jun 1978
Launched	15 May 1980
Commissioned	10 Dec 1983

GOMATI (F 21)

Builder	Mazagon Dock Ltd, Bombay, India
Laid down	1981
Launched	19 Mar 1984
Commissioned	16 Apr 1988

GANGA (F 22)

Builder	Mazagon Dock Ltd, Bombay, India
Laid down	1980
Launched	21 Oct 1981
Commissioned	30 Dec 1985

BRAHMAPUTRA (F 23)

Builder	Garden Reach SY, Calcutta, India
Laid down	1989
Launched	29 Jan 1994
Commissioned	Dec 1996

BEAS (F 24)

Builder	Garden Reach SY, Calcutta, India
Laid down	1994
Launched	1996
Commissioned	1999

BETWA (F 25)

Builder	Garden Reach SY, Calcutta, India
Laid down	1996
Launched	1998
Commissioned	2001

Gomati *(F 21) at sea in 1996. These ships are an interesting mixture of British hull; Dutch, Italian and Russian electronics; Russian weapons; and British helicopters. The hangar is very large – sufficient to accommodate two Sea Kings* (1996)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

SS-N-2D (Rubezh P-22) ('Styx') medium-range anti-ship missile

The 'Godavari' class is armed with four SS-N-2D 'Styx' missiles with two twin forward-facing launch bins either side of a narrow deckhouse on the foredeck. There are no reloads. The SS-N-2D was introduced into Soviet service in 1967 and is essentially an SS-N-2A with an added infra-red seeker. This relatively large anti-ship missile is powered by a liquid-fuelled rocket motor, with a solid fuel booster attached.

Once the target is detected the ship must close with the aim of being within the optimum engagement distance, some 15-20 n miles (28-37 km). Once ready to launch, the ship must face the target, maintain a speed of 15 knots or less, and hold its course for 20-30 seconds before launching the first salvo of two missiles. These may be followed, a minute later, by the second pair. Upon launch, the missile climbs at an angle of 45° to one of five preset altitudes (100, 150, 200, 250 or 350 m), where the onboard radar searches for a target and the receiver is switched on for very short periods to receive signals from a designated range, the range gate being 1 km on either side of the target. The radar locks on only after eight returns have been received, at distances of 3.5-12 n miles (6.5-22 km), whereupon the seeker guidance system switches off the autopilot. A throw-off gyroscope takes the missile on target a few seconds before impact as it becomes too close for radar-generated homing signals. Russian Navy tacticians calculate that seven to eight missiles are required to destroy a cruiser-size target and four for a destroyer, making salvo firing a major feature of any tactical engagement scenario with SS-N-2D missiles to ensure destruction of the target.

Specifications

SS-N-2D
Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.9 ft)
Speed: Mach 0.9
Weight (without booster): 2,600 kg (5,733 lb)
Warhead: 454 kg (1,001 lb) hollow-charge
Fuzes: Impact, proximity
Range: 3-54 n miles (5.5-100 km)
Guidance: Autopilot with active radar (supplemented in some with IR)

MS-2 seeker
Frequency: I-band (8-12 GHz) (four presets)
PRF: 300-500 pps (adjustable)
Altitude control: Barometric pressure device

Manufacturer/Contractor

Raduga, Moscow, Russia.

SURFACE-TO-AIR MISSILES (SAM)

SA-N-4 'Gecko' (OSA-M) point defence system

There is one SA-N-4 launcher just forward of the bridge, with 20 missiles in a below-deck magazine. This system is known to NATO as SA-N-4 (reporting name = Gecko) but is known in Russia as the Osa-M system, while the missile itself is designated 9M33.

SA-N-4 has a distinctive loading and launching system in which the twin-rail launcher normally lies beneath a hinged flat cover plate, emerges to launch its missiles, and then must retract in order to reload. This is likely to result in a low rate of fire which must be slowed even further by the need to close the magazine cover before firing. Underneath the launcher are four revolving drums each with five missiles while the electromechanical and hydraulic machinery is below that. On launch, the booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.5 km), following which the sustainer burns for 15 seconds.

The 9M33 missile has a slender cylindrical body with clipped delta-shaped aerodynamic surfaces. Small control fins are near the nose and there are larger fins at the tail all in 'X' configuration and in line. Midway along the body, on the underside, are two small fins while along most of each side runs a rib which may also contain electrical cables. At the rear of the missiles, on either side, are two beacon transponders.

SA-N-4 is controlled by the Pop Group system. There is a frequency-agile, monopulse radar with a parabolic rotating search antenna operating in H-band (6-8 GHz) and with a typical acquisition range of 16 n miles (30 km). There are two J-band (10-20 GHz) antennas, one of them for a pulse Doppler target-tracking element with a range of 10.75 n miles (20 km) and the smaller parabolic antenna being used to track the missile. Above the prime antennas is a smaller, circular one which emits an I-band (8-10 GHz) uplink capture beam which gathers the missile shortly after launch. The director also has a small, rectangular command uplink emitter. If the Osa-M follows the Romb, the engagement sequence is likely to see the target acquired by the 'Pop Group' air search radar. The data is then displayed on a panoramic display in the operator's console where it is designated either automatically or manually. The missile or missiles (Romb usually fires two missiles) are launched and while one 'Pop Group' antenna automatically illuminates the target, the second tracks the missile and transmits command signals.

Specifications

Range: 8 n miles (15 km)
Altitude: 9.1-3,048 m (130-10,000 ft)
Speed: Mach 2.5
Warhead: 50 kg (110.25 lb)

TORPEDOES

B515 (ILAS-3) anti-submarine torpedo launching system

There are two B515 (also known as ILAS-3) triple mounts on the main deck below the stack. The tubes are manually loaded and trained but remotely operated from the combat information centre, although emergency local operation is possible.

Specifications

Length: 3.4 m (11.15 ft)
Height: 1.2 m (3.93 ft)
Width: 1.285 m (4,216 ft)
Weight: 1,050 kg (2,315 lb) (unloaded)

Manufacturer/Contractor

Whitehead SpA, Salviano, Italy.

Whitehead A 244/S or NST-58

A244/S lightweight air-/surface-launched anti-submarine weapon. Most Indian Navy warships now use the Whitehead A244/S torpedo, which is also produced in India as the NST-58. The seeker in this weapon is the Alenia CIACIO-S which is capable of active, passive or mixed modes for closing on to its target and can discriminate between decoys and real targets in the presence of heavy reverberations, using specially emitted pulses and signal processing. It also discriminates between target noise and reverberations, as well as having a series preset of programmable search patterns and tactical manoeuvres (including re-attack procedures). The seeker has a large search volume covered by multiple preformed beams following a number of self-adaptive search patterns and is reported capable of target detection at −5 dB in good acoustic conditions. The computerised homing system also provides for presettable combinations of signal processing, spatial filtering and tactical torpedo manoeuvring. The software may be reprogrammed by the customer to meet new tactical conditions. Upon launching, the A244/S initially steers a straight course and, if the target is not detected, it then begins a search pattern which may be either a spiral between preselected depths or a helix pattern.

Specifications

Length: 2.7 m (8.85 ft)
Diameter: 324 mm (12.76 in)
Weight: 215 kg (474 lb) (warshot version)
Warhead: 34 kg (75 lb) shaped charge HBX-3 HE
Propulsion: Electric; silver/zinc batteries
Range: 3.5 n miles (6 km)
Speed: 30 kts
Guidance: Active/passive sonar, self-adaptive programmed patterns

Manufacturer/Contractor

Whitehead SpA, Salviano, Italy.

GUNS

57 mm twin L/75 (ZIF-72/AK 725)

There is one twin 57 mm L/75 mounting in 'A' position. This Russian weapon has been designed for prolonged air defence engagements, but can also be used against seaborne and land targets. The 4.57 m (15 ft) long barrels are water-cooled and the mounting consists of the elevating mass with two automatic weapons and the cradle, the rotating structure for the elevating mass with gun drives, firing system and other elements, all on a slip ring with two arrays of ball-bearings. Below decks are the ammunition handling system and the magazine. The turret is made of aluminium alloy.

The 550-round linked belt is initially threaded into the feeder mechanism by hand and is advanced by the cocking mechanism; thereafter, the hydraulic mechanism takes over. The feeder system is capable of operating in bursts or in a sustained form with automatic interruption when only 50 rounds remain in the belt. Each round weighs 6.61 kg (14.57 lb) and the feeder mechanism has 15 rounds per barrel within the turret.

There are two operators in the fire-control station, which is associated with the 'Muff Cob' fire-control system.

'Muff Cob' has its antenna in a 1 m (3.28 ft) wide, weather-proof mounting suspended from a trunnion-yoke carried on a traversing mounting. The radar is supplemented by an electro-optic sensor. The height of the mounting is about 3 m (9.8 ft) and the H-band radar can probably tilt from −10 to +50° as with the gun mounting. It is likely that control of the mounting is conducted from the compartment which houses the radar display system. Remote laying is controlled through a servo follower drive which ensures smooth slew rate changes at all speeds. Manual operation of the mounting is confined to maintenance and repair functions.

Specifications

Length of barrel: 75 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Traverse: ±200°
Elevation: −10 to +85°
Range:
anti-surface: 3.25 n miles (6 km)
anti-air: 6,000 m (19,686 ft)
Rate of fire: 120 rds/min/barrel
Projectile weight: 6.61 kg (14.57 lb)
Power requirements: 220 or 380 V, three phase

30 mm L/65 AK-230 twin mounting

F 20-F 22 only. The four twin AK-230 turrets are located either side of the two masts, giving a 'four-square' defence. The AK-230 is a remotely operated, twin barrel, automatic anti-aircraft gun designed to engage air targets at heights of up to 4,000 m (13,124 ft). It is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically powered mounting is 1.46 m (4.8 ft) high, 3.11 m (10.2 ft) long and 2.1 m (6.9 ft) wide, and consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system. Russian ammunition for this weapon consists of two rounds; BR-83 and OF-83D (see Specifications).

Propellant gas ducted from the breech ejects the empty cartridge case and the rotating breech moves the next chamber into line with the gun. With every round fired, coolant is injected into the barrels, the liners and the front of the revolving breech. During intensive firing, nitrogen gas is blown into the breech opening to prevent the accumulation of explosive gases. Recoil forces are used to move empty cartridges and belt links, together with misfired rounds, into a storage space between the base ring and the magazine.

The fire-control radar is the I/J-band Rys (NATO = Drum Tilt), whose maximum acquisition range is approximately 22 n miles (40 km), with each radar director controlling two gun mountings.

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,445 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
AA: 4,000 m (13,124 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,095-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
type: armour-piercing tracer
weight (complete round): 1.47 kg (3.24 lb)
weight (projectile): 0.35 kg (0.77 lb)

OF-83D:
type: high explosive
weight (complete round): 1.40 kg (3.08 lb)
projectile: 0.27 kg (0.59 lb)
explosive: 30 g (A-XI-2)

30 mm/65 AK-630 close in weapons system
F 23-F 25 only. The second batch of ships have four 30 mm Gatling-type AK-630s in the same positions as the AK-230s of the earlier ships. These have five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AO-18 weapon is a water-cooled, six-barrelled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to the Phalanx, firing bursts of up to 400 rounds, but unlike the US weapon AK-630 features a separate radar director, although it is believed that the installation aboard the carriers slaves the AK-630s to the CADS-1 system.

Specifications
Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,920 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range: 4,000 m (13,214 ft) (radar fire control), 5,000 m (16,405 ft) (electro-optic fire control)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
UOF-84 HE-I weight: 384 g
UOR-84 HE-T weight: 388 g
Fuze: MG-32 point impact (both rounds)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

INS-3 ESM/ECM system
INS-3 (INS = Integrated Naval System) is an Elettronica ESM/ECM system. The main components are the Bharat Ajanta ESM, a 1-18 GHz radar warning system, with a 1,500 emitter library, which was developed from the Elettronica RQN-3. The ECM system is the Elettronica TQN-2 jammer. INS-3 is used to trigger jamming and the SuperBarricade countermeasures system. The array characteristic of the INS-3 is mounted at the head of the short extension on the foremast.

Manufacturers/Contractors
1. Bharat Electronics, Bangalore, India.
2. Elettronica SpA, Rome, Italy.

Gomati *(F 21)* (H & L van Ginderen Collection)

DECOYS

ML Aviation Barricade countermeasures system
SuperBarricade launchers are being fitted in these ships. SuperBarricade is an improved version of the widely used Barricade system and provides ships with means of deploying chaff and infra-red (IR) decoys to counter missile attacks, using a layered defence against the various types of anti-ship missile. The system uses a 102 mm rocket and a redesigned launcher with four sets of triple-cell launchers. The system has a similar control unit to Barricade Mk III and the same tactical computer. The ammunition lockers each contain 24 rockets. There are four decoy modes:

- confusion, in which long-range (Stockade) rockets are fired to confuse enemy search radar and make target selection difficult
- distraction, in which medium-range chaff and/or infrared rockets are fired in a pattern of six around the ship to present alternative targets to missiles during their search phase, affording defence against multiple missiles coming from different directions
- dump is used where a missile has locked on to the ship. The ship uses a jammer to remove the missile's range gate and then fires a single rocket to produce a chaff cloud on which the gate may be 'dumped' thus allowing the jammer to be redeployed.
- centroid is a close-range, final defence mode, used against single missiles. If the incoming missile is locked on to the ship, a pattern of short-range chaff and/or IR rockets is fired to create a large alternative target close to the ship, which manoeuvres away, leaving the missile to home on to the decoy.

Manufacturer/Contractor
ML Wallop Defence Systems, Andover, Hampshire, UK.

Graseby G738 towed torpedo decoy equipment
The G738 is the export version of the British Type 182 towed torpedo decoy, which is designed to decoy both active and passive homing torpedoes, using signals electronically generated within the ship and fed, via the towing cable, to electroacoustic transducers within the towed body. The G738 produces two independently controllable output signals which are radiated simultaneously from the towed decoy. An amplitude modulated noise signal simulates the ship's propeller noise and causes passive-homing torpedoes to be seduced away from the ship towards the towed decoy. The second signal is a swept CW signal, which simulates sonar echoes, in order to confuse or jam the guidance system of active homing torpedoes, thus causing them to miss the ship. The frequency bands covered by both types of output are switchable to meet tactical scenarios and to enable concurrent operation of other sonar and communication equipments.

Specifications
Towed decoy:
diameter: 533 mm (21 in)
length: 2,005 mm (6.58 ft)
weight: 74 kg (163 lb)
Towing cable:
length: 411 m (1,348 ft)
diameter: 14.48 mm (0.57 in)
weight: 269 kg (593 lb)

Manufacturers/Contractors
Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SADOC 2/IPN 10
SADOC 2/IPN 10 (SADOC = *Systema Direzione della Operazioni di Combattimento)* is a mainframe architecture system designed to acquire, process and present data acquired by sensors but can also be used for a number of other functions, including threat evaluation and weapons control, ECM management, aircraft control, conducting ASW operations, as well as datalink and databank management.

Data are received from onboard and offboard sensors via datalinks. The system has two or three Central Processing Units (CPU) mini-computers (Alenia 32-bit CDG-3032 with a 128 k memory), one of which usually acts as the immediate back-up in the event of system failure. Within the consoles are Alenia 16-bit NDC-160 processors, with 64 k memories. Both possess mass memory modules for handling programmes and large amounts of data and an interface with a 10 Mbit/s serial databus.

There are two TAVITAC operating systems; the disk operating system and a time-sharing executive.

The SADOC 2/IPN 10 system was designed in Italy by Selenia (now Alenia Elsag) and was produced in India under licence by Bharat Electronics Ltd (BEL).

Manufacturers/Contractors
Alenia Elsag Sistemi Navali, Rome, Italy (design).
Bharat Electronics, Bangalore, India (licence production).

COMMUNICATIONS AND DATALINKS

Satcom: Inmarsat

WEAPONS CONTROL

MR-103 gunfire control system

MR-103 is the Russian-supplied weapon control system for the 57 mm guns. The director is located on the deckhouse which separates the two pairs of SS-N-2D launchers and includes the Muff Cob director (see below).

MR-310 missile fire control system

The SS-N-4D missile system is controlled by a Russian-supplied fire-control system designated MR-310 by the Indian Navy. The director associated with this system is Pop Group, which is sited on the bridge roof.

RADARS

Set	LW-08	ZW-06 (two)*
Company	HSA	Signaal
Role	Air search	Navigation/helo control
Band	D	I
Beam	2.2 × csc² to 40°	0.9 × 19°
Peak power	150 kW	60 kW
Gain	30 dB	32 dB
Pulsewidth	35/69 µs	0.06/0.6 µs
PRF	1,000/500 pps	4,000/2,000 pps
Scan rate	7.5/15 rpm	24 rpm
Typical ranges	145 n miles (260 km) for 2m² target at 26,000 m (85,000 ft)	14 n miles (26 km)

Note: * May be Russian Don Kay (I-band) in some.

Head Net C

Head Net C is the air/surface search radar and consists of two antennas back to back with one canted at 30° which enables it to act as a height-finder. The radar operates in the E band and has a maximum effective range of approximately 70 n miles (128 km).

Pop Group

Pop Group is the weapon control system for the SA-N-4 missile system, with the director sited on the bridge roof. The director includes an acquisition radar with a long, curved antenna on top of the cab, and two target trackers. The latter two are of different size, but presumably the smaller one performs a similar function to the larger, but at higher frequencies, which would enable them to direct two different missiles against the same target. The system operates in the F/H/I band.

Muff Cob

Muff Cob is the director for the 57 mm fire-control system and is the large cylindrical radome atop the deckhouse on the foredeck. The F/G-band radar radome is supported by a trunnion yoke in a traversing mounting and is thus capable of both elevation and traverse. There is a device to the left of the radome (from the front), with a remotely controlled cover, which may be a TV camera. The F/G band radar is named Muff Cob by NATO and Bars (Wildcat) by the Russian Navy.

Drum Tilt

F 20 to F 22 only. There are two Drum Tilt, H/I band radars for the twin 30 mm guns in the first three ships. The cylindrical radar is permanently tilted upwards at 30° and approximate ranges are reported to be: acquisition — 40,000 m (131,240 ft); tracking 23,000 m (75,463 ft). Russian name is Rys.

Seaguard tracking module

F 23 to F 25 only. The second batch of ships has the Seaguard tracker in place of the Drum Tilt used in the first three ships. The tracking module (TMX) is a general purpose tracking module for accurate long-range tracking of air and surface targets for engagement by guns. The TMX uses a combination of I/J-band radar, FLIR, TV, and laser rangefinder sensors. The I/J-band radar is a fully coherent pulse Doppler system using pulse compression and a TWT transmitter. Real-time FFT Doppler processing is used in both acquisition and tracking modes. The radar incorporates random frequency agility over the entire band, MTI, variable pulse compression ratio, CFAR, frequency coded transmission, staggered PRF, and track-on-jam. When equipped with electro-optical sensors the combined system processing techniques provide redundancy, and make the TMX impervious to ECM and multipath effects. Optional second radar receiver and CW injection are available for ship-to-air missile guidance purposes.

Specifications

Frequency: 8.6-9.5 GHz
Antenna: Cassegrain 1.31 m (4.3 ft) diameter
Transmitter: TWT
Peak power: 4 kW
Pulse length: 0.53-4 µs
Tracking range: 300 m to 70 km
E-O sensors: FLIR spectral bandwidth 8-12 µs, Centroid FTT tracking principle; Laser spectral wavelength 1.06 µs with a 25 Hz data rate
Tracker: Unique three-axis, high-dynamic (3 rad/s; 15 rad/s²); hemispherical tracking (elevation: −35 to +120°)

Manufacturer/Contractor

Oerlikon-Contraves AG, Zurich, Switzerland.

SONARS

Graseby G 750

Godavari (F 20) only. The Graseby G 750 search and attack sonar was developed from the British Type 184M and provides accurate fire-control data from two independent automatic tracking systems, whilst simultaneously maintaining all-round surveillance, independent Doppler search, and classification and continuous torpedo warning. Three separate processing and display systems are incorporated for all-round search and tracking; Doppler, and passive search. In the standard G 750 system, an improved version of the Type 184M cylindrical 32-stave transducer is used to form a large number of beams. Range and bearing measurement is by in-beam scanning, obviating the need for separate expanded displays. Target range and bearing are measured by either: using a manually positioned marker technique, in which the circular markers are placed over the target echo, it being the marker position that is measured; or by echo gating, where the echo range and bearing are measured directly. This form of tracking is normally on acquisition of a possible target and is available either with or without computer assistance.

Operational capabilities of the equipment include active detection of submarines throughout 360° and the ability to track two targets simultaneously. Similar detection coverage and tracking capabilities are available in respect of torpedo targets, with suitable outputs to torpedo warning and avoidance systems. There is also an active search capability over a 45° arc with facilities for determining target Doppler. Four 11° beams forming a 45° 'searchlight' are providing a 360° search facility capable of measuring target Doppler up to ±40 knots. Targets can be tracked to a maximum range of 20 km.

Manufacturer/Contractor

Graseby Marine (Graseby Dynamics Ltd) Watford, UK.

Bharat APSOH

Gomati (F 21) *Ganga* (F 22) only. APSOH is an Indian-designed and -developed sonar, produced by Bharat Electronics, which was trialled in *Himgiri* (F 34).

Manufacturer/Contractor

Bharat Electronics, Bangalore, India.

Fathoms Oceanic VDS

Not in *Godavari.* The second (*Gomati* F 21) and subsequent ships are reported to have a VDS produced by Fathoms Oceanics.

Type 162M

Type 162M sonar detects and classifies both mid-water and seabed targets, displaying port and starboard recordings simultaneously on a single straight-line recorder, which has a maximum range scale of 1,200 yd. Operation is simplified by entirely automatic gain control. The three transducers are all similar and employ 49.8 kHz barium titanate elements. Their beam pattern is fan-shaped, about 3° wide and 40° vertical angle; the side-looking elements have their axes 25° below the horizontal. A loudspeaker and a socket for headphones enable signals to be monitored aurally if required. The three range scales are 0 to 300, 0 to 600 and 0 to 1,200 yd, and accuracy is better than two per cent assuming a sound velocity of 4,920 ft/s.

Manufacturer/Contractor

AB Precision (Poole) Limited, Poole, Dorset, UK.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 24.3 × 14.5 m (80 × 48 ft)
Landing aids: French helicopter handling equipment is fitted
Helicopters: The 'Godavari' class has been designed to operate two Sea King-size helicopters, although ships are frequently seen with one Sea King, one Chetak or one Helix.

Westland Sea King Mk 48 B/C ASW helicopter

Specifications

Dimensions:
main rotor diameter: 18.90 m (62.0 ft)
length overall, both rotors turning: 22.15 m (72.66 ft)
fuselage length: 17.02 m (55.83 ft)
height to rotor head: 4.74 m (15.5 ft)
Weights:
max take-off: 9,752 kg (21,500 lb)
internal cargo capacity: 2,720 kg (6,000 lb)
max speed (never exceed): 144 kts (267 km/h)
typical cruising speed: 120 kts (222 km/h)
service ceiling: 3,720 m (12,200 ft)
range with max standard fuel: 630 n miles (1,166 km)
Engines: 2 — 1,092 kW (1,465 shp) Rolls-Royce Gnome H.1400-IT turboshafts
Role equipment: 6 underwing pylons, torpedo bay, 32 sonobuoy ports, 2 depth-charge racks, search radar, FLIR, MAD
Accommodation: 4 (pilot, co-pilot, two sonar operators)
Sensors: Low-frequency 360° AQS-18/AQS-13F sonar; Doppler radar; SMA/APS-707 radar (chin radome)
Weapons: 2 or 4 homing torpedoes, or 4 depth charges or 2 Sea Eagle anti-ship missiles

PROPULSION

Specifications
System: Steam turbines
Main machinery: 2 Babcock & Wilcox boilers; 38.7 kg/cm² (550 psi); 450°C (850°F); 2 Bhopal turbines; 22.4 MW (30,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The Indian Navy has long set itself the goal of self-sufficiency in naval matters, which includes the design and construction of its own warships. Thus, having produced six 'Leander' class frigates to virtually the same design as the UK original, the Indian Navy next carried out a modification so fundamental that it is, in virtually all respects, a new class of ship. The first batch of three ships was laid down between 1978 and 1981, and entered service between 1982 and 1988. They have a unique combination of Russian, Western and Indian weapon systems which has inevitably led to some equipment compatibility problems.

A second batch of three has now been ordered from Garden Reach Shipyard in Calcutta, of which the first is due to be commissioned in mid-1997. This second batch is officially designated Project 16A, indicating that there are significant changes in the design. The first ship of this batch was scheduled to start sea trials in 1996, but was delayed by Russian equipment supply problems.

DESIGN

The Godavari hull is somewhat larger than that of the Nilgiri (see Table 1), creating extra volume which is used to accommodate a considerably more powerful weapons fit, of which the most significant is a second Sea King-size helicopter.

The Indian designers rejected the Russian practice of placing the anti-ship launchers alongside the bridge and placed them instead on the foredeck, although the width required is so great that the outer launchers are mounted on sponsons.

It is noteworthy that these ships retained a steam-turbine propulsion system at a time when most new ship designs in other navies were changing to gas turbines.

The second batch of three are larger still, with an increase in length of approximately 4 m (13 ft) and width of 1.5 m (4.9 ft), resulting in a displacement growth of some 1,150 tonnes (full load). This will create yet more internal volume and should also improve stability. The second batch also has some noticeable modifications in the bow area, particularly around the SSM launchers, which may indicate that the elderly SS-N-2 Styx has been replaced by a more modern missile such as SS-N-25. It is also reported that an OTOBREDA 76 mm/62 may be fitted.

These ships have a crew of 313, a large number in comparison with other navies' ships of a similar size, such as the British Type 23 — 169; American 'Perry' (FFG 7) class — and the French La Fayette — 139. Shortage of manpower is not, however, a significant problem for the Indian Navy.

TABLE 1: 'NILGIRI' AND 'GODAVARI' CLASSES: COMPARISON OF DISPLACEMENT AND DIMENSIONS

	Nilgiri	Godavari	
		F 20 - F22	F 23 - F 25
Displacement			
standard	2,682 t	3,600 t	4,500 t
full load	2,962 t	3,850 t	5,000 t
Length	113.4 m (372 ft)	126.5 m (414.9 ft)	130.5 m (428.0 ft)
Beam	13.1 m (43 ft)	14.5 m (47.6 ft)	16.0 m (52.5 ft)
Draught	5.5 m (18 ft)	4.5 m (14.8 ft)	n/k

MODERNISATION

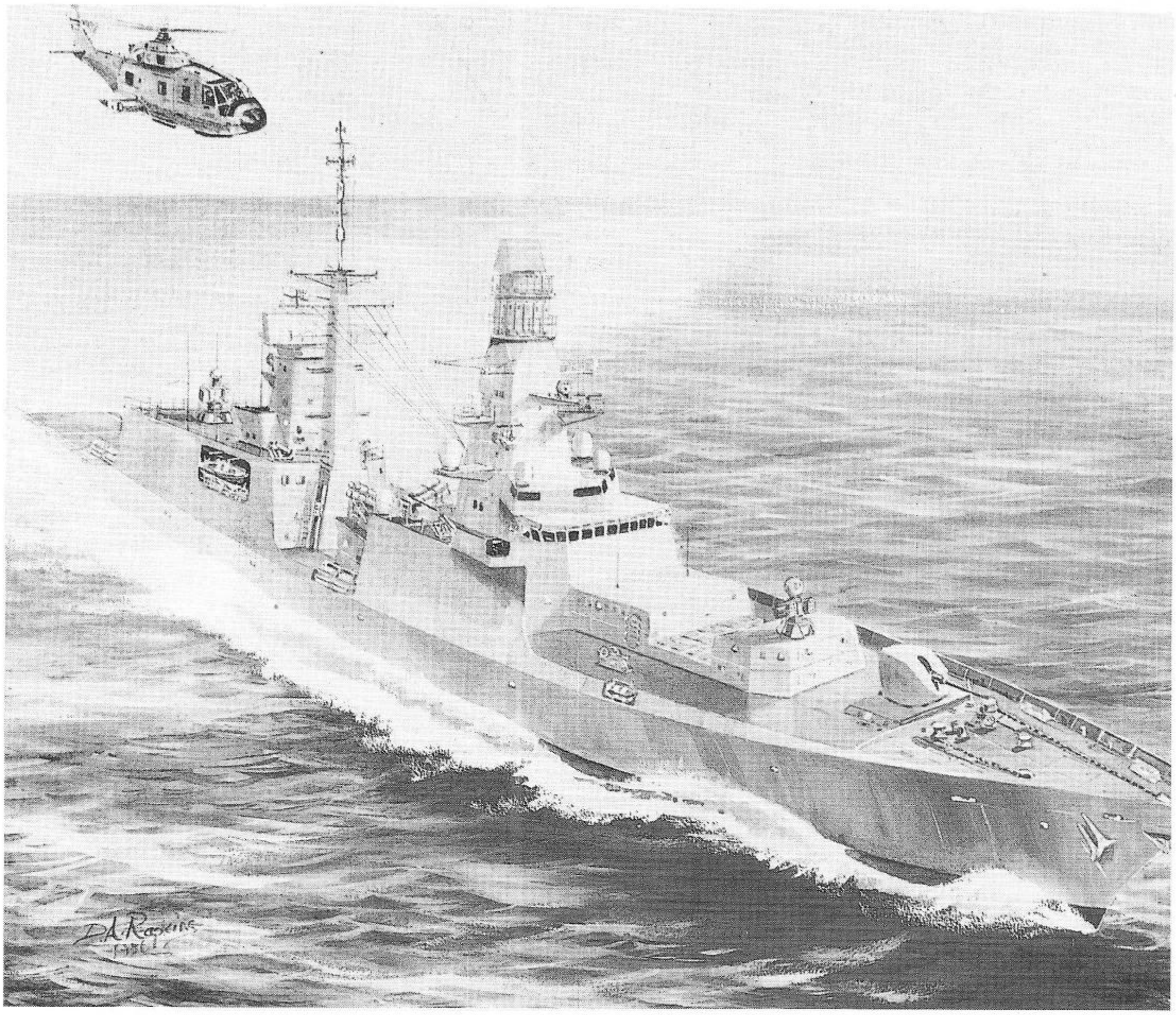
A variety of modernisation programmes is under consideration for the first three ships, including:

Fitting the Indian-developed Trishul surface-to-air missile. Trishul is a rapid reaction missile primarily intended for use against incoming sea-skimming missiles.
Replacing AK 230 guns by AK 630 Gatlings.

Godavari *(F 20). The Sea King helicopter takes up a great deal of room on the flight deck. At the foremast head is the Russian Head Net C radar, with, above it, the Italian Elettronica ESM array, and at the mainmast head is the Dutch Signaal LW 08.*

HORIZON

(Common New-Generation Frigate (CNGF))



An artist's impression of a possible configuration of the UK Royal Navy version of the CNGF

GENERAL SPECIFICATIONS

Operators: France/Italy/UK

Class: HORIZON

Active: 0
Building: 0
Proposed: Italy—4; France—6; UK—12

Displacement:
full load: 6,300 t

Dimensions
Length: 148.8 m (488.2 ft)(oa); 140 m (459.3 ft)(wl)
Beam: 19.9 m (65.3 ft)(max); 17.6 m (57.7 ft)(wl)
Draught: 5.4 m (17.7 ft)

Speed: 30 kts
Range: 7,000 n miles at 18 kts

Complement: 235

Note
These figures are based on Joint Indicative Design #2 and the final design may well differ in detail.

SHIPS

Horizon #1	
Builder	France or Italy
Laid down	Apr 1999
Launched	Jul 2001
In service	Jun 2004
Horizon #2	
Builder	France or Italy
Laid down	Oct 1999
Launched	Apr 2002
In service	Mar 2005
Horizon #3	
Builder	Yarrow, Clydebank, UK
Laid down	Nov 2000
Launched	Feb 2003
In service	Mar 2006

Note
These are speculative dates, based on the programme at August 1996. Note that Horizon #1 will be built in either France or Italy, and that Horizon #2 will be built in whichever of those two does not build Horizon #1. The builders will be: France — DCN Lorient; Italy — Fincantieri, Riva Trigoso. Horizon #3 will be built in the UK.

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

There will be eight surface-to-surface missiles with a range of 80-160 n miles (150-300 km).These are 'non-developmental items' and it is reported that the competing systems are:

Aerospatiale — ANNG *(Anti-Navir Nouvelle Génération)*
Alenia-OTOSystemi — Ulisee/Teseo Mk 3
Saab Dynamics — RBS 15 Mk 3
McDonnell Douglas — Harpoon 2000

SURFACE-TO-AIR MISSILES (SAM)

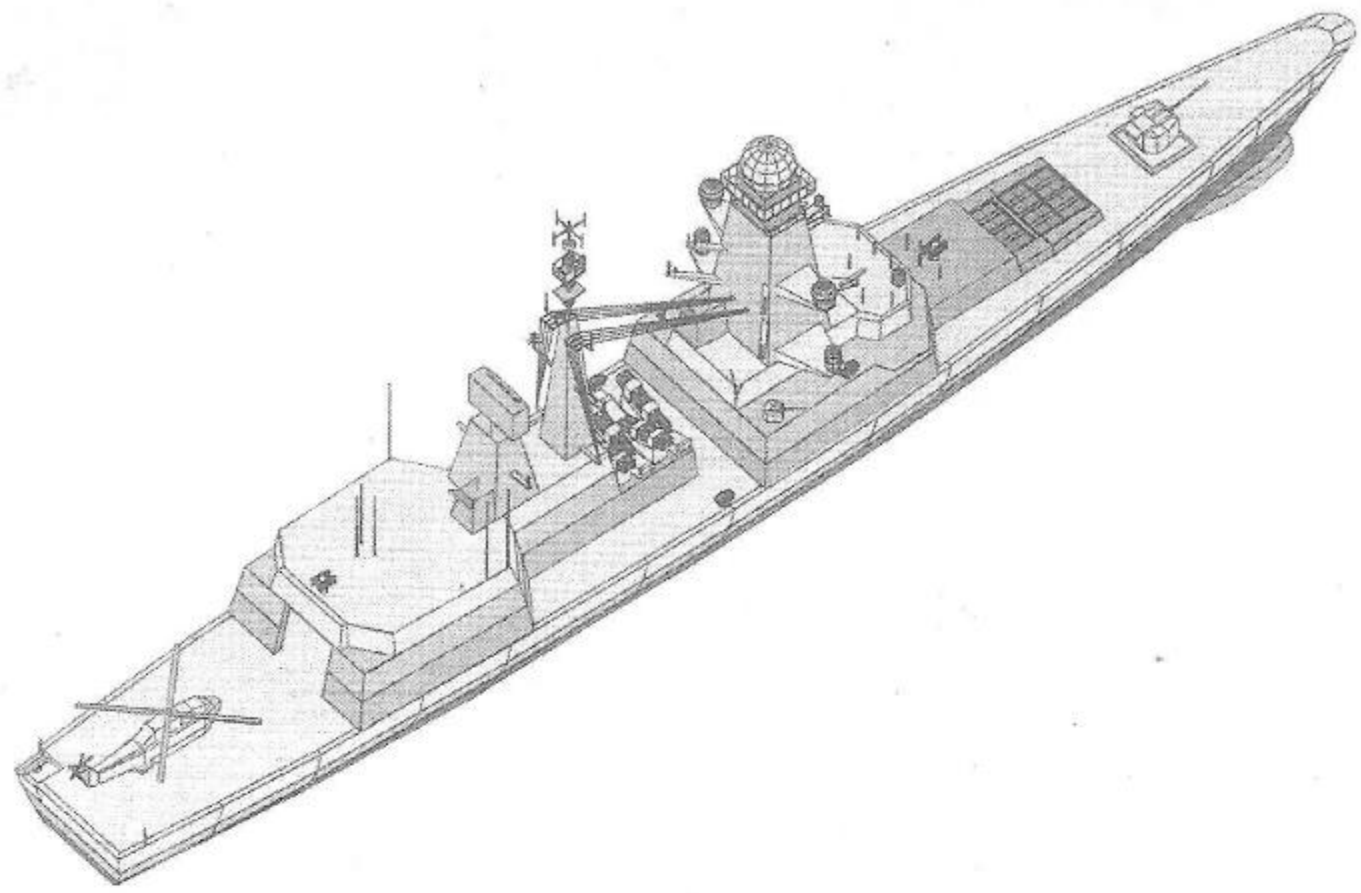
PAAMS VLS

The main anti-air system will be PAAMS (principal air defence missile system). This will comprise a 48-cell vertical launch system mounted in the foredeck, missiles, command and control equipment, a three-dimensional multifunction radar (MFR) and a three-dimensional long-range radar (LRR). The missiles will be two variants of the Aster missile: sixteen Aster 15 and thirty-two Aster 30 weapons.

ILMS

There will be two ILMS (inner layer missile system). The competition for this short-range system has been deliberately left open to either missile or gun solutions and it is reported that potential systems include:

- BAe Dynamics — Naval ASRAAM
- Matra — Sadral
- OTOBREDA — 25 mm Myriad
- Royal Ordnance — 35/1000 Millenium cannon
- Shorts Missile Systems — Seastreak
- VSEL Armaments (with Hughes) — RAM



A computer-generated model of one possible version of the Horizon frigate (DCNI)

TORPEDOES

There will be two twin torpedo launchers, the only current known criterion being that the chosen system must be capable of launching either the Mu 90 (France and Italy) or Sting Ray (UK) torpedoes.

GUNS

127 mm

There will be one 127 mm gun in 'A' position. Current competitors in this field are reported to be:

- OTOBREDA (with VSEL) — 127 mm Alleggerito
- Royal Ordnance (with United Defense) — 127 mm (5 in) Ultra Lightweight

Small Calibre Gun System (SCGS)

There will be two 30 mm cannon, probably on the forward superstructure.

ELECTRONIC WARFARE SYSTEMS

Electronic Warfare (EW)

The Electronic Warfare System (EWS) will be a comprehensive soft-kill package, comprising radar-band ESM and a combination of onboard jammers and offboard decoys, all co-ordinated by decision support software, which will presumably include softkill/hardkill scheduling. There is reported to be general agreement on the requirement except for one area, where Italy is a proponent of 'cross eye' jamming using solid-state onboard systems, while both France and UK prefer using off-board decoys for angular seduction.

Communications band ESM will be the subject of separate national programmes.

DECOYS

There will be four chaff and IR flare launchers and an anti-torpedo defence system.

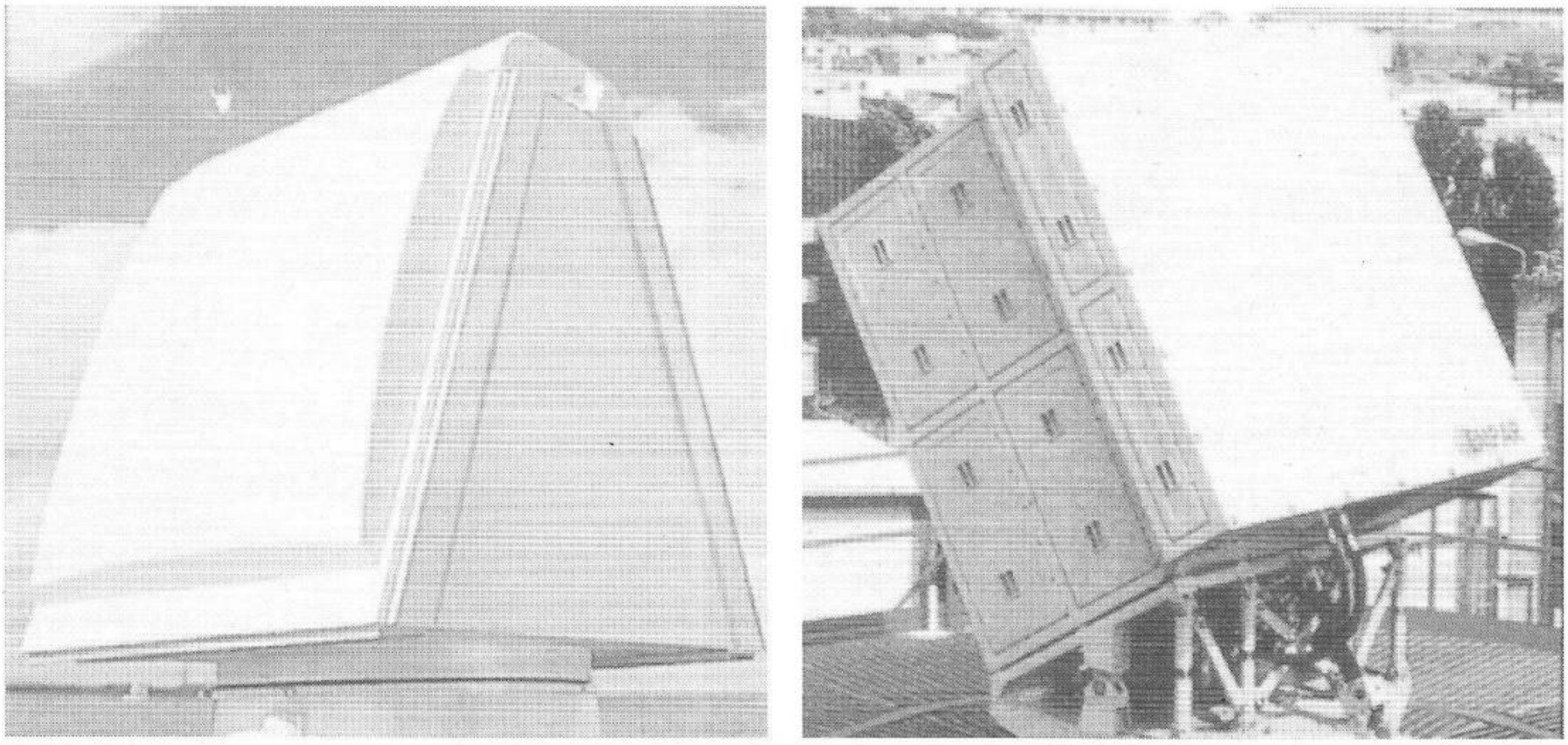
COMMAND AND CONTROL SYSTEMS

COMBAT MANAGEMENT SYSTEM

The Combat Management System (CMS) will combine the functions of real-time command and weapon control; longer-term command support; and own-platform operational information.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 16
Satcom: To be installed.



One of the major areas of difference is that France and Italy have opted for the Empar radar (right) while the UK wants the Siemens-Plessey Sampson (left)

RADARS

There will be three sets:
- Air/surface search
- Surveillance/fire control
- Surface search: I band

SONAR

There will be one bow-mounted sonar set.

AVIATION

HELICOPTERS

It has already been decided that helicopters will be approved national variants:
- France — NH 90
- Italy — EH-101
- UK — Merlin

PROPULSION

Four machinery options are currently under consideration:

System 1: combined diesel, electric and gas turbine (CODLAG), based on the Rolls-Royce Spey SM1C gas turbine, with unspecified diesels and two electric motors.

System 2: combined diesel, electric or gas turbine (CODLOG), in which the gas-turbine component would be the Westinghouse/Roll-Royce WR-21 intercooled/ recuperated (ICR) engine, with unspecified diesels and two electric motors.

System 3: combined diesel or gas turbine (CODOG), based on the General Electric LM-2500 gas turbine.

System 4: combined diesel or gas turbine (CODOG), based on the WR-21 (ICR) engine

All
Shafts: 2

FURTHER INFORMATION

OVERVIEW

This three-nation project involving France, Italy and the UK for a new air defence ship has its origins in the collapse of the eight nation NATO Frigate for the 1990s (NFR90). The Joint Project Office (JPO) was established in London, UK in 1993 and the initial Memorandum of Understanding (MoU) for joint development was signed on 11 July 1994. The aim is to produce an air defence frigate which will enable the three countries to replace current classes:

One of the most fundamental features in the project is that the principle weapons system (PAAMS) is being managed by a separate structure from that of Horizon. What is now the PAAMS trinational project originated in the bi-national Franco-Italian *Famille de Systèmes Anti-aériens Futurs* (FSAF) and there were protracted discussions and much negotiating before the UK was able to join. This caused some 18 months delay, which had a knock-on effect on the Horizon project. This has, however, been overcome and certain parts of the project have been altered to suit the UK's wishes, while the UK has had to pay some FFr 1.5billion ($290 million) to compensate France and Italy for work already done. The UK will also bear most of the extra costs arising from the integration of the Sampson radar.

PROGRAMME

The programme started with an MoU (Memorandum of Understanding) signed on 11 July 1994, which laid down the framework for managing the project and the long-term procurement strategy. This is being followed by a number of supplementary documents, which commit the funds to each stage of the project:

Preliminary supplement. This covered the first segment of definition studies and was assigned at the same time as the MoU (11 July 1994).

Supplement 1. This covers the main part of design definition and was signed on 23 March 1996 (18 months behind schedule)

Supplement 2. This covers the design, build, trials and acceptance of the three first of class ships, of which one is to be built in each of the participating countries. This is scheduled to be signed in mid-1998.

Supplement 3. This will cover the first full production batch, currently estimated to amount to between four and eight ships. It is estimated that this will be signed some two years after Supplement 2.

Supplements 4 onwards. Each further procurement batch will then be funded by further supplements.

DESIGN

The operational requirement is for an area air defence ship, which is capable of defending a task group against early 21st century air threats. It is also required to include command facilities and accommodation. Secondary capabilities include anti-surface warfare, naval gunfire support and anti-submarine warfare.

Initial design studies were carried out on a national basis by DCN Ingenierie (France); Marisat/Fincantieri (Italy); and BMT Defence Services (UK). These were integrated by a trinational working group, operating in conjunction with the JPO, to prepare a Joint Indicative Design (JID). JID1 was presented to the three partner countries in July 1993, which led to JID1(revised). Further revision resulted in JID2, which was completed in early 1995 by the IJVC, and which is intended to provide a common reference design for feasibility and costs purposes, and to provide the IJVC with background feasibility studies to support design definition in critical areas.

MANAGEMENT ORGANISATION

The management and implementation of the project is the responsibility of three principle organisations:

Steering Committee (SC). The SC is a high-level, tri-national, intergovernmental body established under the authority of the three National Armament Directors (NAD).

Joint Project Office (JPO). The JPO manages the Horizon project on behalf of the three governments and is responsible for defining the technical specification, reviewing work progress against specification and ensuring that the warship meets performance requirements within the agreed timescale and budget. As the Warship Procurement Authority, the JPO assumes an overall co-ordinating role between the warship, PAAMS and (during Phase 1) the FDI equipment consortia. The JPO is located in London and reports to the Steering Committee.

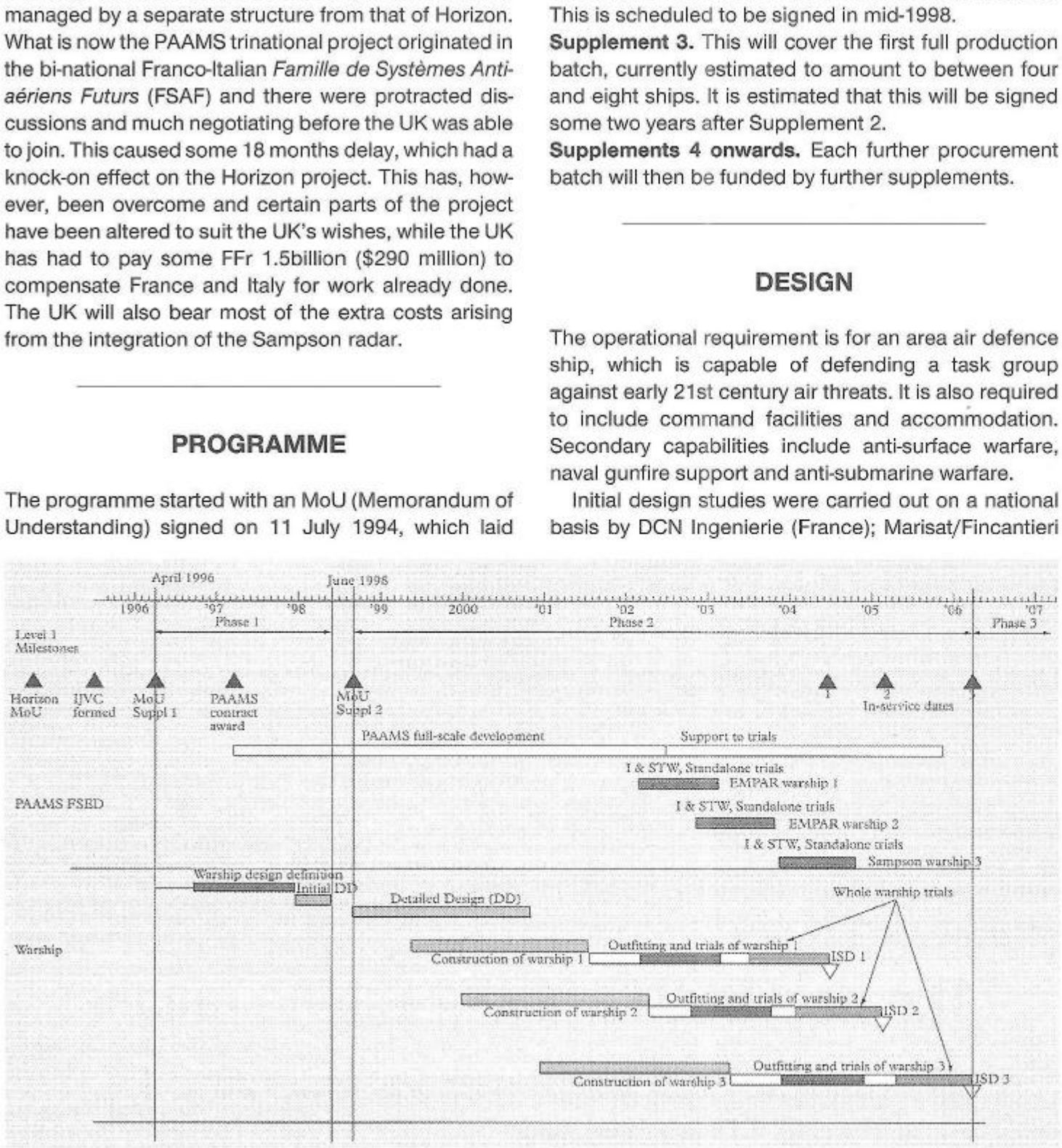
International Joint Venture Consortium (IJVC). The IJVC is owned in equal shares by three national companies: Italy — Orizzonte SpA (jointly owned by Fincantieri and Finmeccanica); France — DCN International; and UK — GEC Marine. IJVC is responsible for managing the programme, subcontracts; and industrial implementation. The IJVC will undertake warship design definition, detailed design, and construction of the three first of class ships. It will also be responsible for systems integration, the Shore Integration Facility (SIF), and procurement, on a best value for money basis, of the three FDIs and all NDIs.

EQUIPMENT FOR PROJECT HORIZON

Equipment for Project Horizon will come from four sources:

Government Furnished Equipment (GFE). The PAAMS system will be produced under separate arrangements and will be transferred to Horizon ships as GFE.

Full Development Items (FDI). FDIs are three major systems which require original design and full development.



This table has been assembled using information released by IJVC Horizon in early 1996. It should be noted that this timetable assumes a three-month gap between the end of Phase 1 and commencement of Phase 2.

The Horizon programme as it stood in late 1996 (Jane's Navy International)

TABLE 1
Air Defence Frigates being Replaced by Project Horizon CNGF

	FRANCE		ITALY		UK
Class	Suffren	Cassard	Doria (Note 1)	Audace	Type 42 (Note 2)
Number in service	2	2	2	2	12
Entered service	1967-1970	1989-1991	1964	1972	1976-1985
Displacement (full load)	6,910 t	4,700 t	6,500 t	4,400 t	4,100 t
Principle weapon system					
Type	Masurca	Standard SM-1MR	Standard SM-1ER	Standard SM-1MR	Sea Dart
Launcher	1	1	1	1	1
Arms	twin arm	one arm	twin arm	single arm	twin arm
No of missiles	48	40		40	22
Anti-ship missiles					
Type	MM38 Exocet	MM40 Exocet	—	Teseo Mk 2	—
Launcher	canister	canister		canister	
No of missiles	4	8		8	
Gun					
Type	100 mm	100 mm	76 mm	127 mm	114 mm Mk 8
Number	2	1	8	1	1
Type	20 mm	20 mm	—	76 mm	20 mm
Number	4/6	2	—	4	4
Torpedoes					
Launcher	2 × 2	2 × 1	2 × 3	2 × 3	2 × 3
Torpedoes	ECAN L5	ECAN L5 (10)	Mk 32	Mk 32/Mk 46	TSWS-2 Stingray
Helicopter					
Type	None	Lynx or Panther	AB-212ASW	AB-212ASW	Lynx HMA Mk 8
Number	—	1	3	2	1
Crew	355	244	484	380	253

Notes
1. The Italian 'Andrea Doria' class air defence ships left service in the late 1980s. Nevertheless, it has always been the intention of the Italian Navy to replace this capability.
2. There are differences between Batches 1, 2 and 3; for the purposes of this table Batch 1 specifications are given.

Non-Development Items (NDI). NDIs will be off-the shelf systems procured within the market-place.
Approved national variants. These are items which, as a result of tri-national agreement, will be procured by the nations themselves.

FULL DEVELOPMENT ITEMS (FDI)

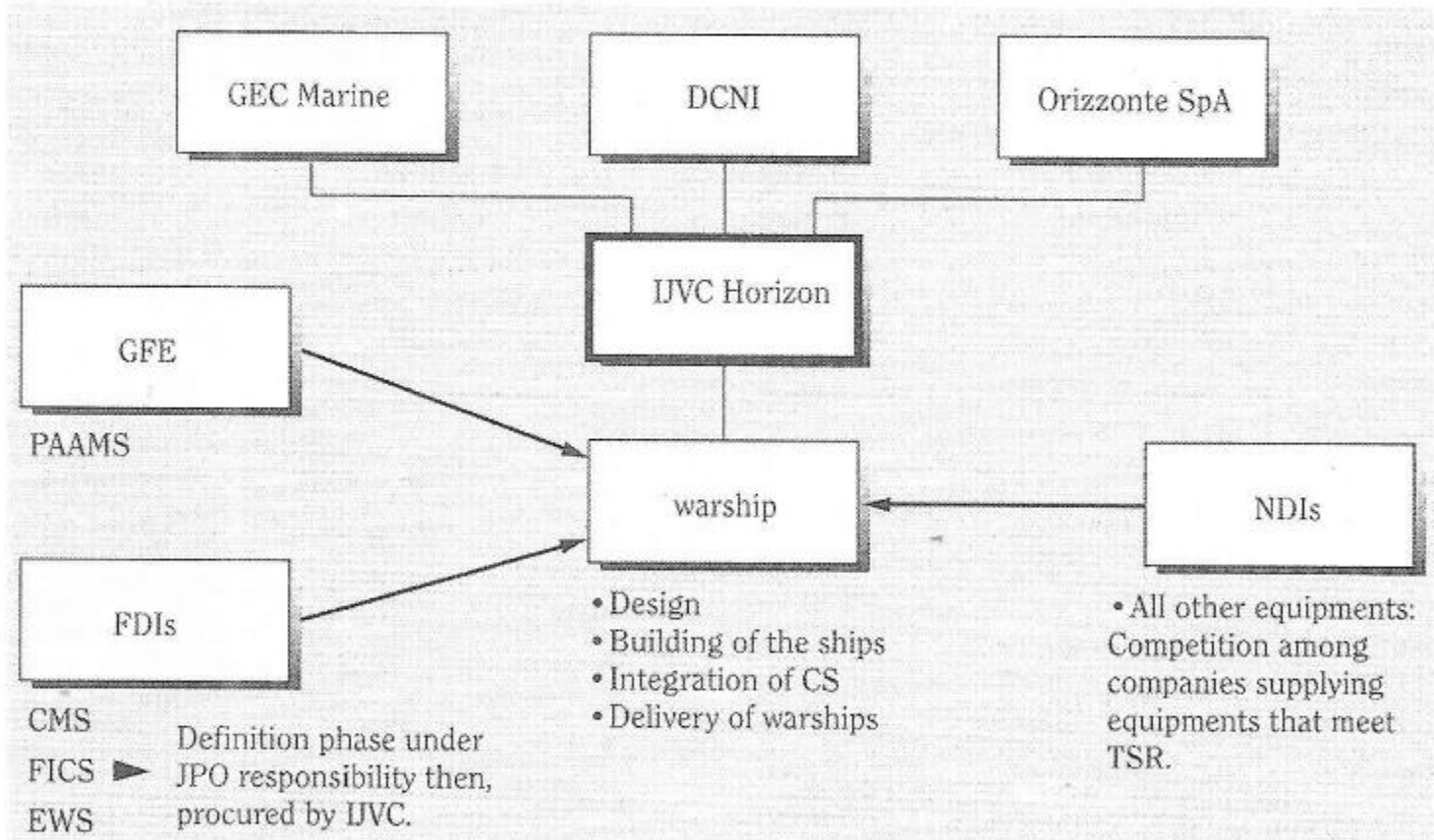
There are three FDIs, each of which will follow the same path of: competitive project definition; selection; full development, acceptance and production. The JPO is leading for the project definition phase and will then hand over responsibility to IJVC Horizon. The three FDIs are:

Combat Management System (CMS). This combines the functions of real-time command and weapon control; longer-term command support; and own-platform operational information. Two industrial consortia started parallel, 2-year, £8 million ($12.4 million), project definition studies in April 1996 for completion in mid-1998:

- EUROCOMBAT. BAeSEMA (UK); Thomson-CSF (France); Alenia Elsag Sistemi Navali (Italy).
- HEPIC EEIG. Ferranti Naval Systems (part of GEC-Marconi S3I (UK); Horizon CMS France (CS Défense, Dassault Electronique, MATRA-CAP Systèmes; Datamat (Italy).

Electronic Warfare System (EWS). The EWS will be a comprehensive soft-kill package, comprising radar band ESM; onboard jammers and offboard decoys, co-ordinated by decision support software (communications band ESM will be the subject of separate national programmes). There is general agreement on the requirement except for one area, where Italy is a proponent of 'cross eye' jamming using solid-state on-board systems, while both France and UK prefer to use offboard decoys for angular seduction. The two groups currently carrying out Phase B project definition are:

- ARCEO. Racal-Thorn Defence (UK); Alenia Elsag Sistemi Navali (Italy); CS Défense (France)
- JANEWS. Elettronica (Italy); Horizon GIE (France) (Thomson-CSF, Dassault Electronique); GEC-Marconi Radar and Defence Systems (UK).



IJVC = International Joint Venture Consortium
GFE = *Government Furnished Equipment*
NDI = *Non-Development Item*
FDI = *Full-Development Item*
CMS = *Combat Management System*
FICS = *Fully Integrated Communication System*
EWS = *Electronic Warfare System*
IJVC Horizon Management Structure (Courtesy: Jane's Navy International)

Fully Integrated Communications System (FICS). FICS will manage all external and internal communications systems, including HF; VHF; UHF; NATO datalinks (Links 11, 14 and 16); and may also include satellite communications (SHF and EHF). FICS will also manage internal communications systems, including message handling/distribution and voice telephone links. Among the issues to be addressed in the PD studies are communications security, interoperability, and, at an industrial level, work-sharing. The three competitors for FICS are:

- NICCO. Thomson-CSF (France); Redifon-MEL and GEC-Marconi Communications (UK); Elmer (Italy)
- Alcatel (France), VSEL (UK); Alcatel Teletra (Italy)
- Italtel (Italy); Siemens Plessey Systems (UK); Racal Communications (UK); Bull SA Europe (France); Dassault Electronique (France).

NON-DEVELOPMENT ITEMS (NDI)

Most of the ships' subsystems will be purchased 'off-the-shelf' as non-development items (NDI). The procurement strategy in this area is that, provided bids meet the technical requirement, first preference will be given to solutions from French, Italian or British companies; second preference will be given to bids from other European Union member nations; finally, the competition will be opened to worldwide competition. Among the systems currently notified to industry as falling in this category are:

Weapons

Medium Calibre Gun System (MCGS), comprising 127 mm gun, complete with mounting, gun control, magazine, handling system, computer controls and all munitions

Small Calibre Gun System (SCGS) with stabilised line of sight

Surface-to-Surface Guided Weapon (SSGW) with 150-300 km range

Inner Layer Missile System (ILMS) for close-range air defence (despite the term 'missile' this could be a gun-based system)

Torpedo Launch System (TLS) capable of launching MU 90 and Stingray.

Sensors

Bow-mounted medium-frequency sonar

IMO-compliant navigation system

IMO-compliant navigation radar

Meteorology and Oceanographic system

Surface surveillance radar.

Communications

Underwater telephone

IFF interrogator/responder compatible with IFF Mk XII.

Data

Data Transfer System (DTS) which will act as the backbone of the combat system, interconnecting the subsystems which require real-time tactical data exchange.

Approved national variants

While it is the intention of the three governments and navies to achieve the maximum commonality, seven national variants have already been approved:

the embarked helicopter, which will be: NH-90 (France); EH-101 (Italy); Merlin (UK)

helicopter-launched air-to-surface missile: AM 39 (France); Marte (Italy); Sea Skua (UK)

lightweight torpedo: MU 90 (France, Italy); Stingray (UK)

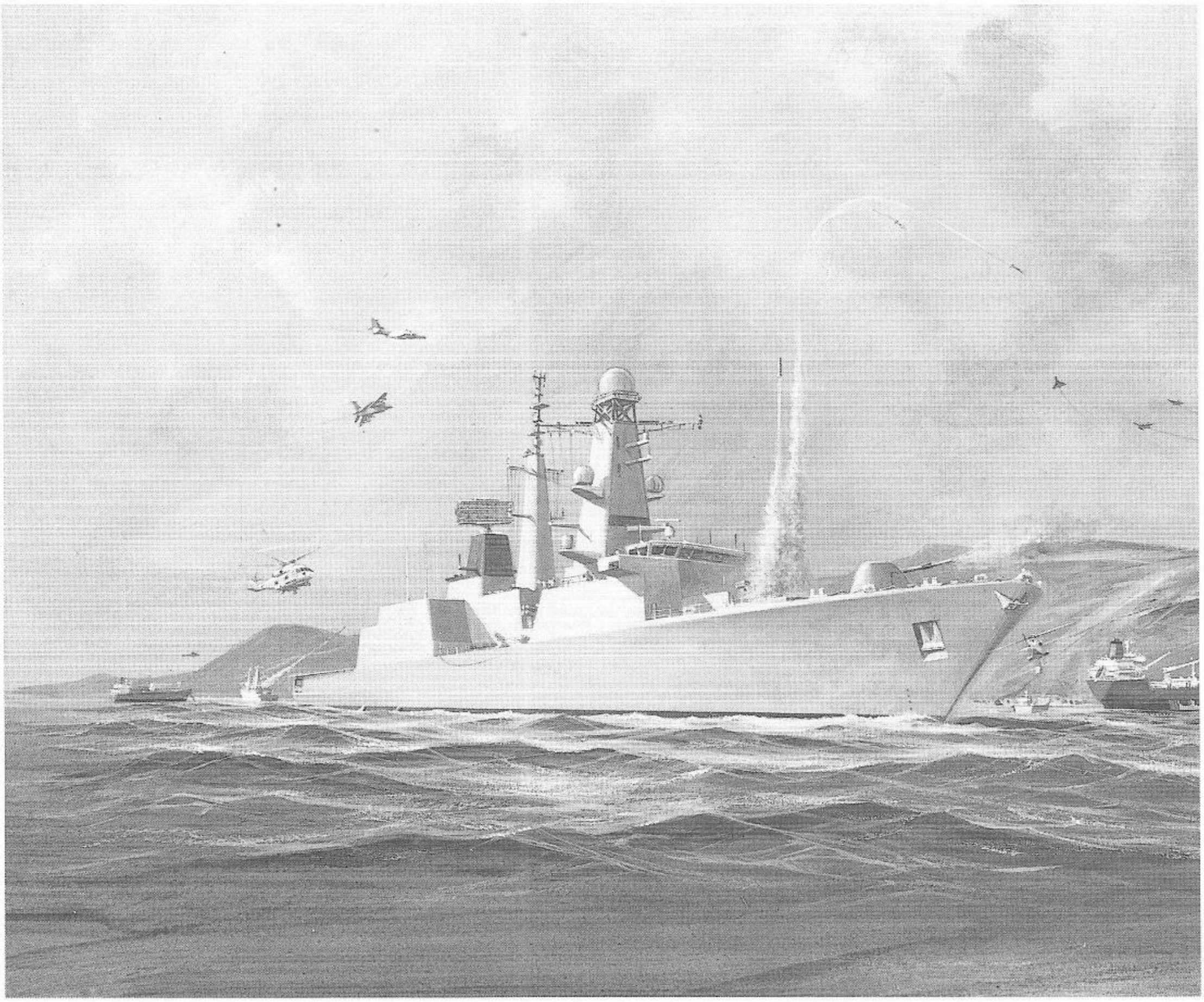
torpedo defence: SLAT (France, Italy); SSTD (UK)

CMS interfaces/interoperability with specific equipments

ship's lifeboats

accommodation (to take account of national differences in space allocation).

Any additional variants must be approved at national armament director/chief of staff level, and the country concerned will bear all additional costs.



Artist's impression of two Horizon frigates providing air defence for an amphibious landing force (Project Horizon JPO)

TRILATERAL FRIGATE CO-OPERATION (TCF) PROGRAMME

(Dutch/German/Spanish Air Defence Frigate)

OVERVIEW

There is no doubt that, for all their good intentions, international collaborative programmes are exceptionally difficult to run, a problem exemplified by the NATO Frigate for the 1990s Programme. As a result, when, in 1989-1990 the NFR 90 project collapsed, the German, Netherlands and Spanish navies, having established that they had generally similar requirements, decided to undertake a much looser form of co-operation. The key to the concept was to co-operate where it was feasible, productive and easy to achieve, and to go their own ways when it was not. What they sought to avoid was the massive bureaucracy, incessant discussions, endless meetings and compromises, and, not infrequently, bad feeling as well, that seemed to be inescapably involved in the more traditional type of collaborative programme.

Their proposal was helped by the fact that all three countries had previous experience of such a project. Germany and the Netherlands had co-operated very well over the Type 122 ('Bremen' class), while the Netherlands and Spain had worked together to their mutual benefit with the AOR ('Patino/Amsterdam' classes) and the LPD ('Rotterdam/Juan de Austria' classes) programmes. The outcome is three types of ship — Type 124 (Germany), LCF (Netherlands) and F 100 (Spain) — as shown in Table 1.

TABLE 1. THE TCF (GERMANY/NETHERLANDS/SPAIN) FRIGATE — SUMMARY OF MAJOR CHARACTERISTICS
(Characteristics of Horizon frigate (UK version) added for purposes of comparison)

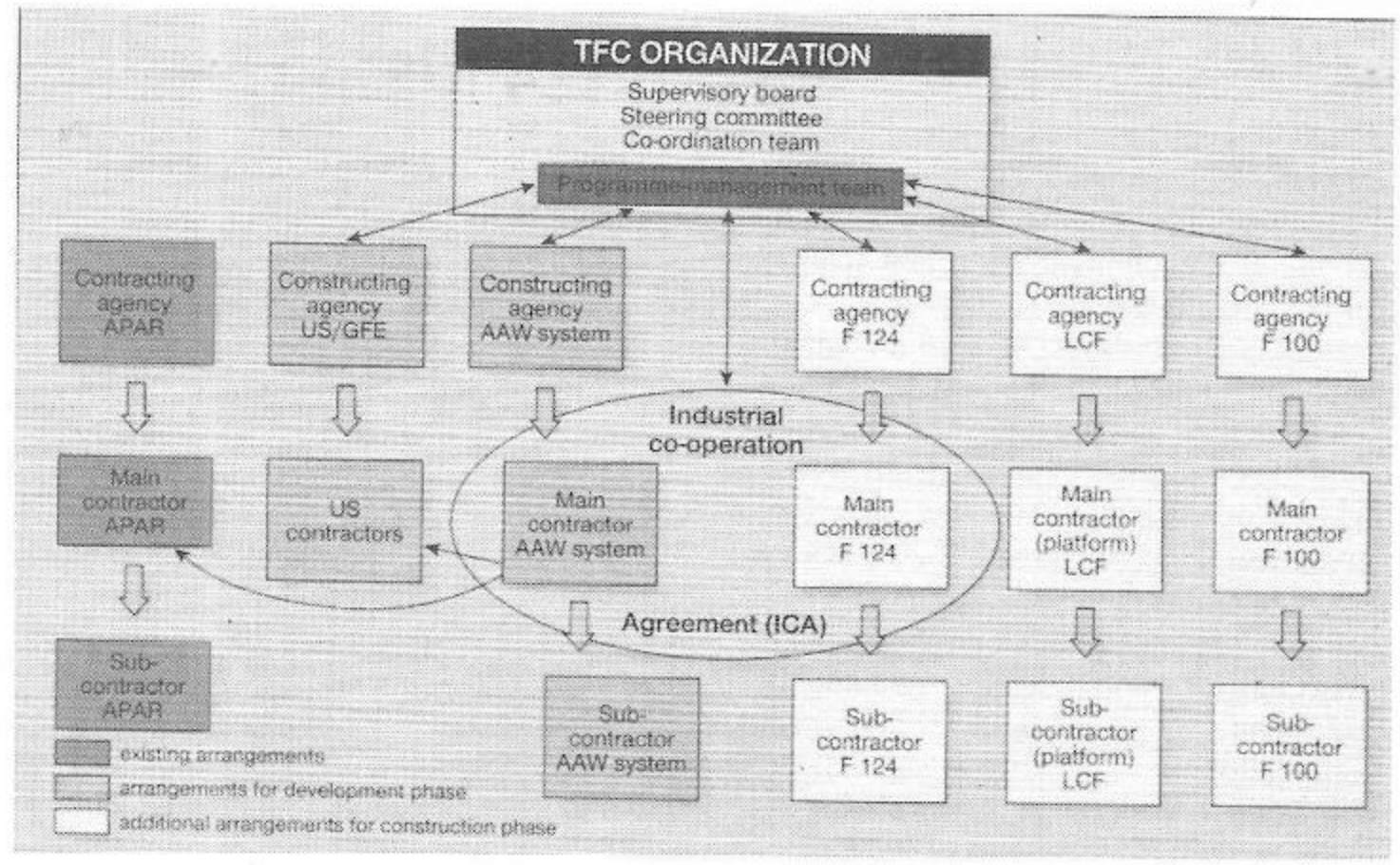
Ship	Type 124	LCF	F 100	Horizon (UK version)
Country	Germany	Netherlands	Spain	France/Italy/UK
Number planned	3	2	4	20
Displacement (full load)	4,700 t	5,860 t	5,761 t	6,500 t
Dimensions length (wl) beam draught	 138.9 m (455.7 ft) 16.7 m (54.8 ft) 4.4 m (14.4 ft)	 130.2 m (427.2 ft) 14.6 m (47.9 ft) 4.6 m (15.1 ft)	 133.2 m (437.0 ft) 15.8 m (51.83 ft) 4.7 m (15.4 ft)	 140 m (459.3 ft) 19.9 m (65.3 ft) 4.8 m (15.7 ft)
Propulsion	CODOG	CODOG	CODOG	CODLAG or CODLOG
Speed	29 kts	28 kts	28 kts	30 kts
Range		5,000 n miles at 18 kts	4,500 n miles at 18 kts	7,000 n miles at 18 kts
Complement	200	202	220	200
Air defence missiles launcher cells (Note 1) missiles	 Mk 41 VLS 32 Standard SM-2MR Evolved Sea Sparrow	 Mk 41 VLS 40 Standard SM-2MR Evolved Sea Sparrow	 Mk 41 VLS 40 Standard SM-2MR Evolved Sea Sparrow	 6 × DCN or BAe VLS PAAMS 16 Aster 15 32 Aster 30
Anti-ship missile systems	8 × Harpoon	8 × Harpoon	8 × Harpoon	8 ANNG
Guns	1 × OTOBREDA 76 mm	2 × Bofors 120 mm (1 × 2)	1 × OTOBREDA 76 mm	1 × 127 mm
CIWS	2 × RAM launcher	2 × Goalkeeper	1 × Meroka	
Torpedoes launcher torpedoes	 4 × Mk 32 fixed n/k	 4 × Mk 32 Mod 9 fixed Mk 46 Mod 5	 4 × Mk 32 Mod 5 fixed n/k	 4 × fixed launcher Sting Ray
Combat data system	SEWACO FD	SEWACO XI	Aegis	Combat Management System (CMS)
Radars air search air/surface search	 SMART-L or TRS-3D APAR	 SMART-L APAR	 TRS-3D SPY-1F	 Sampson
Sonar	n/k	PHS-26	DE 1160	Type 2050
Helicopter	Lynx/NH-90	Lynx/NH-90	S-70B-1 LAMPS III	1 × EH.101

The Memorandum of Understanding (MoU) which established the TCF programme defined five major objectives:

- maximise, as far as is practicable, the harmonisation of the three national ship designs
- co-operate in identifying common ship and combat systems
- share non-recurring development costs
- to use common procurement to maximise economies of scale and reduce purchase price
- establish joint in-service support for the ships

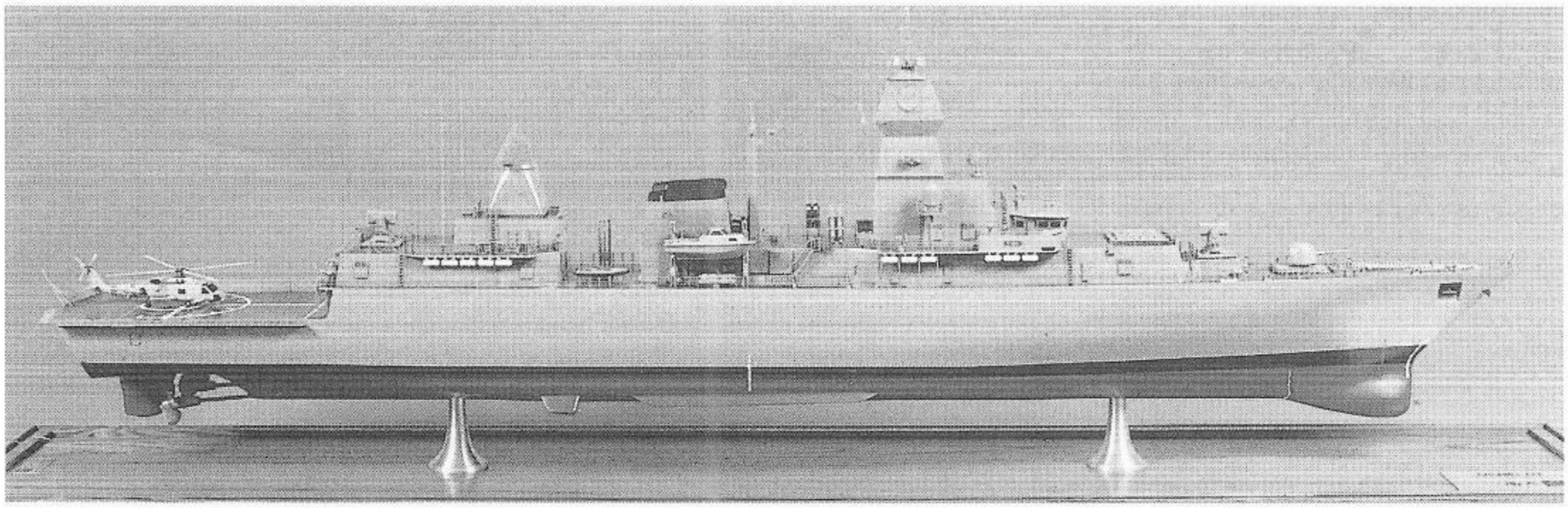
The major area of co-operation was to have been the common anti-air warfare (TFC AAW) system, which would have included the APAR phased-array radar, Standard SM-2 Block III SAM; Evolved Sea Sparrow Missile (ESSM); Mk 41 VLS; and a common C^2 core, linked to national CDS variants. At meetings in late 1994 there were some reservations about the interoperability of APAR with Standard SM-2 and ESSM, since the new Signaal radar uses Interrupted Continuous Wave Illumination (ICWI). Despite assurance that there would be no technical problems, Spain decided to pull out of the AAW project in June 1995.

A Dutch-German-Canadian MoU was signed on 9 July 1996 which sanctioned joint continuation of the project.



The management organization of the Trilateral Frigate Co-operation programme (Jane's Navy International)

SACHSEN (TYPE 124)



A model of Sachsen (ARGE F 124)

GENERAL SPECIFICATIONS

Operator: Germany
Type: Type 124

Class: SACHSEN

Active: 0
Ordered: 3

Proposed: 1

Displacement:
full load: 5,600 t

Dimensions
Length: 143.0 m (469.2 ft)

Beam: 16.7 m (54.8 ft)
Draught: 4.4 m (14.4 ft)

Speed: 29 kts

Complement: 200

SHIPS

The ships will be named *Sachsen* (F 219); *Thüringen* (F 220); *Hessen* (F 221); and (if ordered) *Hamburg* (F 222).

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84B Harpoon

There will be eight Harpoon launcher-containers mounted on the upper deck between the mainmast and the twin stacks, with each group of four facing across the ship at 90° to the centreline.

This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns and, for the terminal phase, can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

GMVLS Mk 41 Mod 3 Vertical Launch System

The Type 124 frigates will be equipped with a Guided Missile Vertical Launch System (GMVLS) Mk 41 Mod 3 with two 16-cell launch cells for a mix of 32 Standard SM-2 and Evolved Sea Sparrow missiles. Each of the two launcher modules is 6.86 m (22.5 ft) high and contains sixteen Mk 22 canisters which are 5.79 m (19 ft) deep and weigh 1,503 kg (3,314 lb) (complete with missile).

Standard Missile 2 Medium-Range (SM-2MR) Block 3

The Type 124 will carry Standard SM-2MR, which can be used for surface-to-air (including passive home-on-jam) and surface-to-surface engagements. The propulsion section uses the Thiokol Mk 104 dual-thrust rocket motor with ARC acting as second source. The SM-2 missile's course is controlled from the ship by means of an RF link until the target comes within the missile seeker's field of view. This system allows the use of the ship's search radar to provide missile launch data and, by shaping the missile flight path into an energy-efficient trajectory, the effective range of the system is doubled.

Specifications
SM-2MR
Length: 4.72 m (15.49 ft)
Diameter: 34.3 cm (13.5 in)
Wing span: 1.06 m (3.47 ft)
Weight: 706.7 kg (1,558 lb)
Speed: Mach 2.5
Range: 37.75 n miles (70 km)
Altitude: 19,800 m (65,000 ft)
Guidance: Semi-active radar homing

Manufacturers/Contractors
Hughes Missile Systems, Tucson, Arizona, USA.
Raytheon Missile Systems Division, Bedford, Massachusetts, USA.

Evolved Sea Sparrow Missile System (ESSMS)/RIM-7RTC Sea Sparrow point defence system

Type 124 frigates will have the Enhanced Sea Sparrow Missile System (ESSMS), a developed version of the Mk 57 NATO Sea Sparrow Missile System (NSSMS), with the RIM-7RTC missile. RIM-7P, which succeeded the RIM-7M missile on the production lines in 1991, has a Missile-Borne Computer (MBC), which controls overall missile performance and links the major missile subsystems. The missile also has an improved low-altitude guidance mode and enhanced subclutter performance against very low-altitude targets. Other features include a 38.6 kg (85 lb) warhead with new fuze for low-altitude use, a command uplink, sample data homing and multiple target designation. The RIM-7R is similar but in addition has a dual-mode semi-active radar and infrared seeker.

ESSM (RIM-7RTC) will have many of the features of RIM-7P/R, including the same guidance system, but with a new autopilot and a larger rocket motor. It will be wingless and with tail control as well as integral thrust vector control both for vertical launch and to double the manoeuvrability. The system will be compatible with the GMVLS Mk 41 through quad-pack launchers.

Targets are detected by the ship's radar and designated through the combat information centre and the tracker system then traverses onto the relevant bearing and elevation, while radar data from the director is processed in the signal data processor to provide range and angle tracking data. The data is then passed to the

firing officer's console which passes prelaunch data and the firing command to the missile which is then launched. The missile lifts to a height of approximately 4 m (13 ft) and then begins to pitch over in the correct azimuth to the intercept point, controlled by the jet vector control, which is then jettisoned (approximately 2 seconds after lift-off). The missile follows a proportional guidance path directly to the intercept point.

Specifications
RIM-7RTC
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.3 ft)
Weight: 231.5 kg (510 lb)
Speed: Mach 1
Range: 8 n miles (14.5 km)
Guidance: Semi-active radar

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime (system)).
Raytheon Company, Missile Systems Division (prime (missile)).
Hughes Missile Systems (second missile source).

RIM-116A RAM close in weapons system
There will be two 21-cell Mk 49 launchers for the Rolling-Airframe Missile (RAM): one on the foredeck, the other aft on the roof of the twin hangars. RAM is a lightweight, close in, quick reaction, anti-missile defence system, the RIM-116 missile being based on the Sidewinder air-to-air missile, but with significant modifications, enabling it to be used as a fire-and-forget system. There is an infrared, terminal guidance seeker in the nose (taken from the Stinger man-portable surface-to-air missile), behind which is a new dual-mode passive radio frequency seeker for mid-course guidance. Most of the rear of the missile is based upon Sidewinder components. Missiles are stored in sealed launcher-containers, which are manually loaded into the 21-cell Mk 49 RAM Standard Launchers.

Radar and electro-optical sensors provide details of target location, distance and speed, while the ship's ESM system inputs data on the target's radar frequency, as well as correlating radar data on location. On launch, the missile is spun-up by a rifling band as it is driven down the launch tube, and then as it leaves the launcher the four tail fins deploy which maintain the spin. Aerodynamic control is provided by the two canard surfaces, which also deploy after launch. The autopilot and control system maintain the initial line of sight course towards the target and then the RF seeker is activated and once this acquires the target it takes control of the guidance system and makes the appropriate course alterations. The IR seeker is also activated and when a sufficient signal-to-noise ratio is achieved this takes over guidance control for the terminal phase. The missile is capable of manoeuvres up to 20 *g* in any direction. The system can only be fired automatically at the moment, but manual control will become possible with Block 2 missiles.

Specifications
Mk 49 RAM Standard launcher
Traverse: 360°
Elevation: −25 to +80°
Turning circle: 3.27 m (10.7 ft)

RIM-116 missile
Length: 2.79 m (9.1 ft)
Diameter: 12.7 cm (5 in)
Wing span: 43.4 cm (17 in)
Weight: 73.6 kg (241 lb)
Speed: Mach 2
Range: 5.17 n miles (9.6 km)
Warhead: 9.09 kg fragmentation blast WDU-17B
Motor: Hercules/Aerojet Mk 36 solid propellant rocket

Manufacturer/Contractor
RAM Systems GmbH, D-85521 Riemerling, Germany.

TUBES

324 mm US Mk 32 Mod 9 (two twin) torpedo tubes
Four 324 mm (12.75 in) US Mk 32 Mod 9 (two twin) torpedo tubes will be mounted within the superstructure, immediately below the RAS station. The spacious torpedo compartments will be sited either side of the main corridor on the main deck level and will house a number of reloads and reloading gear. The tubes will launch the torpedoes through permanently open apertures in the ship's side at a forward angle of 45° to the ship's centreline.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Under current plans the torpedoes will be Alliant Techsystems Mk 46 324 mm torpedoes, although it seems more probable that the German DM 4A1 will be in use by the time these ships enter service.

GUNS

OTOBREDA 76 mm (3 in)/62 Compact
There will be one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission. In the anti-surface role, the 76 mm gun can be controlled either from the CIC or by a new target designation sight, two of which are installed, one on each bridge wing. This sight will be the same pattern as that used in the Type 123, enabling the 76 mm gun to be fired from the bridge under full visual control.

Specifications
Calibre: 76.2 mm (3.0 in)
Barrel length: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Rheinmetall Rh-202 20 mm cannon
One of the lessons of Gulf deployments is the need for a light, short-range gun. Therefore, the Type 124 ships will mount two Rheinmetall Rh-202 20 mm cannon, which have been taken from decommissioned Klasse 520 landing craft. These are mounted in the bridge wings, abaft the target designation sights.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

OTOBREDA SCLAR launchers
The Type 124 will carry four OTOBREDA SCLAR launchers, firing Buck System IRRAS and DUERAS 118 mm infrared and chaff decoys.

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

DASA FL-1800S-II
The integrated ESM/ECM suite will be the DASA FL-1800S-II as used in the Type 123 ships.

Manufacturer/Contractor
DASA, Ulm, Germany.

DECOYS

Chaff launchers.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Signaal SEWACO FD command and fire-control system
SEWACO FD (FD = Fully Distributed) is an automatic threat evaluation, weapon assignment and sensor allocation system, which can also be used as a planning aid through inputs of intelligence data and decision support facilities. SEWACO FD has been developed from the SEWACO system, with distributed processing power replacing the centralised computer complexes. The processing power is formed by SIGMA (SIGnaal Modular Architecture) nodes, one of which is built into every MOC (Multifunction Operator Console) and Bus Terminal Server (BTS). These SIGMA nodes consist of a number of SUN-1S type processor boards, each with 16 Mbyte RAM and capable of 12.5 Mips. These nodes are housed in both Multifunction Operator Consoles (MOCs) and Bus Terminal Servers (BTSs).

The software package, designated TACTICOS, is written in Ada but includes SPLICE (Subscription Paradigm for the Logical Interconnection of Concurrent Engines) distributed database and data communication modules, which operate alongside UNIX. The hardware is linked through a dual Ethernet (IEEE 802.3) standard LAN (local area network), with subsystems either linked directly to the LAN through a digital data interface bustap, or through a BTSs interface. These BTSs also have spare processing power which they bring into use automatically to compensate for failures in standard processor modes.

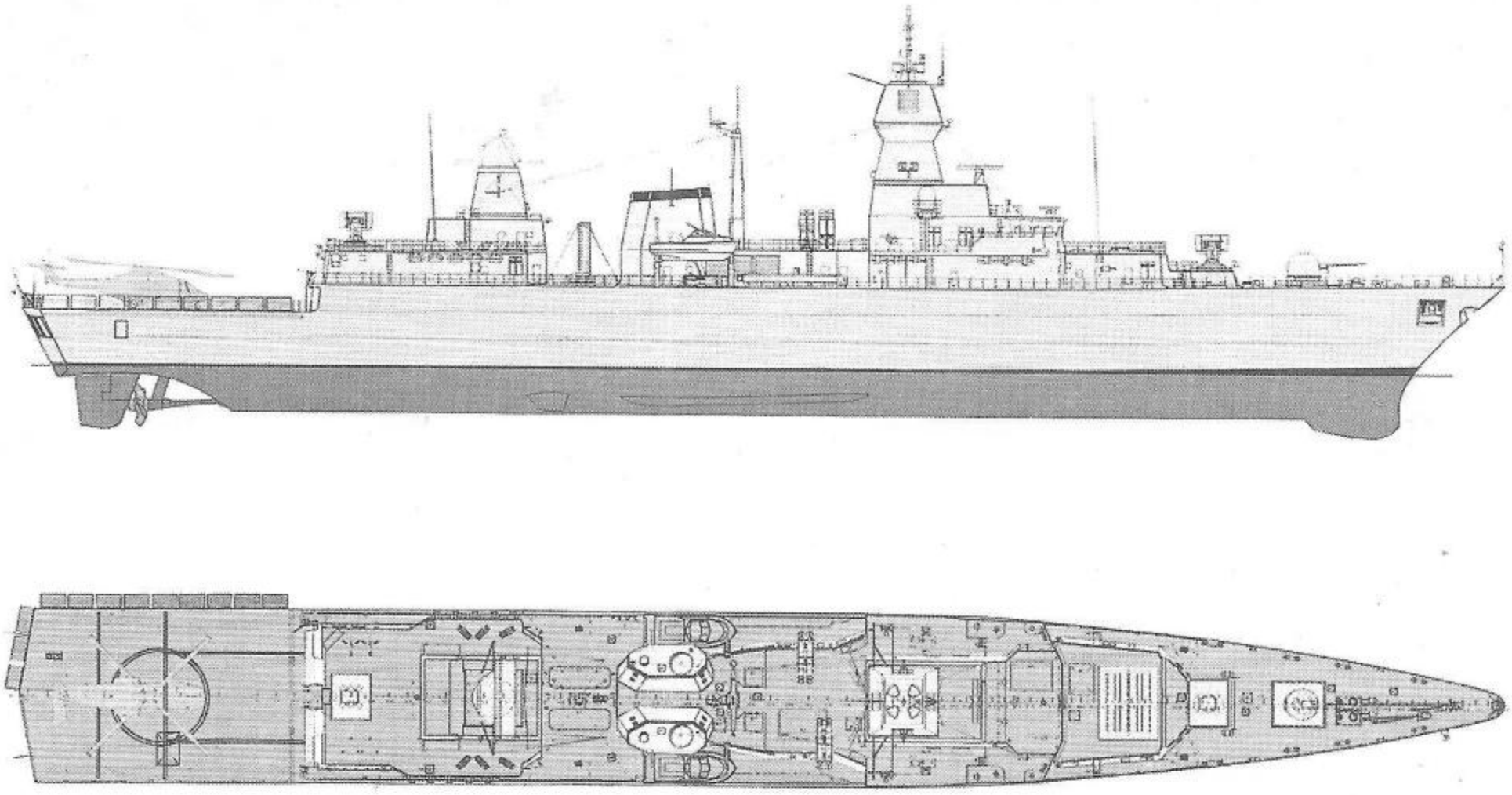
Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11; Link 16

WEAPONS CONTROL

SIRIUS long-range infra-red surveillance and tracking system
The Type 124 will be fitted with at least one Signaal SIRIUS Long-Range Infra-Red Surveillance and Tracking system (LR-IRST), which will reinforce the horizon search capabilities against sea-skimming anti-ship missiles. The system will use both the 3 to 5 µm and 8 to 10 µm thermal infra-red bands to provide the earliest possible detection for the full range of possible threats. High-resolution cameras will be stabilised to cope with



A concept drawing of the 'Sachsen' (F124) class of the German Navy (ARGE F 124)

ship's motion using a patented Signaal-developed wedge stabilised platform. Advanced signal processing will support the long-range detection capability, as well as the automatic tactical arena evaluation for confirmed target data. SIRIUS is designed to compliment the ship's existing radar capabilities by conducting horizon searches in selected scenarios, such as emission control and severe radar jamming conditions. Two operational modes are provided for these conditions, one to ensure the earliest detection of sea-skimming anti-ship missiles for use in multisensor evaluations, and one to provide confirmed, low false alert rate target data for immediate use by air defence systems such as CIWS, NSSM.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

SMART-L 3D volume search radar

The air search array will be mounted on the mainmast and this function in the Type 124 is likely to be performed either by the Signaal SMART-L or by the TRS-3D. Details of the former are given below.

SMART-L is the D-band version of the successful family of SMART multibeam 3D radars. SMART-L is designed to provide:

medium-range detection of the latest generation of small 'stealth' air targets
long-range detection of conventional aircraft
high ECCM performance
guidance support for patrol aircraft
surface surveillance up to the radar horizon

SMART-L is optimised for the early detection and tracking of very small aircraft and missiles. The accurate 3D target information (even under multipath conditions), gathered by the SMART-L radar provides an essential contribution to the threat evaluation process, especially in multiple attack scenarios, and it allows the weapon control system to perform the fastest lock on.

The antenna consists of a stack of 24 linear arrays, with all 24 arrays being used during reception while 16 arrays are used during transmission. By controlling the phase of the RF energy, supplied by the 16 transmit elements, the illumination pattern can be controlled and the level stabilised. Received radar energy is processed by 24 receiver channels and fed to a beamforming network in which 14 beams are formed in the elevation coverage of zero to +70°. The output signals of the beamformer are further processed by a Doppler processor for the extraction of the target Doppler speed for clutter rejection, and fast but reliable track initiation and maintenance. SMART-L is capable of automatic detection, track initiation and tracking of 1,000 air targets up to a range of 400 km. Surface surveillance is performed by a dedicated LPI radar using Frequency Modulated Continuous Wave (FMCW) techniques.

Specifications

Antenna
Type: Linear array
Polarisation: Vertical
Horizontal beamwidth: 2.2°
Vertical beamwidth: 0-70° (illumination pattern dependent)
Illumination pattern: Local area, long range, burn-through and customer specific
Vertical beamwidth receiver: 14 beams of 6° approx
Rotation speed: 12 rpm
D-band transmitter
Type: Solid-state
D-band receiver and processor
Beamformer: FFT
Doppler filtering: FFT
Range: Up to 300 km against a fighter aircraft

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

APAR active phased-array radar

Hollandse Signaalapparaten BV (Signaal) and the Royal Netherlands Navy have signed a contract for the product development phase of the APAR (Active Phased-Array Radar) multifunction radar. This contract is based on a Memorandum of Understanding (MoU) between Canada, Germany and the Netherlands in which the three participants stated their intention to develop, build and test the APAR radar system and proceed with the product development phase. For project realisation, Signaal is leading a consortium of Daimler-Benz Aerospace AG, Germany; Northern Telecom Ltd (NTL), Canada; and FEL/TNO Physics and Electronics Laboratory of the Netherlands. Signaal is responsible for the overall system design and programme management. FEL/TNO takes part in the overall system design, Daimler-Benz will design and manufacture the front-end processing chain, while NTL will manufacture the transmit/receive modules. All industries will take part in the design of these modules, including Microwave Monolithic Integrated Circuits (MMIC).

APAR is a multifunction, phased-array radar for anti-air and anti-surface warfare tasks, including:

- multitarget tracking
- weapon control support
- special search functions

APAR is able to perform multiple capabilities simultaneously, such as multitarget tracking and missile guidance, resulting in multiple engagement channels. Other features are the latest adaptive processing and measures against undesired propagation effects.

APAR works in the I/J bands and has four active, phased-array faces, giving a total coverage of 360 × 70°. Each of the four arrays will have 3,200 transmit/receive elements grouped in 32 column assemblies, with each of the latter having a data distribution unit and a converter. The system uses pencil beams with a ±60° off-centreline shifting capability, resulting in a 15° overlap with the adjacent quadrant. The radar's functions include horizon search (to 75 km); multitarget tracking (250-plus tracks to 150 km); missile guidance support for Sea Sparrow (RIM-7P), Enhanced Sea Sparrow, Standard SM-2, and active-homing missiles; surface gunfire support (splash spotting); cued search (confirm/gather targets detected by other sensors); and surface search and track (to 32 km).

APAR will enable the anti-air system to conduct up to 16 simultaneous engagements in the terminal phase, with 32 missiles in the air. APAR has also been tailored to meet the requirements of littoral warfare, using clutter-filter techniques and with the ability to integrate radar returns with digitised maps.

The system is designed to be compatible with a fully distributed architecture command system such as SEWACO, in which it can fulfil the role of a fire-control support sensor, multitarget tracking radar and dedicated sea skimmer detection radar.

Specifications

Frequency: I/J-band
Spatial coverage: 360 × 70°
Instrumented range: Horizon search 75 km; air target search 150 km; surface search 32 km; back-up volume search 150 km
Track capacity: More than 200 targets
Guidance capability for: RIM-7P Sparrow; ESSM (Evolved Sea Sparrow Missile); (SM 2) Standard Missile 2

Manufacturers/Contractors

Hollandse Signaalapparaten, Hengelo, Netherlands (prime).
Daimler-Benz Aerospace, Ulm, Germany.
Northern Telecom (NORTEL), Canada.
FEL/TNO (Physics and Electronics Laboratory), Den Haag, Netherlands.

SONAR

STN Atlas DSQS-23BZ

The Type 124 will have the bow-mounted, active search, DSQS-23BZ, medium-frequency sonar.

Manufacturer/Contractor

STN Atlas Elektronik, Bremen, Germany.

PROPULSION

Specifications

System: Combined diesel and gas turbine (CODAG)
Main machinery: 2 General Electric GE-7LM2500 9A-ML gas turbines; 38 MW (51,600 shp) sustained; 2 MTU 20V 956 TB 92 diesels; 8.14 MW (11,400 bhp) sustained
Shafts: 2
Propellers: cp
Auxiliary power: 4—750kW MWM TBD-602-V16K diesel generators

FURTHER INFORMATION

PROGRAMME

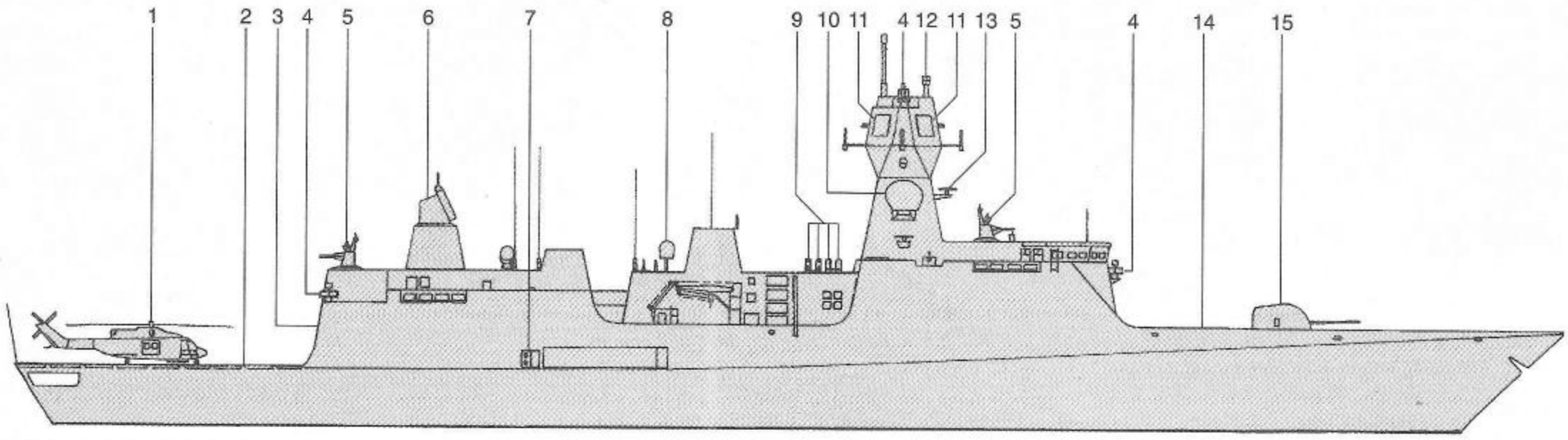
During the early years of the next century numerous NATO navies will require a new class of air defence ship and at one stage there was a plan to develop a NATO frigate to meet all their needs. This plan fell through and while the British, French and Italians opted for a collaborative project (Project Horizon) the Dutch, German, and Spanish navies have taken a different approach. In this the partners will work together only on those elements of the project upon which there is complete agreement, thus, it is hoped, saving money, but without the constant argument and delays which seem to bedevil fully collaborative projects.

Thus, there will be three different hulls, three different propulsion systems, and two different air warning systems, with Germany and Netherlands opting for APAR while Spain has recently decided to adopt Aegis. All three designs will, however, use Evolved Sea Sparrow.

STRUCTURE

All the details are speculative based on the Type 123 hull.

LCF PROJECT



LCF Project (Ian Sturton)
1 *NH-90 or Westland Lynx* **2** *Flight deck* **3** *Hangar* **4** *ARGOSystem APECS II* **5** *Signaal SGE 30 Goalkeeper CIWS* **6** *Signaal SMART-L* **7** *Twin Mk 32 Mod 9 fixed launcher for 324 mm torpedoes* **8** *Satcom* **9** *McDonnell Douglas Harpoon anti-ship missiles* **10** *Signaal SEWACOXI, Link 11/16, SATCOMS* **11** AAPAR air/surface search/fire control **12** *SIRWS IRST electro-optic director* **13** *Signaal Scout surface search* **14** *Mk 41 VLS for Standard SM-1MR and quad pack Evolved Sea Sparrow SAM* **15** *Twin Bofors 120 mm (4.7 in)/50 (from 'Tromp' class) or single OTOBREDA 127 mm*

GENERAL SPECIFICATIONS

Operator: Netherlands
Type: LCF *(Luchverdedigings en Commando Fregat)*

Class: LCF PROJECT

Proposed: 2
Building: 0

Active: 0

Displacement:
full load: 6,044 t

Dimensions
Length: 126.7 m (415.7 ft)(wl)
Beam: 14.6 m (47.9 ft)

Draught: 4.6 m (15.1 ft)

Speed: 28 kts
Range: 5,000 n miles at 18 kts

Complement: 202 (32 officers) (including Flag staff)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84A/C Block 1C Harpoon

Eight Harpoon anti-ship missile canisters will be mounted immediately abaft the foremast, with two groups of four launchers, each group pointing outwards with the effluxes being led through built-in tubes to vent through the opposite side of the superstructure.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

Mk 41 Mod 0 GMVLS

There will be one Mk 41 Mod 0 guided-missile vertical launch system (GMVLS) situated in the foredeck, consisting of five eight-cell modules. These will contain a mix of Standard SM-2MR Block IIIA missiles and Evolved Sea Sparrow Missile (ESSM) quad packs.

Standard Missile 2 Medium-Range (SM-2MR) Block 4

The LCFs will carry Standard SM-2MR Block IIIA missiles, which can be used for surface-to-air (including passive home-on-jam), surface-to-surface and anti-sea skimmer engagements. The propulsion section uses the Thiokol Mk 104 dual-thrust rocket motor with ARC acting as second source. The SM-2 missile's course is controlled from the ship by means of an RF link until the target comes within the missile seeker's field of view. This system allows the use of the ship's search radar to provide missile launch data and by shaping the missile flight path into an energy-efficient trajectory the effective range of the system is doubled.

Specifications
SM-2MR
Length: 4.72 m (15.49 ft)
Diameter: 34.3 cm (13.5 in)
Wing span: 1.06 m (3.47 ft)
Weight: 706.7 kg (1,558 lb)
Speed: Mach 2.5
Range: 37.75 n miles (70 km)
Altitude: 19,800 m (65,000 ft)
Guidance: Semi-active radar homing

Manufacturers/Contractors
Hughes Missile Systems, Tucson, Arizona, USA.
Raytheon Missile Systems Division, Bedford, Massachusetts, USA.

Evolved Sea Sparrow Missile System (ESSMS)/RIM-7RTC point defence system

The LCFs will also be armed with the Enhanced Sea Sparrow Missile System (ESSMS), a developed version of the Mk 57 NATO Sea Sparrow Missile System (NSSMS), with the RIM-7RTC missile. RIM-7P, which succeeded the RIM-7M missile on the production lines in 1991, has a Missile-Borne Computer (MBC), which controls overall missile performance and links the major missile subsystems. The missile also has an improved low-altitude guidance mode and enhanced subclutter performance against very low-altitude targets. Other features include a 38.6 kg (85.1 lb) warhead with new fuze for low-altitude use, a command uplink, sample data homing and multiple target designation. The RIM-7R is similar, but in addition has a dual-mode semi-active radar and infra-red seeker.

ESSM (RIM-7RTC) will have many of the features of RIM-7P and RIM-7R, including the same guidance system, but with a new autopilot and a larger rocket motor. It will be wingless and with tail control as well as integral thrust vector control both for vertical launch and to double the manoeuvrability. The system is fully compatible with the GMVLS Mk 41, but since each cell was dimensioned to house a Tomahawk missile a special module has been developed which accommodates four Sea Sparrows in a single vertical launch cell. These are known as 'quad packs'.

Targets are detected by the ship's radar and designated through the combat information centre and the tracker system then traverses onto the relevant bearing and elevation, while radar data from the director is processed in the signal data processor to provide range and angle tracking data. The data is then passed to the firing officer's console which passes prelaunch data and the firing command to the missile which is then launched. The missile lifts to a height of approximately 4 m (13 ft) and then begins to pitch over in the correct azimuth to the intercept point, controlled by the jet Vector Control, which is then jettisoned (approximately 2 seconds after lift-off). The missile follows a proportional guidance path directly to the intercept point.

Specifications
RIM-7P/R
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in),
Wing span: 1.02 m (3.34 ft)
Weight: 231.5 kg (510 lb)
Speed: Mach 1
Range: 8 n miles (14.5 km)
Guidance: Semi-active radar

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime (system)).

Raytheon Company, Missile Systems Division (prime (missile)).
Hughes Missile Systems (second missile source).

TUBES

One pair of 324 mm US Mk 32 Mod 9 torpedo tubes will be mounted on each side of the ship at the main deck level. These are the Mod 9 version, which consists of two Mk 10 tubes one above the other and held together by two steel brackets. The tubes are angled at approximately 45° to the ship's centreline and stick out of the torpedo room; there is a pneumatically operated muzzle door. Reloading is carried out using a Hughes Seamaster reloading system

Specifications
Length: 3.56 m (11.68 ft)
Height: 1.38 m (4.53 ft)
Width: 70.3 cm (2.31 ft)
Tubes: 2
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

BOFORS TAK 120 L/50 medium-calibre dual-purpose guns
It has recently been revealed that the gun system will be a twin 120 mm mounting in 'A' position. The guns will be taken from the 'Tromp' class frigates and will be refurbished (and also possibly rehoused in a new 'stealthy' turret. The guns in these mountings were originally installed in single mounts in the Dutch destroyer *Gelderland* (D 811) and were removed when it was stricken in 1973, completey refurbished and then installed in the 'Tromp' class ships. The TAK 120 L/50 barrels are of monobloc construction with exchangeable liners and are water-cooled. They have a vertical, sliding wedge breech block and automatic rammer, each barrel being fed by a separate ammunition hoist.

Specifications
TAK 120 L/50
Calibre: 120 mm (4.7 in)
Length of barrel: 50 calibres
Muzzle velocity: 850 m/s (2,789 ft/s)
Traverse: 360° at 22°/s
Elevation: −9 to +85° at 25°/s
Crew: n/k
Range: 11 n miles (20.5 km)
Rate of fire: 40 rds/min/barrel
Weight of shell: 24 kg (53 lb)

Manufacturer/Contractor
Bofors Ordnance, Sweden.

As this book closed for press the Royal Netherlands Navy announced that instead of the Bofors TAK 120 their ships will mount the OTOBREDA 127 mm.

Signaal/General Electric SGE-30 30 mm Goalkeeper close in weapons system
There will be two Signaal/General Electric 30 mm 7-barrelled Gatling Goalkeeper close in weapons systems. One will be mounted in a central position at the after end of the hangar roof, and the other will be mounted on the bridge roof. Goalkeeper is an autonomous, fully automatic system, consisting of a General Electric Sea Vulcan 30 gun, I-band search radar, I/K-band tracking radar, TV camera, and ancillaries. The Sea Vulcan 30 is based upon the electrohydraulically powered GAU-8/A 30 mm seven-barrel, Gatling gun, with each barrel firing once during each revolution of the barrel cluster. The gun is very reliable, with 33,000 mean rounds between stoppages. The mounting has an ammunition capacity of 1,190 rounds carried in a linkless system using a feed and storage drum, which is claimed to be sufficient for several target engagements before reloading is necessary. The warhead kill capability of Goalkeeper against anti-ship missiles is achieved by use of MPDS rounds which have high-density, tungsten-alloy penetrators. For 'soft' targets, HEI and TP types of ammunition can be used.

The I-band search radar uses a 2,050 × 280 mm linear array antenna with an integrated sidelobe suppression antenna. The antenna rotates at 60 rpm and has a horizontal beam-width of 1.7° and a vertical beam-width of 60°. The radar is powered by a water-cooled, synthesiser-driven, TWT transmitter with high output power for greater frequency and PRF flexibility in the face of ECM threats.

Specifications
Calibre: 30 mm (1.2 in)
Muzzle velocity: 1,020 m/s (3,346 ft/s) (TP, HEI); 1,150 m/s (APDS) (3,773 ft/s)
Traverse: 360°
Elevation: −25 to +85°
Mounting weight: 6,800 kg (14,991 lb)
Crew: 0
Range: 1.61 n miles (200 m to 3 km)
Rate of fire: 4,200 rds/min
Ammunition: 369 g (TP, HEI, HEISD, API, MPDS)

Manufacturers/Contractors
Hollandse Signaalapparaten BV, Hengelo, Netherlands (system/radar).
General Electric Company, Armament Systems Department (gun).

Oerlikon 20mm
Two single Oerlikon 20 mm guns will be mounted either side of the bridge superstructure.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

The ESM/ECM suite will be the ArgoSystems APECS II intercept/jammer.

DECOYS

Countermeasures will include four SRBOC chaff launchers and a Nixie torpedo decoy system.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

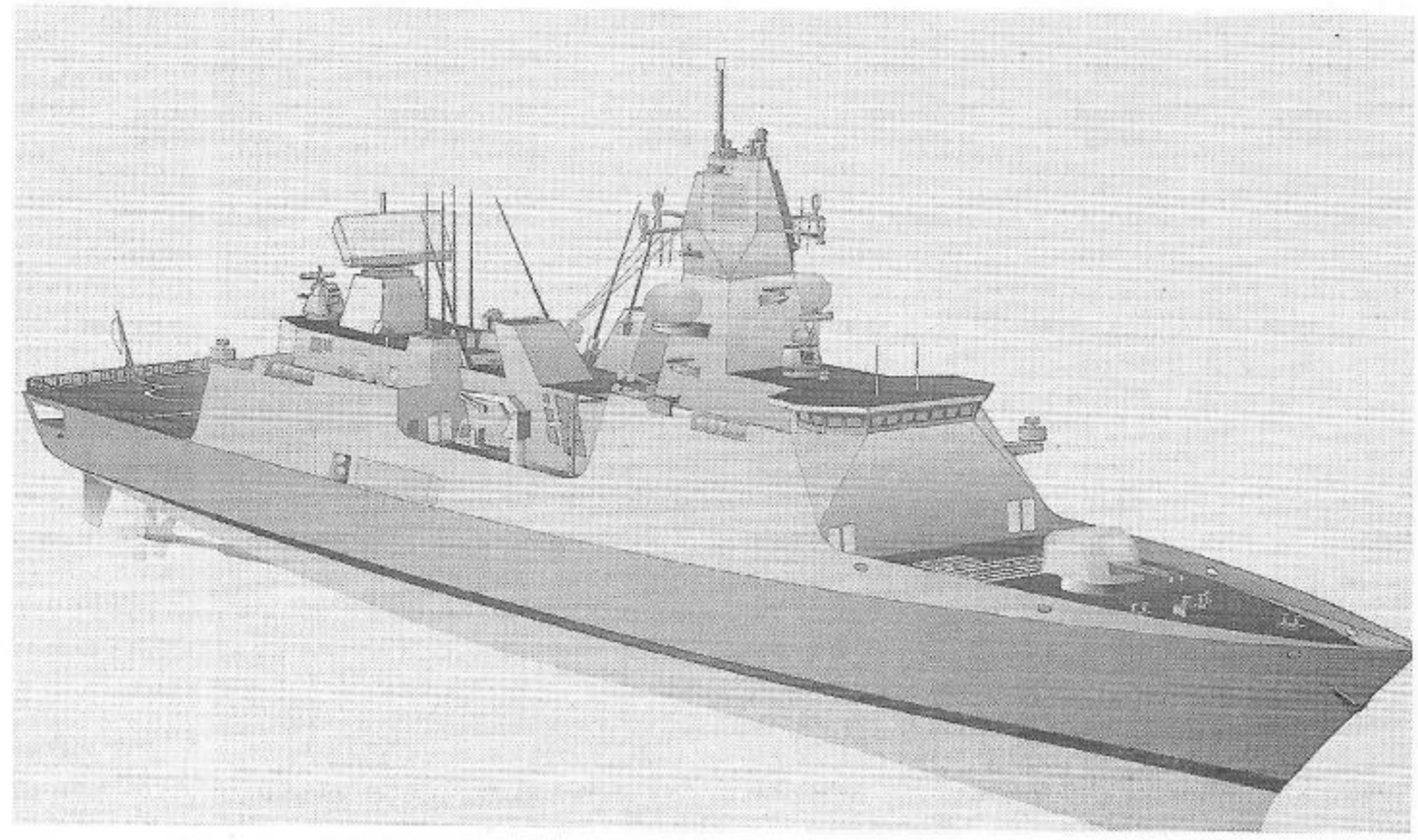
A new version of the Signaal command system, SEWACO XI, is under development for these ships.

COMMUNICATIONS AND DATALINKS

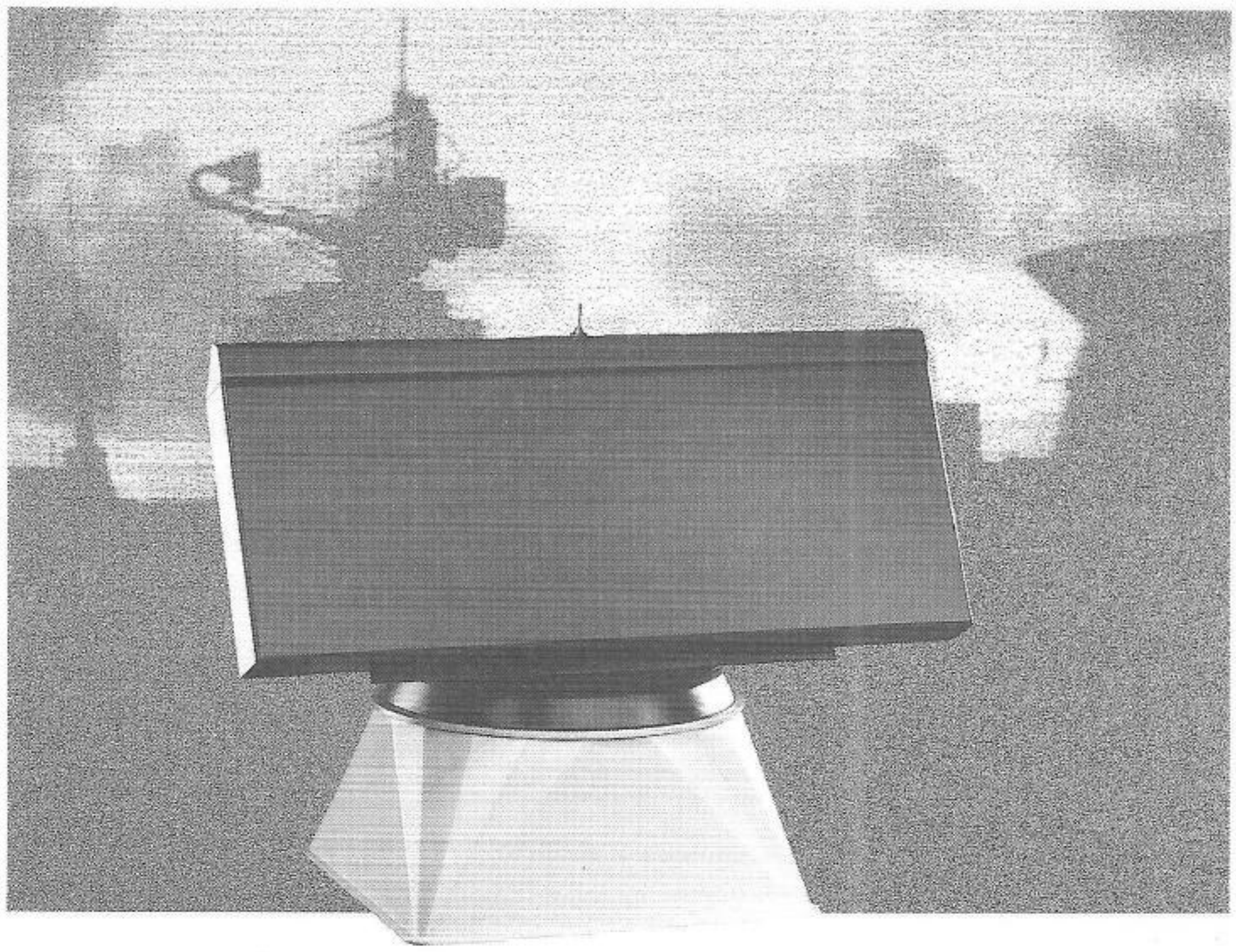
Datalinks: Link 11; Link 16; Satcoms

WEAPONS CONTROL

SIRIUS long-range infra-red surveillance and tracking system
The LCF will be fitted with at least one Signaal SIRIUS Long-Range Infra-Red Surveillance and Tracking system (LR-IRST), which will reinforce the horizon search capabilities against sea-skimming anti-ship missiles. The system will use both the 3 to 5 μm and 8 to 10 μm thermal infra-red bands to provide the earliest possible detection for the full range of possible threats.



Dutch LCF frigate (Royal Schelde)



Signaal's SMART-L is the air-search radar of the Dutch LCF frigate (Signaal)

High-
resolution cameras will be stabilised to cope with ship's motion using a patented Signaal-developed wedge stabilised platform. Advanced signal processing will support the long-range detection capability, as well as the automatic tactical arena evaluation for confirmed target data. SIRIUS is designed to complement the ship's existing radar capabilities by conducting horizon searches in selected scenarios, such as emission control and severe radar jamming conditions. Two operational modes are provided for these conditions, one to ensure the earliest detection of sea-skimming anti-ship missiles for use in multisensor evaluations, and one to provide confirmed, low false alert rate target data for immediate use by air defence systems such as CIWS, NSSM.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

SMART-L 3D volume search radar

The air search array will be mounted on the mainmast and this function in the Type 124 is likely to be performed either by the Signaal SMART-L or by the TRS-3D. Details of the former are given below.

SMART-L is the D-band version of the successful family of SMART multibeam 3D radars. SMART-L is designed to provide:

medium-range detection of the latest generation of small 'stealth' air targets
long-range detection of conventional aircraft
high ECCM performance
guidance support for patrol aircraft
surface surveillance up to the radar horizon

SMART-L is optimised for the early detection and tracking of very small aircraft and missiles. The accurate 3D target information (even under multipath conditions), gathered by the SMART-L radar provides an essential contribution to the threat evaluation process, especially in multiple attack scenarios, and it allows the weapon control system to perform the fastest lock on.

The antenna consists of a stack of 24 linear arrays, with all 24 arrays being used during reception while 16 arrays are used during transmission. By controlling the phase of the RF energy, supplied by the 16 transmit elements, the illumination pattern can be controlled and the level stabilised. Received radar energy is processed by 24 receiver channels and fed to a beamforming network in which 14 beams are formed in the elevation coverage of zero to +70°. The output signals of the beamformer are further processed by a Doppler processor for the extraction of the target Doppler speed for clutter rejection, and fast but reliable track initiation and maintenance. SMART-L is capable of automatic detection, track initiation and tracking of 1,000 air targets and up to a range of 400 km. Surface surveillance is performed by a dedicated LPI radar using Frequency Modulated Continuous Wave (FMCW) techniques.

Specifications

Antenna
Type: Linear array
Polarisation: Vertical
Horizontal beamwidth: 2.2°
Vertical beamwidth: 0-70° (illumination pattern dependent)
Illumination pattern: Local area, long range, burn-through and customer specific
Vertical beamwidth receiver: 14 beams of 6° approx
Rotation speed: 12 rpm
D-band transmitter
Type: Solid state
D-band receiver and processor
Beamformer: FFT
Doppler filtering: FFT
Range: Up to 300 km against a fighter aircraft

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

APAR active phased-array radar

Hollandse Signaalapparaten BV (Signaal) and the Royal Netherlands Navy have signed a contract for the product development phase of the APAR (Active Phased-Array Radar) multifunction radar. This contract is based on a Memorandum of Understanding (MoU) between Canada, Germany and the Netherlands in which the three participants stated their intention to develop, build and test the APAR radar system and proceed with the product development phase. For project realisation, Signaal is leading a consortium of Daimler-Benz Aerospace AG, Germany; Northern Telecom Ltd (NTL), Canada; and FEL/TNO Physics and Electronics Laboratory of the Netherlands. Signaal is responsible for the overall system design and programme management. FEL/TNO takes part in the overall system design, Daimler-Benz will design and manufacture the front-end processing chain, while NTL will manufacture the transmit/receive modules. All industries will take part in the design of these modules, including Microwave Monolithic Integrated Circuits (MMIC).

APAR is a multifunction, phased-array radar for anti-air and anti-surface warfare tasks, including:

multitarget tracking
weapon control support
special search functions

APAR is able to perform multiple capabilities simultaneously, such as multitarget tracking and missile guidance, resulting in multiple engagement channels. Other features are the latest adaptive processing and measures against undesired propagation effects.

APAR works in the I/J bands and has four active, phased-array faces, giving a total coverage of 360 × 70°. Each of the four arrays will have 3,200 transmit/receive elements grouped in 32 column assemblies, with each of the latter having a data distribution unit and a converter. The system uses pencil beams with a ±60° off-centreline shifting capability, resulting in a 15° overlap with the adjacent quadrant. The radar's functions include horizon search (to 75 km); multitarget tracking (250-plus tracks to 150 km); missile guidance support for Sea Sparrow (RIM-7P), Enhanced Sea Sparrow, Standard SM-2, and active-homing missiles; surface gunfire support (splash spotting); cued search (confirm/gather targets detected by other sensors); and surface search and track (to 32 km).

APAR will enable the anti-air system to conduct up to 16 simultaneous engagements in the terminal phase, with 32 missiles in the air. APAR has also been tailored to meet the requirements of littoral warfare, using clutter-filter techniques and with the ability to integrate radar returns with digitised maps.

The system is designed to be compatible with a fully distributed architecture command system such as SEWACO, in which it can fulfil the role of a fire-control support sensor, multitarget tracking radar and dedicated sea skimmer detection radar.

Specifications

Frequency: I/J-band
Spatial coverage: 360 × 70°
Instrumented range: Horizon search 75 km; air target search 150 km; surface search 32 km; back-up volume search 150 km
Track capacity: More than 200 targets
Guidance capability for: RIM-7P Sparrow; ESSM (Evolved Sea Sparrow Missile); (SM 2) Standard Missile 2

Manufacturers/Contractors

Hollandse Signaalapparaten BV, Hengelo, Netherlands (prime).
Daimler-Benz Aerospace, Ulm, Germany (Germany).
Northern Telecom (NORTEL), Canada (Canada).
FEL/TNO (Physics and Electronics Laboratory), Den Haag, Netherlands.

Scout surface surveillance and navigation 'quiet' radar

The surface search and navigation radar will be the new Signaal Scout, a low probability of intercept (LPI) radar which uses FMCW (frequency-modulated continuous wave) techniques and a very low transmitter power to ensure that it is virtually non-detectable by ESM systems. It is thus able to offer users the possibility of radar-aided pilotage and surface target surveillance in radar silence conditions.

Specifications

Frequency: I-band
Transmitter: Solid-state, low output
Transmitter power: Selectable 1 mW to 1 W max
Antenna: Dual slotted waveguide
Rotation speed: 24 rpm
Receiver: High dynamic range

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

SONAR

Signaal PHS-36 hull-mounted search and attack sonar

The PHS-36 will provide information for the data handling functions of active sonar, passive sonar, acoustic support and track management and other functions such as equipment monitoring. The sound velocity processing and recording system also provides data for acoustic support.

The transducer is based on that of the French TSM 2080 but with Signaal electronics. A colour-coded presentation on a Signaal GOS, high-resolution console

gives a graphic picture of sonar information. The dual-processing system performs FM and CW processing simultaneously to cope with both noise-limited and reverberation-limited conditions, as well as with a variety of submarine running conditions as provided for ASW scenarios. The main functions performed by the sonar processor are auto-detection, auto-track initiation and auto-track processing.

Specifications

Transmission
Frequencies: 5.5 kHz, 6.5 kHz, 7.5 kHz
Pulse type: CW, FM, FM + CW (a sequential transmission per interval)
Pulse length: 75-1,200 ms depending on range-scale/pulse type selections
Reception
Preformed beams: 32
Bandwidth passive mode: Band I low; Band II high
Accuracy
Range: CW (300 ms) <70 yd; FM <20 yd
Bearing: <2°
Doppler speed: CW (300 ms) <0.2 kts
Vertical beamwidth: 13° (narrow beam); 24° (wide beam)

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

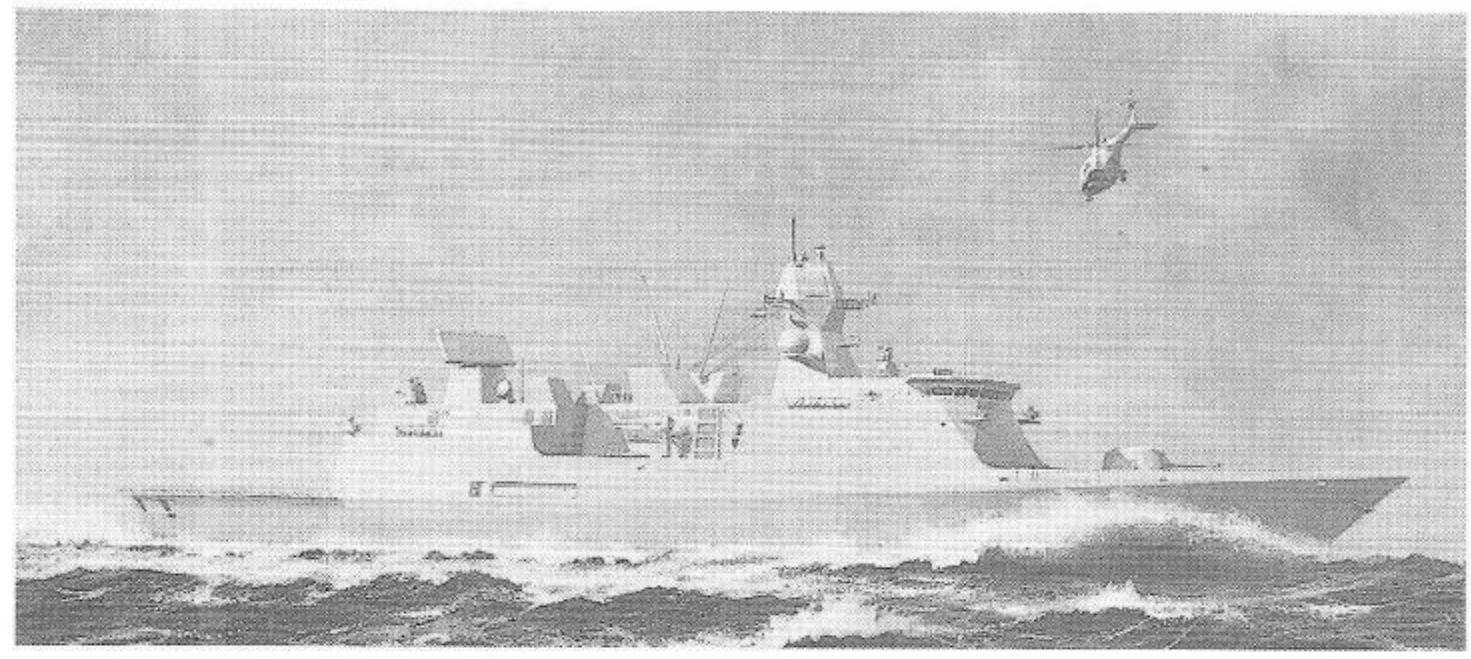
AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 27 × 18.8 m (88.6 × 61.7 ft)

HELICOPTER

One Westland Super Lynx or (later) NH-90.



Artist's impression of Royal Netherlands Navy LCF with NH-90 helicopter overhead (Royal Schelde)

PROPULSION

Specifications
System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 Rolls-Royce Spey SM1C; 25.2 MW (33,800 hp) sustained; 2 Stork-Wärtsila 16V6ST diesels; 8.4 MW (11,424 hp(m))
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

The RNethN's original intention was to order two new air defence ships in 1996, under the designation LCF (LCF = *Luchtverdeigings en Commando Fregat*). The first of these will be laid down in the last quarter of 1997 for completion in 2003, and the second in May 1998 for completion in 2003/4.

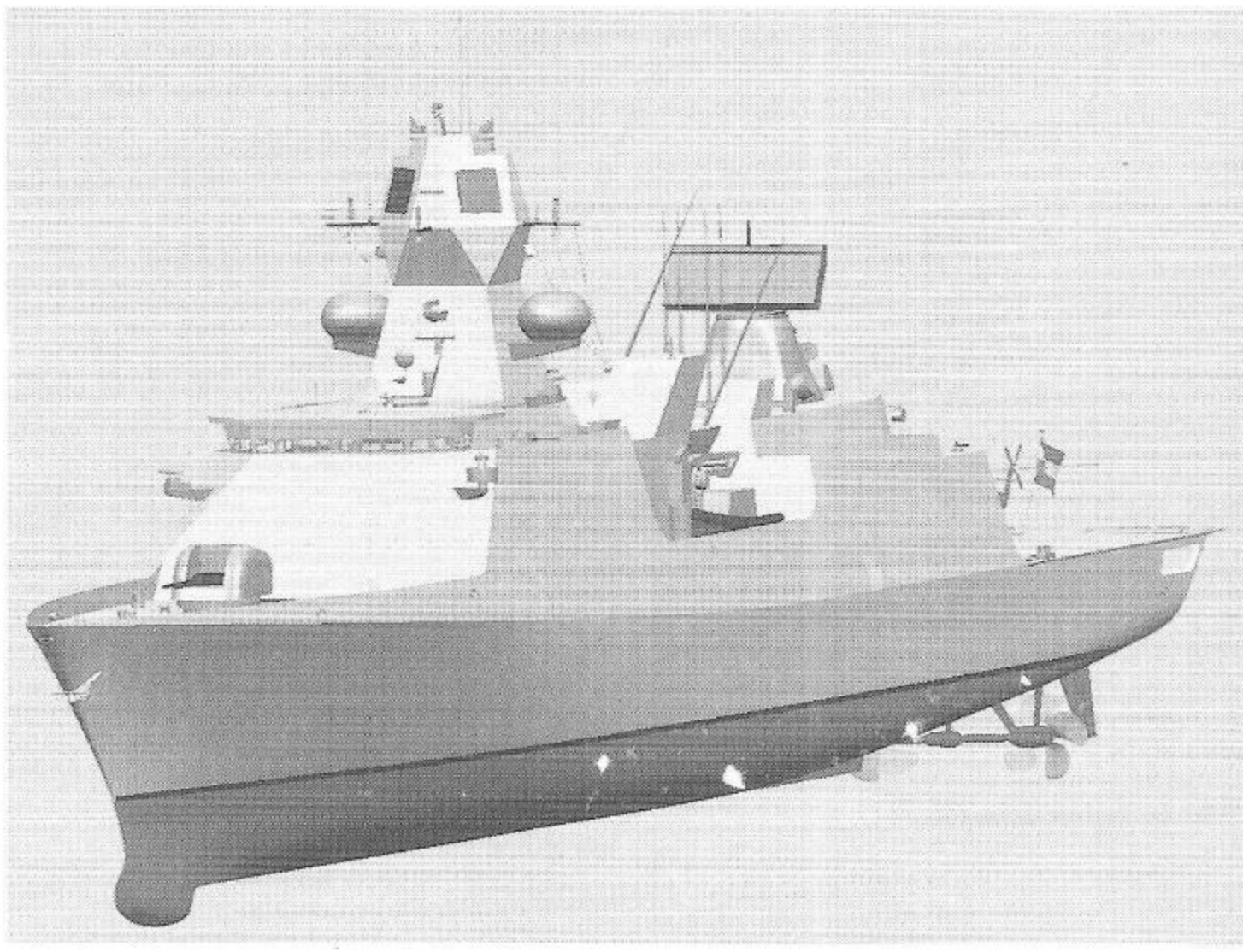
STRUCTURE

The original hull design used in project definition studies was based on a slightly enlarged version of the Karel Doorman (M class) design, but the design is now substantially larger.

Changes are still being made and Tomahawk cruise missiles are being considered.

DAMAGE CONTROL

Very detailed ship vulnerability studies have been carried out and the final hull design has 13 watertight compartments and seven vertical fire zones, bounded by PirMa blast and shrapnel resistant bulkheads. There are also distributed electrical power and chilled water mains.



Computer-generated impression of the LCF. As with the German and Spanish frigates, the Dutch programme seems to have proceeded much more smoothly than Project Horizon and the UAE Navy has expressed a serious interest in an order for four (Royal Netherlands Navy)

GUNS

The twin 120 mm L/50 turrets are being removed from the two 'Tromp' class frigates, which will suffice for the first two LCFs. If, however, further ships are built there may be a problem over the provision of similar guns unless spare turrets were built at the same time as the twin 'Tromp' class turrets.

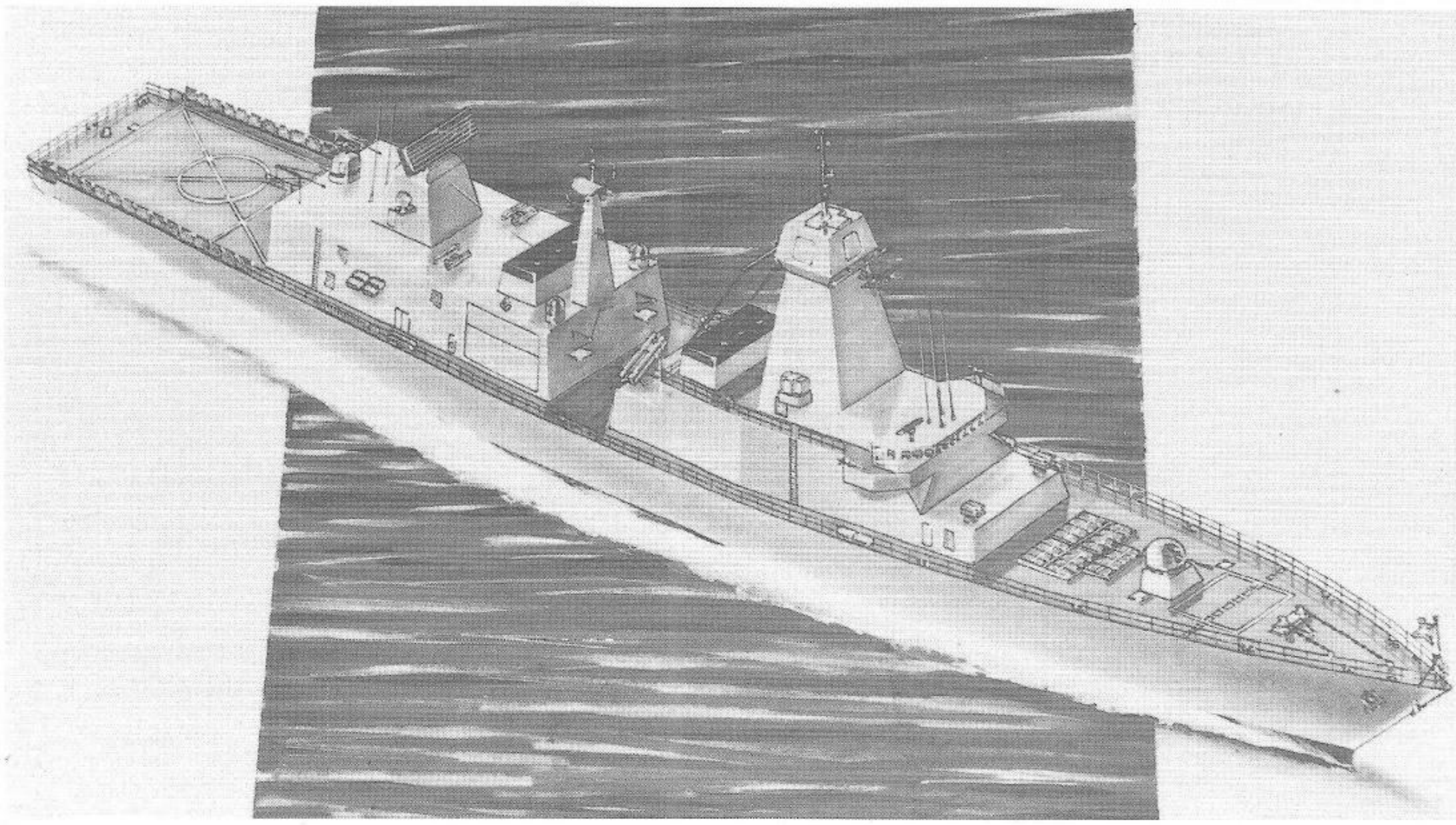
EXPORT

The UAE, which has recently bought two 'Kortenaer' class frigates, expressed strong interest in 1996 in the LCF, suggesting a possibility of an order for up to six. Financial and manpower constraints could well, however, reduce this to two or at most, three ships.

THE FUTURE

The RNethN has designed two slightly cheaper derivatives of the LCF, which are intended for the AAW mission but will lack the command facilities (hence their designation of LF). These would be laid down in 2003 and 2004 and would be funded by deferring the NH-90 helicopter programme, advancing replacement of two of the four remaining Kortenaers by eighteen months, and cancelling the Capability Upkeep Programme (CUP) for the two Jacob van Heemskerck AAW frigates.

F 100



An earlier design study for the F 100

GENERAL SPECIFICATIONS

Operator: Spain

Class: F 100

Planned: 4
Building: 0
Active: 0

Displacement:
full load: 5,761 t

Dimensions
Length: 133.2 m (437.0 ft)
Beam: 15.8 m (51.83 ft)
Draught: 4.7 m (15.4 ft)

Speed: 28 kts
Range: 4,500 n miles at 18 kts

Complement: 220

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84A/C Block 1C Harpoon

Eight Harpoon anti-ship missile canisters will be mounted.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

Mk 41 Mod 0 GMVLS

There will be one Mk 41 Mod 0 guided missile vertical launch system (GMVLS) situated in the foredeck, consisting of five eight-cell modules. These will contain a mix of Standard SM-2MR Block IIIA missiles and Evolved Sea Sparrow Missile (ESSM) quad packs.

Standard Missile 2 Medium-Range (SM-2MR) Block 4

The Standard SM-2MR Block IIIA missiles can be used for surface-to-air (including passive home-on-jam), surface-to-surface and anti-sea skimmer engagements. The propulsion section uses the Thiokol Mk 104 dual-thrust rocket motor with ARC acting as second source. The SM-2 missile's course is controlled from the ship by means of an RF link until the target comes within the missile seeker's field of view. This system allows the use of the ship's search radar to provide missile launch data and, by shaping the missile flight path into an energy-efficient trajectory, the effective range of the system is doubled.

Specifications
SM-2MR
Length: 4.72 m (15.49 ft)
Diameter: 34.3 cm (13.5 in)
Wing span: 1.06 m (3.47 ft)
Weight: 706.7 kg (1,558 lb)
Speed: Mach 2.5
Range: 37.75 n miles (70 km)
Altitude: 19,800 m (65,000 ft)
Guidance: Semi-active radar homing

Manufacturers/Contractors
Hughes Missile Systems, Tucson, Arizona, USA.
Raytheon Missile Systems Division, Bedford, Massachusetts, USA.

Evolved Sea Sparrow Missile System (ESSMS)/RIM-7RTC point defence system

The F 100s will also be armed with the Enhanced Sea Sparrow Missile System (ESSMS), a developed version of the Mk 57 NATO Sea Sparrow Missile System (NSSMS), with the RIM-7RTC missile. RIM-7P, which succeeded the RIM-7M missile on the production lines in 1991, has a Missile-Borne Computer (MBC), which controls overall missile performance and links the major missile subsystems. The missile also has an improved low-altitude guidance mode and enhanced subclutter performance against very low-altitude targets. Other features include a 38.6 kg (85.1 lb) warhead with new fuze for low-altitude use, a command uplink, sample data homing and multiple target designation. The RIM-7R is similar, but in addition has a dual-mode semi-active radar and infra-red seeker.

ESSM (RIM-7RTC) will have many of the features of RIM-7P and RIM-7R, including the same guidance system, but with a new autopilot and a larger rocket motor. It will be wingless and with tail control as well as integral thrust vector control both for vertical launch and to double the manoeuvrability. The system is fully compatible with the GMVLS Mk 41, but since each cell was dimensioned to house a Tomahawk missile a special module

has been developed which accommodates four Sea Sparrows in a single vertical launch cell. These are known as 'quad packs'.

Targets are detected by the ship's radar and designated through the combat information centre and the tracker system then traverses onto the relevant bearing and elevation, while radar data from the director is processed in the signal data processor to provide range and angle tracking data. The data is then passed to the firing officer's console which passes prel-aunch data and the firing command to the missile which is then launched. The missile lifts to a height of approximately 4 m (13 ft) and then begins to pitch over in the correct azimuth to the intercept point, controlled by the jet vector control, which is then jettisoned (approximately 2 seconds after lift-off). The missile follows a proportional guidance path directly to the intercept point.

Specifications

RIM-7P/R
Length: 3.66 m (12 ft)
Diameter: 20.3 cm (8 in)
Wing span: 1.02 m (3.3 ft)
Weight: 231.5 kg (510 lb)
Speed: Mach 1
Range: 8 n miles (14.5 km)
Guidance: Semi-active radar

Manufacturers/contractors;

Raytheon Company, Equipment Division (prime (system)).
Raytheon Company, Missile Systems Division (prime (missile)).
Hughes Missile Systems (second missile source).

TORPEDOES

324 mm Mk 32 Mod 9 torpedo launchers

Two twin Mk 32 Mod 9 324 mm (12.75 in) fixed torpedo launchers will be mounted in the superstructure. 24 torpedoes will be carried.

Mk 46 Mod 5 torpedo

Specification

Mk 46 Mod 5
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight:
torpedo: 230 kg (507 lb)
warhead: 44 kg (97 lb)
Speed: 40 kts (max)
Range: 5.9 n miles (11 km)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg; PBXN-103

ANTI-SUBMARINE MORTARS

There will be two LCASW anti-submarine mortars.

GUNS

OTOBREDA 76 mm (3 in)/62 Compact

There will be one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is desig-nated to the air defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission. The gun will be directed by the DORNA fire-control system.

Specifications

Calibre: 76.2 mm (3.0 in)
Barrel length: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

Bazan Meroka

A single Bazan Meroka 12-barrelled 20 mm/120 close in weapons system (CIWS) will be sited centrally at the after end of the hangar roof. Meroka is unique in its con-figuration and operation, consisting of 12 Oerlikon 20 mm KAA barrels arranged in a single unit of two superimposed rows of six with a common breech block. All operations, such as loading, feeding and unlocking, are carried out using compressed air from reservoirs on the mounting, which are recharged from an onboard compressor. Ammunition is brought to the barrels by two belt feeds, supplied by a hydraulically powered, rotating, 72-round magazine. Meroka will be cued by an AESN RAN-12L search radar.

Specifications

Calibre: 20 mm (0.79 in)
Length of barrel: 120 calibres
Muzzle velocity: 1,215 m/s (3,986 ft/s)
Traverse: 360° at 90°/s
Elevation: −20 to +85°
Crew: 0
Range: 0.75 n miles (1.5 km)
Rate of fire: 2,700-3,600 rds/min
Ammunition: 337 g (TP-T, HEI, SAPHEI-T, AP-T); 310 g (APDS-T)

Manufacturer/Contractor

Fabrica de Artilleria de Bazan, Spain.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC COUNTERMEASURES (ECM)

Aldebaran

Aldebaran is an integrated radar intercept and jamming suite; the ESM element is manufactured by ENSA, while the ECM element is produced by Inisel. These are both Spanish companies and Aldebaran is, in fact, the first indigenously designed and developed EW system for Spanish naval use. There is little information on the current status but the first prototype unit was delivered in 1989, and it is believed that production equipments have already been delivered to the Spanish Navy. It is scheduled to be integrated with the Altair IR warning system for protection against sea-skimming missiles.

Elnath

Elnath is a communications intercept and jamming system.

Manufacturer/Contractor

ENSA.

DECOYS

Four Spanish-designed chaff launchers are part of the Aldebaran EW suite.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

The F 100 will be fitted with a specially designed combat data suite being developed by Bazan's FABA combat systems division, with Lockheed Martin serving as prime subcontractor. This will be derived from the Aegis system as installed in the 'Arleigh Burke' (DDG 51) class, and based on the Baseline III Phase 5 system, but with an increased degree of distributed processing.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11; Link 16.
Satcom: AN/WSN-7.

WEAPONS CONTROL

DORNA fire-control system

DORNA *(Direccion de tiro Optronica y Radarica Naval)* naval fire-control system is being developed by Bazan's FABA division (FABA = *Fabrica de Artilleria de Bazan*) and Inisel.

DORNA will be part of the overall ship's command system, but with specific responsibility for control of the 76 mm gun. It will be of modular, distributed architecture design based upon the Motorola 68020 microprocessor and will run on Ada. The system will consist of a sensor group on a stabilised platform, a dis-play system and a processor for ballistic calculations. The sensor group will consist of a director with a K-band (27 GHz) tracking radar, a high-definition television camera, an infra-red camera and a laser rangefinder. The director will be capable of automatic tracking in both electronic and electro-optic modes. The display system will feature a multifunction console with two high-resolution displays.

Manufacturers/Contractors

Fabrica de Artilleria de Bazan (FABA) (prime).
Inisel (subcontractor).

SIRIUS long-range infra-red surveillance and tracking system

The F 100 will be fitted with at least one Signaal SIRIUS Long-Range Infra-Red Surveillance and Tracking sys-tem (LR-IRST), which will reinforce the horizon search capabilities against sea-skimming anti-ship missiles. The system will use both the 3 to 5 µm and 8 to 10 µm thermal infra-red bands to provide the earliest possible detection for the full range of possible threats. High-resolution cameras will be stabilised to cope with ship's motion using a patented Signaal-developed wedge stabilised platform. Advanced signal processing will support the long-range detection capability, as well as the automatic tactical arena evaluation for confirmed tar-get data. SIRIUS is designed to compliment the ship's existing radar capabilities by conducting horizon searches in selected scenarios, such as emission control and severe radar jamming conditions. Two operational modes are provided for these conditions, one to ensure the earliest detection of sea-skimming anti-ship missiles for use in multisensor evaluations, and one to provide confirmed, low false alert rate target data for immediate use by air defence systems such as CIWS, NSSM.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

Air/surface search: Aegis SPY-1D (Baseline III Phase 5)
Surface search: AN/SPS-67
Fire control: Mk 99 slave illuminators.

SONARS

The principle sonar will be the Raytheon DE 1160LF(I), hull-mounted, active search and attack, medium-frequency sonar. It is also possible that an active towed sonar may also be installed.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: There will be a large flight deck aft.

HELICOPTERS

The F 100 will operate the Sikorsky S-70B-1 Seahwak LAMPS III system.

PROPULSION

Specifications
System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 General Electric LM-2500 gas turbines; 2 Caterpillar/Bazan diesel engines

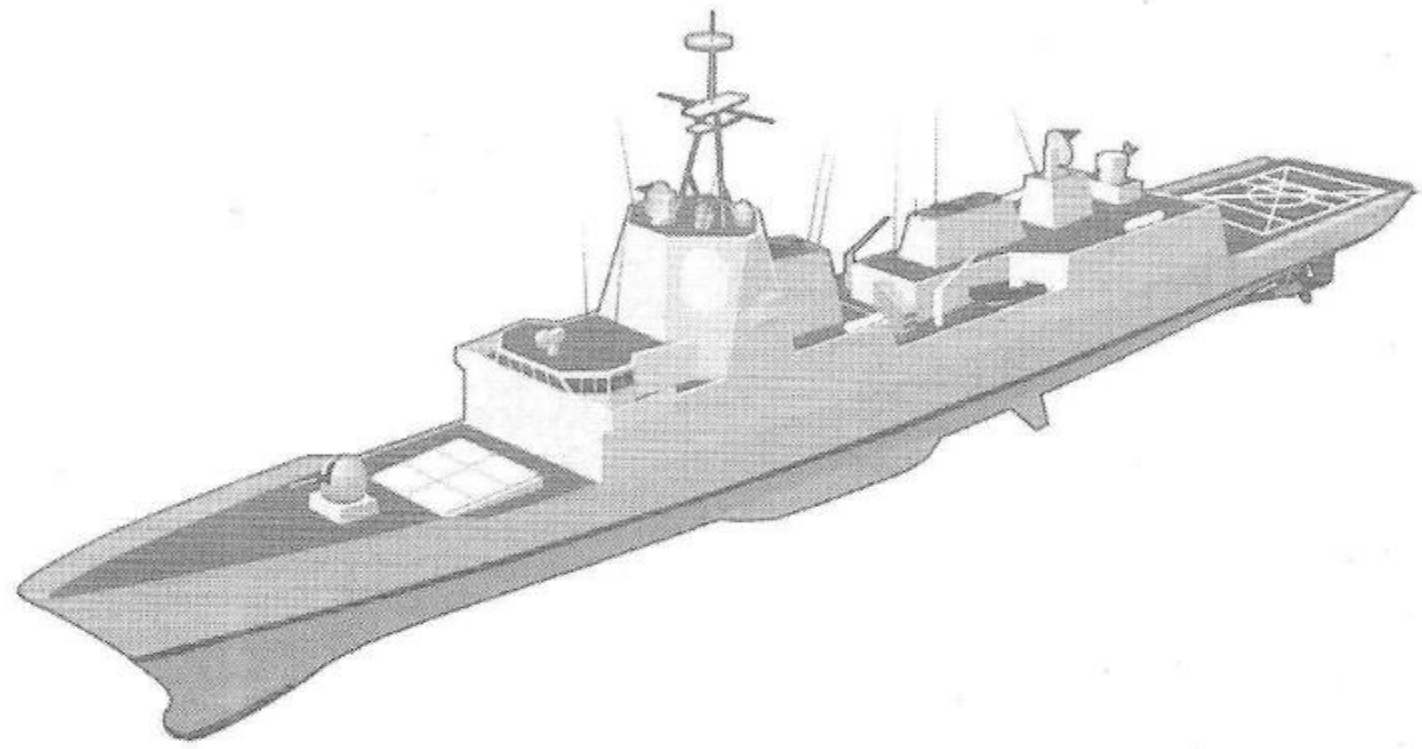
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

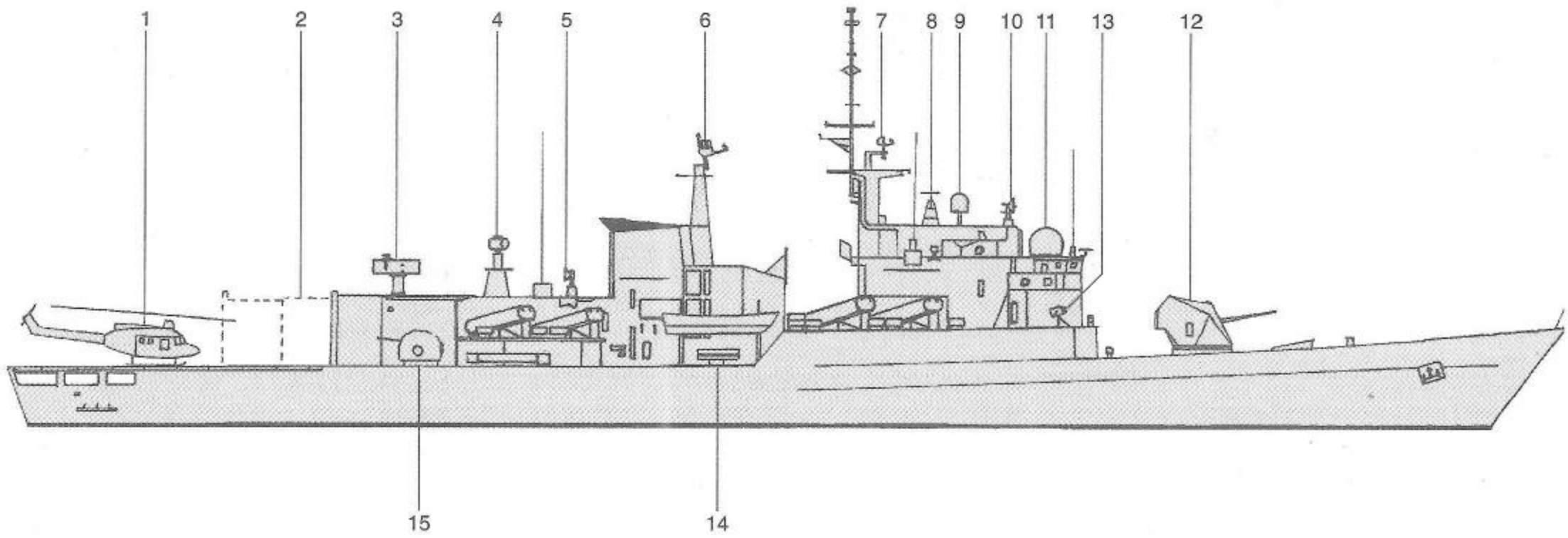
Project definition took place between September 1992 and mid-1995, with detailed design work starting in January 1996.

Spain withdrew from the APAR air defence radar project in June 1995 and decided to purchase the AN/SPY-1D Aegis system, instead. The in-service date for the first of class has now slipped to 2001.



Computer-generated picture of the latest design of the F 100 frigate with SPY-1D Aegis radar (Jane's Navy International)

LUPO



Lupo (Ian Sturton)
1 *AB212 ASW helicopter* **2** *Telescopic hangar* **3** *Mk 29 eight-cell launcher for NATO Sea Sparrow* **4** *US Mk 95 Mod 1 director for SAM* **5** *Selenia SPG 74 fire-control radar (part of Dardo system)* **6** *Selenia SPS 774 air search radar* **7** *SMA SPQ 2F surface search radar* **8** *SMA SPN 748 navigation radar* **9** *Satcom* **10** *Selenia SPG 70 fire-control radar (part of Argo system)* **11** *SMA SPS 702 low-altitude search radar* **12** *OTOBREDA 127 mm/54 Compact automatic gun* **13** *OTOBREDA SCLAR chaff launcher* **14** *US Mk 32 triple 324 mm torpedo tubes* **15** *OTOBREDA twin 40 mm guns (part of Dardo system)*

GENERAL SPECIFICATIONS

Operator: Italy

Class: LUPO

Built: 4
Active: 4

Displacement:
standard: 2,208 t
full load: 2,525 t

Dimensions
Length: 113.2 m (371.3 ft)
Beam: 11.3 m (37.1 ft)

Draught: 3.7 m (12.1 ft)

Speed: 35 kts (gas turbines); 21 kts (diesels)
Range: 4,350 n miles at 16 kts (diesels)

Complement: 185 (16 officers)

SHIPS

LUPO (F 564)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 11 Oct 1974
Launched 29 Jul 1976
Commissioned 12 Sep 1977

SAGITTARIO (F 565)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 4 Feb 1976
Launched 22 Jun 1977
Commissioned 18 Nov 1978

PERSEO (F 566)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 28 Feb 1977
Launched 12 Jul 1978
Commissioned 1 Mar 1980

ORSA (F 567)
Builder Fincantieri, Muggiano, Italy
Laid down 1 Aug 1977
Launched 1 Mar 1979
Commissioned 1 Mar 1980

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

OTOBREDA Teseo Mk 2 (TG 2)

There are eight missiles, housed in four pairs of individual launcher-containers; two pairs are mounted either side of the mast, while the other two pairs are mounted on a platform deck either side of the forward end of the hangar. All the launcher-containers face outward at about 30° to the ship's centreline. The Teseo system is based on the Otomat missile, which has folding wings and is powered by a turbojet with solid fuel rocket boosters. The warhead is a semi-armour-piercing type, which is claimed to penetrate up to 8 cm of nickel-chromium armour. The Mk 2 system is designed for over-the-horizon targeting using a co-operating Agusta-Bell AB 212ASW helicopter with SMA MM/APS-705 I-band radar and PRT-405 tracking and datalink system. On the first leg, the missile flies directly towards the helicopter and only when it passes under the helicopter does the latter transmit target location data.

The target may be acquired by the ship's radar, by the radars of friendly ships or by helicopter radars. Data on the target's location are transmitted to the missile's autopilot and the turbojet is started. Once it has reached full power the boosters are ignited and the missile is launched, but as the missile can turn through angles of up to ±200° the warship does not have to be facing the target during the launch phase.

Once launched, the missile climbs to 150 m (492 ft) accelerated by the boosters which burn for 4 seconds until it reaches cruising speed at a distance of some 2.15 n miles (4 km) from the launch point, where the boosters are jettisoned. The missile then descends to a cruising altitude of 15-20 m (48-64 ft), a compromise between ensuring good communications with the mothership and the need to make it difficult for the target to detect it. The missile continues towards the target with mid-course guidance correction until the radar seeker, which is azimuth only, is activated at a predetermined point and scans a 40° sector, then acquires the target at a range of about 6.5 n miles (12 km). For the terminal phase the Otomat drops to sea-skimming height.

The Otomat system is capable of engaging two separate targets simultaneously in sea states up to Force 7.

Specifications

Length: 4.46 m (14.6 ft)
Diameter: 46 cm (18.1 in)
Wing span: 1.36 m (4.46 ft)
Weight:
with booster: 770 kg (1,698 lb)
without booster: 762 kg (1,680 lb)
Range: 86 n miles (160 km)
Speed: Mach 0.9
Guidance: Inertial and active radar homing
Propulsion: Turbomeca TR 281 Arbizon III turbojet; 400 kg st
Booster: Two SNPE solid-propellant boosters; 3,500 kg st each.
Warhead: Semi-armour-piercing; 210 kg (463 lb); HE 65 kg (143 lb)
Fuzes: Impact, proximity

Manufacturer/Contractor

OTOBREDA, Italy

SURFACE-TO-AIR MISSILES (SAM)

Raytheon Sea Sparrow point-defence missile system

There is a single Mk 29 octuple launcher for the Sea Sparrow system, which is located on the hangar roof. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast/fragmentation warhead and a dual-purpose proximity impact fuze. These ships can fire either Sea Sparrow

RIM-7M or Aspide missiles, giving significantly increased capacity. There are no reloads.

Specifications
RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited in the waist below the stack.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 127 mm/54 Compatto
There is one OTOBREDA 127 mm/54 Compatto mounting in 'A' position. This weapon is designed to provide naval gunfire support, to engage surface targets and to engage air targets, including anti-ship missiles and fixed-wing aircraft which do not have standoff weapons. The turret is unmanned and is slaved to the fire-control radar. It is totally enclosed in a glass fibre shield. Much of the turret and the lower part of the mounting are made of aluminium alloy. The below-deck element of the mounting consists of three drums each containing 22 rounds, which are stocked automatically from two chain-driven lower hoists which lead to the magazines and are loaded manually. The gun captain uses his control to select which drums are to be replenished and with what ammunition. The weapon is compatible with all US 5 in L/54 ammunition.

Specifications
Gun
Calibre: 127 mm
Length of barrel: 54 calibres
Muzzle velocity: 808 m/s (2,625 ft/s)
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 13,600 m (45,000 ft)
Rate of fire: 45 rds/min
Weight of shell: 32 kg (70 lb)

Mounting
Compatto
Training: 330° at 40°/s
Elevation: −15 to +85° at 30°/s
Ready rounds: 66
Crew: 5

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy

OTOBREDA 40 mm L/70 Compact (Type 70) twin mounting
Two twin 40 mm turrets are mounted at main deck level either side of the hangar.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 600 rds/min/mount
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Ready rounds: 736
Crew: 2

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Oerlikon 20 mm cannon
Two single, manually operated Oerlikon 20 mm cannon have been fitted as a temporary measure for particular operations.

Specifications
Calibre: 20 mm
Length of barrel : 70 calibres
Muzzle velocity: 835 m/s
Range:
anti-surface: 0.81 n miles (1.5 km)
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +90°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Elettronica Lambda EW system
The EW system in the 'Lupo' class is a combination of the Elettronica SLR-4 radar warning and SLQ-D jammer suites. The ESM section is SLR-4, which provides 100 per cent intercept probability, passive surveillance, automatic instantaneous warning of programmed threat, automatic analysis of threat parameters, automatic identification and tracking of threats, a synthetic data display, instantaneous DF, and broad frequency coverage. The SLQ-D ECM section provides self-protection by using jammers. An assessment of antennas in the ship suggests that included in the suite are the ELT 521 deception jammer and ELT 318 noise jammer. The suite is controlled from a single operator's position.

Manufacturer/Contractor
Elettronica SpA, Rome, Italy.

DECOYS

OTOBREDA SCLAR rocket launchers
Two 20-tube, 105 mm OTOBREDA SCLAR, multipurpose, rocket launchers are sited on the 01 deck level under the bridge wings. The control unit is linked to the ship's radar and a control panel in the ECM compartment to provide the necessary operating signals, with the data needed to stabilise the two launchers against pitch and roll being provided by the ship's gyrocompass. The system provides defence against radar

Orsa *(F 567)*

and IR homing missiles, confuses enemy radars, and provides illumination for visual fire control at night. Provision is made to load different types of rockets in various arrangements (long-range chaff, medium-range chaff, illuminating) to permit mixed salvos. Automatic selection of the rockets to be fired is possible from the remote fire-control unit and the time fuzes and launch sequence may be similarly controlled. The rockets all have double-base propellant motors with folding fins and electronic fuzes while their speed to burnout is 260-645 m/s (853-2,116 ft/s).

Specifications

Launcher weight: 1.15 t (empty); 1.75 t (with 20 rockets)
Trunnion height: 1.17 m (3.84 ft)
Traverse: 300° at 60°/s
Elevation: −5 to +60° at 30°/s
Rate of fire: 1 rd/s

Chaff distraction rocket
Type: SNIA 105 LR-C
Length: 1.85 m (6.0 ft)
Diameter: 105 mm (4 in)
Max range: 12 km
Weight: 27 kg (59.5 lb)
Payload: 10.2 kg (22.5 lb)

Chaff seduction rocket
Type: SNIA 105 MR-C
Length: 1.83 m (6.0 ft)
Diameter: 105 mm (4 in)
Max range: 4.7 km
Weight: 29 kg (63.9 ft) (SNIA 105 MR)
Payload: 17.4 kg (38.36 lb)

Infra-red seduction
Type: SNIA 105 MR-IR

Illumination
Type: SNIA 105 LR-I
Payload: 10.2 kg (22.5 lb)
Range: 4 km

Manufacturers/Contractors

OTOBREDA, Brescia, Italy (launcher).
SNIA BPD, Italy (rockets).

AN/SLQ-25 Nixie noisemaker

One AN/SLQ-25 Nixie (Phase 1), solid-state, modular design electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom or in a partially or totally enclosed location on the main deck. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm (3.10 ft) long, 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor

Aerojet ElectroSystems, Sacramento, California, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SADOC 2/IPN 10

SADOC 2/IPN 10 (SADOC = *Systema Direzione della Operazioni di Combattimento)* is a mainframe architecture system designed to acquire, process and present data acquired by sensors. It can also be used for a number of other functions, including threat evaluation and weapons control, ECM management, aircraft control, conducting ASW operations, as well as datalink and databank management. Data are received from onboard and offboard sensors via datalinks. The system has two or three Central Processing Units (CPU) mini-computers (Alenia 32-bit CDG-3032 with a 128 k memory), one of which usually acts as the immediate back-up in the event of system failure. Within the consoles are Alenia 16-bit NDC-160 processors, with 64 k memories. Both possess mass memory modules for handling programmes and large amounts of data and an interface with a 10 Mbit/s serial databus. Programming language is Ada.

There are two TAVITAC operating systems; the disk operating system and a time-sharing executive. The system uses a 10 Mbit/s serial bus. The main displays and command positions are in the COC *(Centrale Operativa Combattimento).* This system designated SADOC 2 in the Italian Navy and IPN-10 for export.

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome, Italy.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11
Satcom: Satcom
IFF: Mk XII

WEAPONS CONTROL

Argo NA 10 Mod 2 fire-control system

The NA 10 Mod 2 system is designed for surface engagement, air engagements or shore bombardments and can control three guns of two calibres simultaneously, using an RTN 10X fire-control radar. The system is operated through the Main Control Unit (MCU), a console with a ballistic computer, which is used for target acquisition, tracking and engagement either manually or automatically. Two periscopic sights may also be used to provide supplementary target data input to the radar and permit a second target to be engaged. In addition to target data input the MCU receives information from the true wind computer, and data on ship course and speed from the log and gyrocompass, while a vertical reference system provides roll and pitch information.

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome, Italy.

Dardo

There are two Dardo systems, each controlling one 40 mm gun. Dardo is an automatic CIWS, with manual override, designed to engage sea-skimming and diving missiles as well as manned aircraft. It is a mainframe system and consists of a digital data processing and interface unit (DPU), a supervisory console and the Orion RTN 20X radar. Each system controls a single twin 40 mm gun mounting and optional equipment includes optical designators. The DPU uses an 18-bit mini-computer with a 20 k memory, 82 different instructions and a maximum application time of 10.5 µs. Software is written in Assembler language. The DPU receives input from the gyrocompass, inertial reference, the log and the wind reference unit.

The Orion RTN 20X, J-band (10-12 GHz) radar has a stabilised, monopulse, cassegrain antenna with polarisation twist. The transmission frequency and PRF can be changed randomly on a pulse-to-pulse basis over a wide frequency spectrum. The fully digital receiver uses a multicanceller MTI and is equipped to reduce the effects of multipath on low-flying targets. An electro-optical unit (daylight or low-light level TV or infrared) can be installed to the right of the antenna which has maximum slewing speeds of 2.2 rad/s (training), 1.5 rad/s (elevation). The radar can detect missiles at ranges of >10 km.

Initial target acquisition is by the RAN 10S search radar which interfaces directly with the system. Once the RTN 20 radar has acquired the target or targets the system conducts automatic tracking, assigning target priorities where necessary. The operator may override the system to engage lower-priority targets where necessary. Targets can be engaged at distances of 300-3,500 m and up to 10 may be tracked simultaneously.

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome, Italy.

Mk 91 Mod 1 fire-control system

There are two Mk 91 Mod 1 directors: one is on the bridge roof, the other atop a small tower aft. The Mk 91 fire-control system operates in either automatic or semi-automatic modes from target acquisition to interception. It is a mainframe system using an NFT (Norsk Forsvarsteknologi) Mk 157 digital computer which performs all necessary calculations, stores data and is responsible for data distribution.

The Mk 95 tracker-illuminator consists of a Mk 78 radar director with separate transmitting and receiving antennas, a director controller (Mk 106) and a low-light TV camera (Mk 6) with 2.4 × 2.4° and 10 × 10° fields of view. The I-band radar directs the Sea Sparrow missile to fly a lead-angle course to the intercept point enabling the ship to protect both itself and other ships in company. Inboard equipment includes a Mk 73 continuous wave illuminator transmitter, a signal data processor (Mk 17), a signal data converter (Mk 80) and a director controller (Mk 106). There is a radar set console (Mk 83), with Bell Aerospace low-light television monitor and a firing officer's console (Mk 86).

Because of its I-band frequency the Mk 91 will detect sea-skimming missiles sooner than lower-frequency search radars; the system can thus be fully autonomous, conducting search, detection and engagement automatically. It can also accept outside designations from radar, EW or optic sources. Radar data from the director is passed to the signal data processor to provide range and angle tracking data. This data is passed to the firing officer's console from where prelaunch data and firing commands are relayed to the Mk 29 trainable launcher and missile. The launcher then trains in azimuth to the intercept point and in superelevation to optimum angle to maximise missile kinetic energy. Should the correct azimuth be blocked by the ship's superstructure, the launcher trains to the nearest clear azimuth and commands the missile to 'fly around the corner' to the direct path to the intercept. On launch, the missile flies a proportional navigation path (lead angle intercept) directly to the intercept point in a lofted trajectory which maximises energy and minimises image effects.

In 1991 Raytheon modified the Mk 91 systems aboard the 'Lupo' class to enable them to launch either RIM-7M or RIM-7P or Aspide missiles.

Manufacturer/Contractor

Raytheon Company, Equipment Division (prime).

RADARS

Set	SPS-774 (RAN-10S)	SPS-702**	SPQ-2F**	SPN-748	SPG-70 (RTN-10X)	Mk 95* (two)	SPG-74 (RTN-20X) (two)
Company	Selenia	SMA	SMA	SMA	Selenia	Raytheon	Selenia
Role	Air/surface search	Surface search/ target indicatiion	Surface search	Navigation	Fire control (Argo)	Mk 91 Mod 1 fire-contol system (SAM)	Dardo fire-control system (40 mm)
Band	E/F	I	I	I	I/J	I	I/J
Range	85 n miles (155 km)	22 n miles (40 km)	22 n miles (40 km)		22 n miles (40 km)		8 n miles (15 km)
Beam	1.5 × 17°	–	–				–
Peak power	140 kW	200 kW	200 kW		200 kW	2 kW	200 kW
Gain	28 dB	–	–				–
Pulsewidth	0.4 µs	1.5 µs	1.5 µs		1.5 µs		1.5 µs
PRF	900 pps-	450-550 pps	450-550 pps		450-550 pps		450-550 pps
Scan rate	15/30 rpm	40 rpm	40 rpm		–		–

Notes
* Mk 91 Mod 1 uses twin Mk 95 radars
** These sets are virtually identical but are used for different purposes

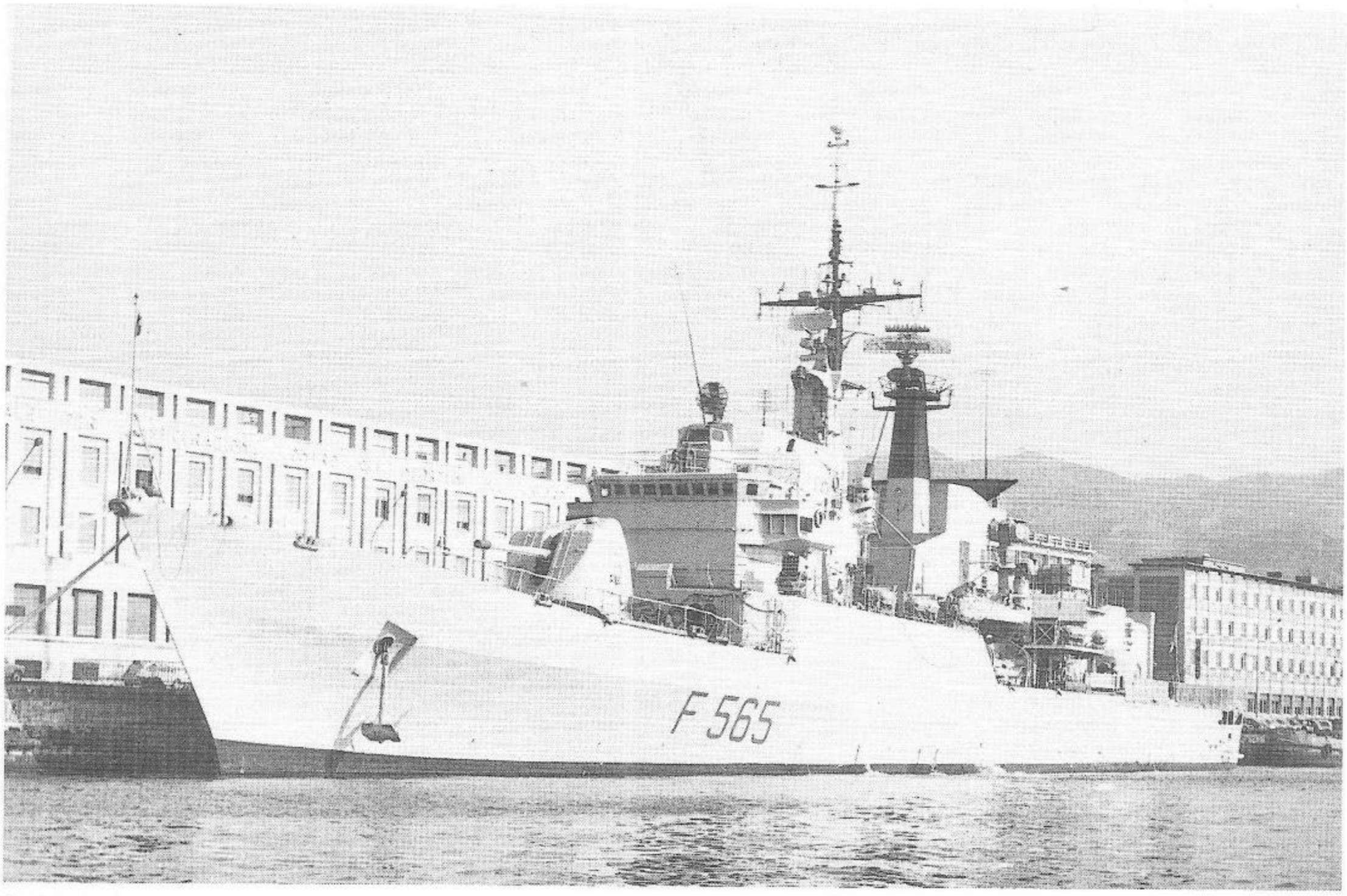
SONAR

Raytheon DE 1160B sonar

The Raytheon DE1160B sonar system is the commercial version of the AN/SQS-56 hull-mounted sonar and is an active/passive, preformed beam, digital sonar providing panoramic echo ranging and panoramic (DIMUS) passive surveillance. All signal processing, except transducer-received signal amplification and linear transducer transmit drive, is accomplished in digital hardware. All visual data are presented on flicker-free, digitally refreshed television-type raster scan CRT displays. System timing, control and interface communication are accomplished by a general purpose mini-computer which is a component of the basic system. Both 400 Hz synchro and MIL-STD-1397 Type A or C, category II digital interfaces are available in the basic sonar system. A single operator can search, track, classify and designate multiple targets from the active system while simultaneously maintaining anti-torpedo surveillance on the passive display. Computer-assisted system control permits the operator to concentrate on the sonar data being displayed rather than on the system control.

Manufacturer/Contractor

Raytheon Company, Submarine Signal Division, Portsmouth, Rhode Island, USA.



Sagittario *(F 565)* (H & L van Ginderen Collection)

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 24 × 11.3 m (79 × 37 ft)

Hangar: The hangar is a telescopic design which extends by some 8 m (28 ft) to enclose the helicopter for protection and maintenance.

HELICOPTERS

One Agusta-Bell AB 212ASW.

Specifications

Dimensions:

main rotor diameter: 14.63 m (48.0 ft)

height to rotor head: 3.91 m (12.82 ft)

rotor disc area: 168.1 m² (1,809 sq ft)

Weight:

max take-off weight: 5,070 kg (11,177 lb)

Performance:

max speed (never exceed): 130 kts (240 km/h)

typical cruising speed: 100 kts (185 km/h)

hovering ceiling (out of ground effect): 396 m (1,300 ft)

range (max standard fuel): 2 n miles (615 km)

Engine: one Pratt & Whitney Canada PT6T-6 Turbo Twin-Pac rated at 1,398 kW (1,875 shp)

Role equipment: torpedoes, AS-12 ASMs or Elettronica Gufo 2000 EW intercept equipment

PROPULSION

Specifications

System: combined diesel or gas turbine (CODOG)

Main machinery: 2 Fiat/General Electric LM-2500 gas turbines; 37.3 MW (50,000 hp) sustained; 2 GMT BL 230.20 M diesels; 7.3 MW (10,000 hp (m)) sustained

Shafts: 2

Propellers: cp

Auxiliary machinery: 4 GMT 236SS diesel generators, 780 kW at 1,200 rpm.

FURTHER INFORMATION

PROGRAMME

The 'Lupo' class frigates were designed for surveillance duties in the Mediterranean waters for which Italy is responsible (which extend as far as Gibraltar in war) patrolling sealanes, escort duties, and other NATO duties.

Four 'Lupo' class frigates were ordered for the Italian Navy, followed by orders from Peru (four), Venezuela (six) and Iraq (four). All have been constructed, but the Iraqi ships were never delivered (see under Modernisation).

DESIGN

The hull is designed for high speed, long range, good manoeuvrability and a low noise signature. The interior is divided into 15 watertight compartments with the requirement that the ship can remain afloat with any three adjacent compartments flooded.

As is customary with Italian designs, the Lupo is both fast and highly manoeuvrable. The ship has demonstrated an ability to attain a speed in excess of 35 knots in less than 60 seconds from a standing start, and to come to a 'crash stop' from maximum speed in less than 40 seconds. The ship's turning circle is less than 500 m (1,640 ft).

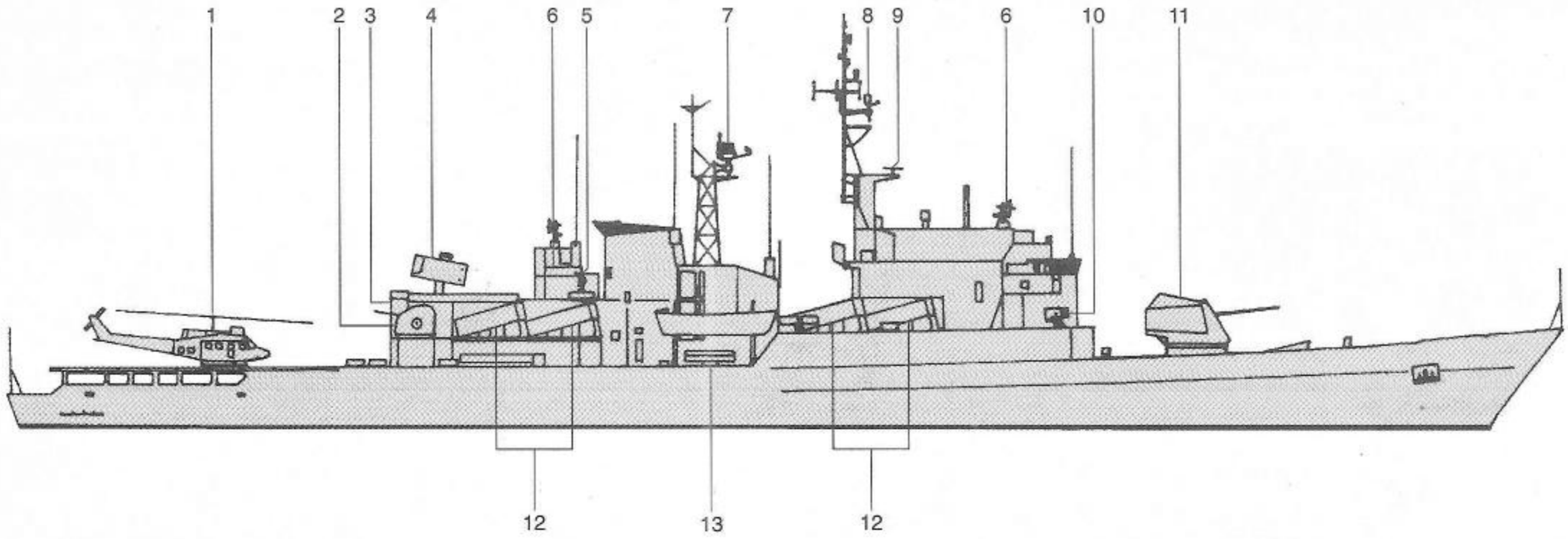
MODERNISATION

These ships all underwent a mid-life update, which started in 1991 and was completed in 1994. The work done included installing a new low-altitude CORA SPS 702 search radar (this is the large white radome on the bridge roof), new gyros and improved communications including Satcom.

Iraqi ships

Iraq ordered four ships but these were not delivered. They were transferred to the Italian Navy on 20 January 1992 and are designated the 'Artigliere' class.

MELITON CARVAJAL (LUPO)



Montero (Itan Sturton)

1 *AB 212 ASW helicopter* **2** *OTOBREDA twin 40 mm/70 Compact* **3** *Helicopter hangar (not telescopic)* **4** *Selenia Albatros eight-cell launcher for Aspide SAMs* **5** *Selenia RTN 20X fire-control radar (for Dardo)* **6** *Selenia RTN 10X fire-control radar* **7** *Selenia RAN 10S air search radar* **8** *Selenia RAN 11X surface search radar* **9** *SMA 3RM 20R navigation radar* **10** *OTOBREDA 105 mm SCLAR chaff launcher* **11** *OTOBREDA 127 mm (5 in)/54 Compact automatic gun* **12** *OTOBREDA Otomat Teseo Mk 2* **13** *Triple 324 mm ILAS torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Italy
Operator: Peru
Type: Lupo

Class: MELITON CARVAJAL

Purchased: 2
Built: 2
Active: 4

Displacement:
standard: 2,208 t
full load: 2,500 t

Dimensions:
Length: 113.2 m (371.3 ft)
Beam: 11.3 m (37.1 ft)
Draught: 3.7 m (12.1 ft)

Speed: 35 kts
Range: 3,450 n miles at 20.5 kts

Complement: 185 (20 officers)

SHIPS

MELITON CARVAJAL (FM 51)

Builder	Fincantieri, Riva Trigoso, Italy
Laid down	8 Aug 1974
Launched	17 Nov 1976
Commissioned	5 Feb 1979

MANUEL VILLAVICENCIO (FM 52)

Builder	Fincantieri, Riva Trigoso, Italy
Laid down	6 Oct 1976
Launched	7 Feb 1978
Commissioned	25 Jun 1979

MONTERO (FM 53)

Builder	SIMA, Callao, Peru
Laid down	Oct 1978
Launched	8 Oct 1982
Commissioned	25 July 1984

MARIATEGUI (FM 54)

Builder	SIMA, Callao, Peru
Laid down	1979
Launched	8 Oct 1984
Commissioned	10 Oct 1987

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

OTOBREDA Teseo Mk 2

There are eight missiles, housed in four pairs of individual launcher-containers; two pairs are mounted either side of the mast, while the other two pairs are mounted on a platform deck either side of the forward end of the hangar. All the launcher-containers face outward at about 30° to the ship's centreline. The Teseo system is based on the Otomat missile, which has folding wings and is powered by a turbojet with solid fuel rocket boosters. The warhead is a semi-armour-piercing type, which is claimed to penetrate up to 8 cm of nickel-chromium armour. The Mk 2 system is designed for over-the-horizon targeting using a co-operating Agusta-Bell AB 212ASW helicopter with SMA MM/APS-705 I-band radar and PRT-405 tracking and datalink system. On the first leg, the missile flies directly towards the helicopter and only when it passes under the helicopter does the latter transmit target location data.

The target may be acquired by the ship's radar, by the radars of friendly ships or by helicopter radars. Data on the target's location are transmitted to the missile's autopilot and the turbojet is started. Once it has reached full power the boosters are ignited and the missile is launched, but as the missile can turn through angles of up to ±200° the warship does not have to be facing the target during the launch phase.

Once launched, the missile climbs to 150 m (492 ft) accelerated by the boosters which burn for 4 seconds until it reaches cruising speed at a distance of some 2.15 n miles (4 km) from the launch point, where the boosters are jettisoned. The missile then descends to a cruising altitude of 15-20 m (49-65.6 ft), a compromise between ensuring good communications with the mothership and the need to make it difficult for the target to detect it. The missile continues towards the target with mid-course guidance correction until the radar seeker, which is azimuth only, is activated at a predetermined point and scans a 40° sector, then acquires the target at a range of about 6.5 n miles (12 km). For the terminal phase the Otomat drops to sea-skimming height.

The Otomat system is capable of engaging two separate targets simultaneously in sea states up to Force 7.

Specifications

Length: 4.46 m (14.6 ft)
Diameter: 46 cm (18.1 in)
Wing span: 1.36 m (4.5 ft)
Weight:
with booster: 770 kg (1,698 lb)
without booster: 762 kg (1,680 lb)
Range: 86 n miles (160 km)
Speed: Mach 0.9
Guidance: Inertial and active radar homing
Propulsion: Turbomeca TR 281 Arbizon III turbojet; 400 kg st
Booster: Two SNPE solid propellant boosters; 3,500 kg st each.
Warhead: Semi-armour-piercing; 210 kg (463 lb); HE 65 kg (143 lb)
Fuzes: Impact, proximity

Manufacturer/Contractor

OTOBREDA, Italy

SURFACE-TO-AIR MISSILES (SAM)

The Albatros Mk 2 Mod 9 system comprises two elements:
Riva-Calzoni launcher
Aspide missile

Riva-Calzoni Albatros launcher

The single, eight-cell Albatros launcher is located on the hangar roof in 'X' position. Produced by Riva-Calzoni, it has eight launch cells, four on each side of

the mounting, each with a frangible front and rear cover. There are no reload facilities.

Specifications
Albatros launcher
Height: 2.98 m (9.2 ft)
Width: 3.82 m (12.5 ft)
Length: 3.82 m (12.5 ft)
Weight (loaded): 8.5 t
Traverse: 360° at 45°/s
Elevation: −5 to +80° at 25°/s.

Alenia Aspide missile
The system uses the Selenia (now Alenia) Aspide SAM, a missile developed by Selenia from the US Sparrow. Targets are detected by the ship's primary search radar and then allocated to the fire-control system. The target is acquired by the fire-control system radar and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews in the target's direction. The missile control system selects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds. When the decision is made to engage the target with missiles the reversible prelaunch commands are issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode. In the latter, two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at once may be controlled by the tracker, according to the manufacturer who also claims the system can engage horizontal targets at up to 15 km, vertical ones at 5 km and lateral ones at 8 km. A short reaction time gives the system the ability to destroy anti-ship missiles even when detection is late.

Specifications
Aspide missile
Length: 3.7 m (12.1 ft)
Diameter: 20.3 cm (8 in)
Wing span: 80 cm (31.5 in)
Weight: 220 kg (485 lb)
Speed: Mach 2.5
Range: 7 n miles (13 km)
Altitude: 15-5,000 m (49-16,405 ft)
Warhead: 33 kg (72.8 lb)
Guidance: Semi-active radar

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy (system/missile).
Riva-Calzoni, Bologna, Italy (launcher).

TORPEDOES

B515 anti-submarine torpedo launching system.
There are two triple B515 (ILAS) torpedo tubes in the waist. The tubes are manually loaded and trained but remotely operated from the combat information centre, although emergency local operation is possible.

Specifications
Length: 3.4 m (11.15 ft)
Height: 1.2 m (3.9 ft)
Width: 1.285 m (4.2 ft)
Weight: 1,050 kg (2,315 lb) (unloaded)

Manufacturer/Contractor
Whitehead, Division of Gilardini SpA.

A244/S lightweight air-/surface-launched anti-submarine weapon
The torpedo used in these ships is believed to be the Whitehead A244/S. The seeker in the A244/S is the Alenia CIACIO-S which is capable of active, passive or mixed modes for closing on to its target and can discriminate between decoys and real targets in the presence of heavy reverberations by specially emitted pulses and signal processing. It also discriminates between target noise and reverberations, as well as having a series preset of programmable search patterns and tactical manoeuvres (including re-attack procedures). The seeker has a large search volume covered by multiple preformed beams following a number of self-adaptive search patterns and is reported capable of target detection at −5 dB in good acoustic conditions. The computerised homing system also provides for presettable combinations of signal processing, spatial filtering and tactical torpedo manoeuvring. The software may be reprogrammed by the customer to meet new tactical conditions. Upon launching, the A244/S initially steers a straight course and, if the target is not detected, it then begins a search pattern which may be either a spiral between preselected depths or a helix pattern.

Specifications
Length: 2.7 m (8.85 ft)
Diameter: 324 mm (12.75 in)
Weight: 215 kg (474 lb) (warshot version)
Warhead: 34 kg (75 lb) shaped charge HBX-3 HE
Propulsion: Electric; silver/zinc batteries
Range: 3.5 n miles (6 km)
Speed: 30 kts
Guidance: Active/passive sonar, self-adaptive programmed patterns

Manufacturer/Contractor
Whitehead SpA, Salviano, Italy.

Montero *(FM 53). The relatively heavy armament of eight Teseo anti-ship missiles, Aspide SAMs and an AB 212ASW helicopter makes this class one of the most heavily armed frigates in any Pacific Navy*

GUNS

OTOBREDA 127 mm/54 Compatto
There is one OTOBREDA 127 mm/54 Compatto mounting in 'A' position. This weapon is designed to provide naval gunfire support, to engage surface targets and to engage air targets, including anti-ship missiles and fixed-wing aircraft which do not have standoff weapons. The turret is unmanned and is enclosed by a glass fibre shield. Much of the turret and the lower part of the mounting are made of aluminium alloy. The below-deck element of the mounting consists of three drums each containing 22 rounds, which are stocked automatically from two chain-driven lower hoists which lead to the magazines and are loaded manually. The gun captain uses his control to select which drums are to be replenished and with what ammunition. The weapon is compatible with all US 5 in L/54 ammunition.

Specifications
Gun
Calibre: 127 mm
Length of barrel: 54 calibres
Muzzle velocity: 808 m/s (2,625 ft/s)
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 13,600 m (45,000 ft)
Rate of fire: 45 rds/min
Weight of shell: 32 kg (70 lb)

Mounting
Compatto
Training: 330° at 40°/s
Elevation: −15 to +85° at 30°/s
Crew: 5

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm L/70 Compact (Type 70) twin mounting
Two twin 40 mm turrets are mounted aft, either side of the hangar.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 600 rds/min/mount
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Elettronica Lambda EW system

The EW system in the Peruvian 'Lupo' class ships is a combination of the Elettronica SLR-4 radar warning and SLQ-D jammer suites in the Lambda system. The ESM section is SLR-4, which provides 100 per cent intercept probability, passive surveillance, automatic instantaneous warning of programmed threat, automatic analysis of threat parameters, automatic identification and tracking of threats, a synthetic data display, instantaneous DF, and broad frequency coverage. The SLQ-D ECM section provides self-protection by using jammers. An assessment of antennas in the ship suggests that included in the suite are the ELT 521 deception jammer and ELT 318 noise jammer. The suite is controlled from a single operator's position.

Manufacturer/Contractor

Elettronica SpA, Rome, Italy

DECOYS

OTOBREDA SCLAR rocket launchers

Two 20-tube, 105 mm OTOBREDA SCLAR, multipurpose, rocket launchers are sited beneath the bridge wings. The control unit is linked to the ship's radar and a control panel in the ECM compartment to provide the necessary operating signals, with the data needed to stabilise the two launchers against pitch and roll being provided by the ship's gyrocompass. The system provides defence against radar and IR homing missiles, confuses enemy radars, and provides illumination for visual fire control at night. Provision is made to load different types of rockets in various arrangements (long-range chaff, medium-range chaff, illuminating) to permit mixed salvos. Automatic selection of the rockets to be fired is possible from the remote fire-control unit and the time fuzes and launch sequence may be similarly controlled. The rockets all have double-base propellant motors with folding fins and electronic fuzes while their speed to burnout is 260-645 m/s (853-2,116 ft/s).

Specifications

Launcher weight: 1.15 t (empty); 1.75 t (with 20 rockets)
Trunnion height: 1.17 m (3.83 ft)
Traverse: 300° at 60°/s
Elevation: −5 to +60° at 30°/s
Rate of fire: 1 rd/s

Chaff distraction rocket
Type: SNIA 105 LR-C
Length: 1.85 m (6.0 ft)
Diameter: 105 mm
Max range: 12 km
Weight: 27 kg (59.5 lb)
Payload: 10.2 kg (22.49 lb)

Chaff seduction rocket
Type: SNIA 105 MR-C
Length: 1.83 m (6.0 ft)
Diameter: 105 mm
Max range: 4.7 km
Weight: 29 kg (64 lb) (SNIA 105 MR)
Payload: 17.4 kg (38.4 lb)

Infra-red seduction
Type: SNIA 105 MR-IR

Illumination
Type: SNIA 105 LR-I
Payload: 10.2 kg (22.49 lb)
Range: 4 km

Manufacturers/Contractors

Breda Meccanica Bresciana SpA (launcher).
SNIA BPD (rockets).

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SADOC 2/IPN 10

SADOC 2/IPN 10 (SADOC = *Systema Direzione della Operazioni di Combattimento)* is a mainframe architecture system designed to acquire, process and present data acquired by sensors. It can also be used for a number of other functions, including threat evaluation and weapons control, ECM management, aircraft control, conducting ASW operations, as well as datalink and databank management. Data are received from onboard and offboard sensors via datalinks. The system has two or three Central Processing Units (CPU) mini-computers (Alenia 32-bit CDG-3032 with a 128 k memory), one of which usually acts as the immediate back-up in the event of system failure. Within the consoles are Alenia 16-bit NDC-160 processors, with 64 k memories. Both possess mass memory modules for handling programmes and large amounts of data and an interface with a 10 Mbit/s serial databus. Programming language is Ada.

There are two TAVITAC operating systems; the disk operating system and a time-sharing executive. The system uses a 10 Mbit/s serial bus. The main displays and command positions are in the COC *(Centrale Operativa Combattimento).* This system is designated SADOC 2 in the Italian Navy and IPN-10 for export.

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome, Italy.

WEAPONS CONTROL

Argo NA21 Mod 2 fire-control system

There are two NA 10 Argo systems, designed for surface engagement, air engagements or shore bombardments which can control three guns of two calibres simultaneously, using an RTN 10X fire-control radar. The system is operated through the Main Control Unit (MCU), a console with a ballistic computer, which is used for target acquisition, tracking and engagement either manually or automatically. Two periscopic sights may also be used to provide supplementary target data input to the radar and permit a second target to be engaged. In addition to target data input the MCU receives information from the true wind computer, and data on ship course and speed from the log and gyrocompass, while a vertical reference system provides roll and pitch information.

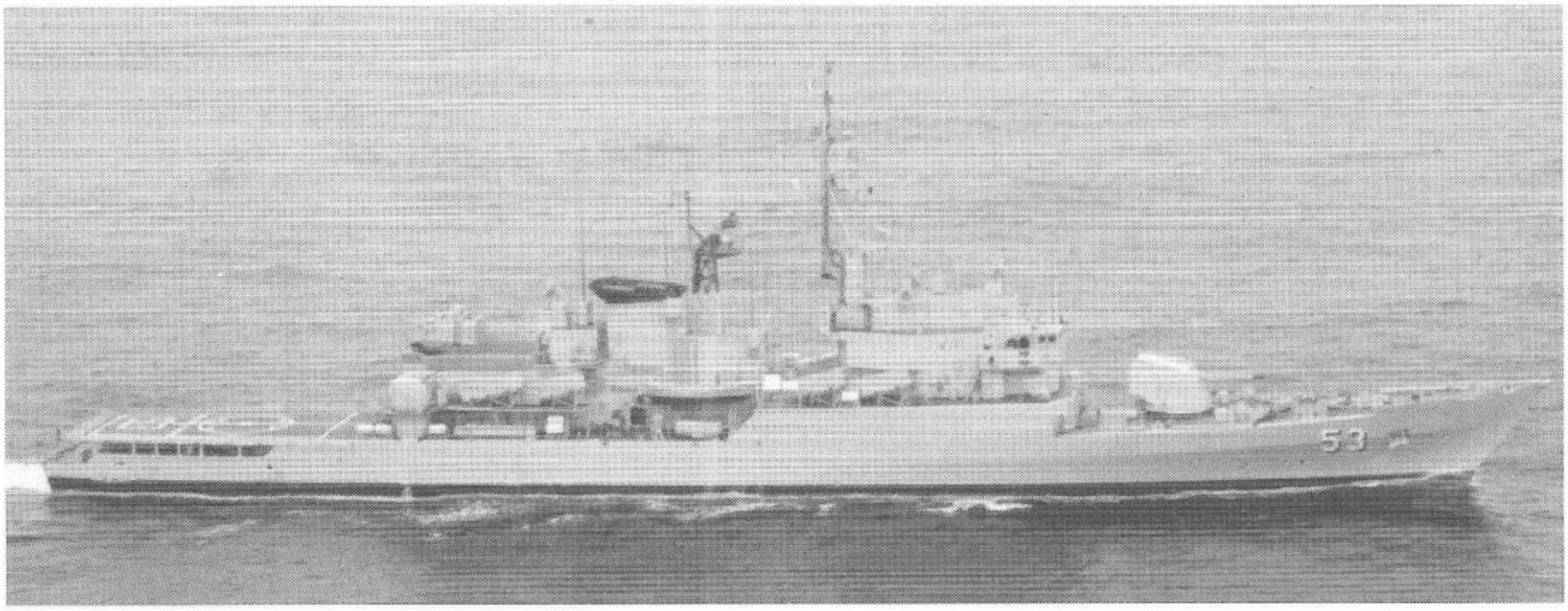
Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome, Italy.

Dardo

There are two Dardo systems, each controlling one 40 mm gun. Dardo is an automatic CIWS, with manual override, designed to engage sea-skimming and diving missiles as well as manned aircraft. It is a mainframe system and consists of a digital data processing and interface unit (DPU), a supervisory console and the Orion RTN 20X radar. Each system controls a single twin 40 mm gun mounting and optional equipment includes optical designators. The DPU uses an 18-bit mini-computer with a 20 k memory, 82 different instructions and a maximum application time of 10.5 µs. Software is written in Assembler language. The DPU receives input from the gyrocompass, inertial reference, the log and the wind reference unit.

The Orion RTN 20X, J-band (10-12 GHz) radar has a stabilised, monopulse, cassegrain antenna with polarisation twist. The transmission frequency and PRF can be changed randomly on a pulse-to-pulse basis over a wide frequency spectrum. The fully digital receiver uses a multicanceller MTI and is equipped to reduce the effects of multipath on low-flying targets. An electro-optical unit (daylight or low-light level TV or infrared) can be installed to the right of the antenna which has maximum slewing speeds of 2.2 rad/s (training), 1.5 rad/s (elevation). The radar can detect missiles at ranges of >10 km.



Peruvian frigate Montero *(FM 53) was the first major warship to be constructed in any shipyard on the Pacific coast of South America. The ships are generally similar to the first two ships built in Italy, but the Peruvian-built ships do not have a telescopic hangar and the after end of the flight deck does not reach the transom* (Peruvian Navy)

Initial target acquisition is by the RAN 10S search radar which interfaces directly with the system. Once the RTN 20 radar has acquired the target or targets the system conducts automatic tracking, assigning target priorities where necessary. The operator may override the system to engage lower-priority targets where necessary. Targets can be engaged at distances of 300-3,500 m (984-11,483 ft) and up to 10 may be tracked simultaneously.

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome, Italy.

SONAR

EDO Model 610E hull-mounted active sonar system

The EDO Model 610E sonar is an all solid-state low-frequency (6, 7 and 8 kHz) sonar and is designed for the long-range (up to 29,000 m (32,000 yd)) detection of submarines in deep and shallow water. The hull-mounted transducer has 36 staves and is 1.25 m (4.1 ft) in diameter. It is a scanning sonar with two active consoles, enabling it to perform a search-while-track function. Facilities offered include a search capability in three 120° sectors, passive correlation, and reverberation processing. The transmitter and receiver beams are preformed. Output is available for a fire-control system. All mode changes and range scale changes are controlled by console push-buttons, and displays include a Doppler display on each of the active consoles and a passive sonar bearing time recorder display.

Manufacturer/Contractor

EDO Corporation, Government Systems Division, College Point, New York, USA

RADARS

Set*	RAN-10S (SPS-774)	RAN-11L/X (SPQ-712)**	3 RM 20R (BPS-704)	RTN-10X (SPG-70) (2)	RTN-20X (SPG-74) (2)
Company	Selenia	Selenia	SMA	Selenia	Selenia
Role	Air/surface search	Surface search	Navigation	Fire control (Argo)	Dardo fire-control system (40 mm)
Band	E/F	B and H	I	I/J	I/J
Range	85 n miles (155 km)	45 n miles (82 km)	40 n miles (73 km)	22 n miles (40 km)	8 n miles (15 km)
Beam	1.5 × 17°	B: 6.6 × 16° H: 1.1 × 6°	2 × 26°		–
Peak power	140 kW	B: 0.3 kW H: 180 kW	7/20 kW	200 kW	200 kW
Gain	28 dB	B: 22 dB 35 dB	<27 dB		–
Pulsewidth	0.4 µs	B: 2.9 µs H:1.5/0.15 µs	0.05/0.15/ 0.5/1.5 µs	1.5 µs	1.5 µs
PRF	900 pps	H:450-550 pps	6,000/3,000/ 1,500/750 pps	450-550 pps	450-550 pps
Scan rate	15/30 rpm	15/30 rpm	25 rpm	–	–

Notes:
* Set numbers in first row are Italian export designations; numbers in brackets are national MM (Marina Militare) designations.
** This set is actually two separate sets, using one antenna group, divided horizontally.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 25.2 × 11.3 m (83 × 37 ft)
Hangar: The hangar was originally a telescopic design but has been fixed in the Peruvian ships.

HELICOPTERS

One Agusta-Bell AB 212ASW.

Specifications

Dimensions:
main rotor diameter: 14.63 m (48.0 ft)
height to rotor head: 3.91 m (12.82 ft)
rotor disc area: 168.1 m² (1,809 sq ft)
Weight:
max take-off weight: 5,070 kg (11,177 lb)

Performance:
max speed (never exceed): 130 kts (240 km/h)
typical cruising speed: 100 kts (185 km/h)
hovering ceiling (out of ground effect): 396 m (1,300 ft)
Engine: 1 Pratt & Whitney Canada PT6T-6 Turbo Twin-Pac rated at 1,398 kW (1,875 shp)
Role equipment: Selenia (now Alenia) radar, Bendix ASQ-18 dipping sonar, ECM. Two Mk 46 or 244/S torpedoes or depth bombs.

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 Fiat/General Electric LM-2500 gas turbines; 37.3 MW (50,000 hp) sustained; two GMT BL 230.20 M diesels; 7.3 MW (10,000 hp(m)) sustained
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

These four ships were ordered from Fincantieri, with the first two being built in Italy and the second pair at Servicios Industriales de la Marina, (SIMA), Callao, the two ships involved, *Montero* and *Mariategui,* being the first major warships to be built on the Pacific Coast of South America. Virtually all the parts were supplied from Italy and five Italian engineers were resident at the yard throughout the programme. Although experienced in constructing merchant ships, the yard had to modernise many aspects of its work to cope with the warships; it was, for example, the first time that the yard became involved in welding aluminium. Surprisingly, the experience gained through this programme has not been used to build further warships.

DESIGN

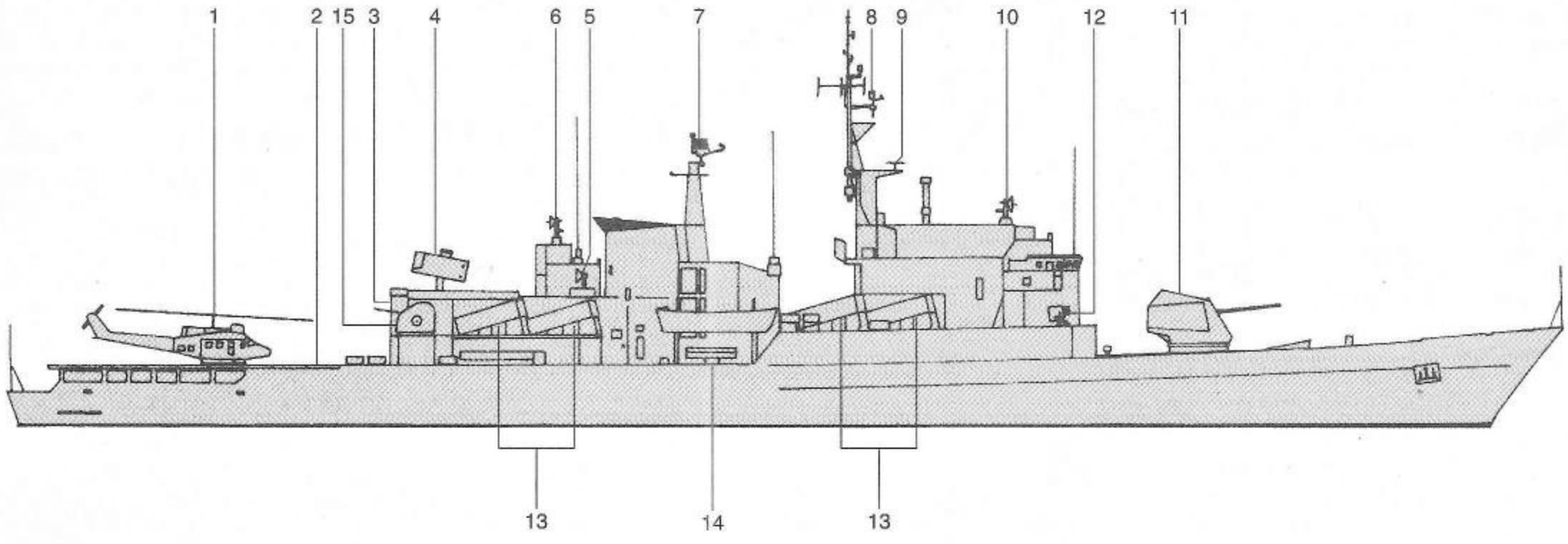
The two ships built by Fincantieri in Italy are identical to those built for the Italian Navy, except that the hangar is fixed. The two built in South America however, have several differences:

- They were built by traditional methods, in one piece from the keel up, compared with the Italian-built ships which were constructed by the modular method.
- Instead of being mounted on the main deck, the two twin 40 mm mounts are on a pedestal at 01 deck level.
- Reloading of the Albatros is by hand rather than using power, as the Peruvian naval staff considered it unlikely that they would have to operate under conditions of NBC close-down.
- The flight deck does not extend to the transom (as in the Italian originals) but, because the hangar is fixed, it is actually some 1.22 m (4 ft) longer.
- Facilities and accommodation have been installed for a Flag officer and his staff so that these two ships can act as flotilla leaders when required.
- Some accommodation and storerooms have been rearranged to take account of Peruvian traditions and requirements.

MODERNISATION

The only known change has been the installation of helicopter in-flight refuelling (HIFR) facilities in 1989, so that Sea King helicopters can refuel without landing.

MARISCAL SUCRE (MODIFIED LUPO)



Mariscal Sucre (Ian Sturton)
1 *AB212 ASW helicopter* **2** *Flight deck* **3** *Non-telescopic hangar* **4** *Albatros launcher for Aspide missiles* **5** *Selenia RTN 20X fire-control radars (part of Dardo system)* **6** *Selenia Orion 10XP fire-control radar* **7** *Selenia RAN 10S air/surface search radar* **8** *SMA SPQ 2F surface search radar* **9** *SMA 3RM 20R navigation radar* **10** *Selenia Orion 10XP fire-control radar (part of Argo system)* **11** *OTOBREDA 127 mm (5 in)/54 automatic gun* **12** *OTOBREDA 105 mm SCLAR chaff launcher* **13** *OTOBREDA Otomat Teseo Mk 2 anti-ship missile* **14** *Triple ILAS 3 324 mm torpedo tubes* **15** OTOBREDA twin 40mm/70 compact

GENERAL SPECIFICATIONS

Country of origin: Italy
Operator: Venezuela
Type: Modified Lupo

Class: MARISCAL SUCRE

Built: 6
Active: 6

Displacement:
standard: 2,208 t
full load: 2,520 t

Dimensions:
length: 113.2 m (371.3 ft)
beam: 11.3 m (37.1 ft)
draught: 3.7 m (12.1 ft)

Speed: 35 kts (gas turbines); 21 kts (diesels)
Range: 5,000 n miles at 15 kts

Complement: 185

SHIPS

MARISCAL SUCRE (F 21)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 19 Nov 1976
Launched 28 Sep 1978
Commissioned 10 May 1980

ALMIRANTE BRION (F 22)
Builder Fincantieri, Riva Trigoso, Italy
Laid down Jun 1977
Launched 22 Feb 1979
Commissioned 7 Mar 1981

GENERAL URDANETA (F 23)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 23 Jan 1978
Launched 23 Mar 1979
Commissioned 8 Aug 1981

GENERAL SOUBLETTE (F 24)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 26 Aug 1978
Launched 4 Jan 1980
Commissioned 5 Dec 1981

GENERAL SALOM (F 25)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 7 Nov 1978
Launched 13 Jan 1980
Commissioned 3 Apr 1982

ALMIRANTE GARCIA (F 26)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 21 Aug 1979
Launched 4 Oct 1980
Commissioned 30 July 1982

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

OTOBREDA Teseo Mk 2

There are eight missiles, housed in four pairs of individual launcher-containers; two pairs are mounted either side of the mast, while the other two pairs are mounted on a platform deck either side of the forward end of the hangar, all the launcher-containers facing outward at about 30° to the ship's centreline. The Teseo system is based on the Otomat missile, which has folding wings and is powered by a turbojet with solid fuel rocket boosters. The warhead is a semi-armour-piercing type, which is claimed to penetrate up to 8 cm of nickel-chromium armour. The Mk 2 system is designed for over-the-horizon targeting using a co-operating Agusta-Bell AB 212ASW helicopter with SMA MM/APS-705 I-band radar and PRT-405 tracking and datalink system. On the first leg, the missile flies directly towards the helicopter and only when it passes under the helicopter does the latter transmit target location data.

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Once launched, the missile climbs to 150 m (492 ft) accelerated by the boosters which burn for 4 seconds until it reaches cruising speed at a distance of some 2.15 n miles (4 km) from the launch point, where the boosters are jettisoned. The missile then descends to a cruising altitude of 15-20 m (49-66 ft), a compromise between ensuring good communications with the mothership and the need to make it difficult for the target to detect it. The missile continues towards the target with mid-course guidance correction until the radar seeker, which is azimuth only, is activated at a predetermined point and scans a 40° sector, then acquires the target at a range of about 6.5 n miles (12 km). For the terminal phase the Otomat drops to sea-skimming height.

The Otomat system is capable of engaging two separate targets simultaneously in sea states up to Force 7.

Specifications

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Diameter: 46 cm (18.1 in)
Wing span: 1.36 m (4.5 ft)
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Guidance: Inertial and active radar homing
Propulsion: Turbomeca TR 281 Arbizon III turbojet; 400 kg st
Booster: Two SNPE solid propellant boosters; 3,500 kg st each.
Warhead: semi-armour-piercing; 210 kg (463 lb); HE 65 kg (143 lb)
Fuzes: Impact, proximity

Manufacturer/Contractor

OTOBREDA, Italy

SURFACE-TO-AIR MISSILES (SAM)

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Riva-Calzoni launcher
Aspide missile

Riva-Calzoni Albatros launcher

The single, eight-cell Albatros launcher is located on the hangar roof in 'X' position. Produced by Riva-Calzoni, it has eight launch cells, four on each side of the mounting, each with a frangible front and rear cover. There are no reloading facilities.

Specifications

Albatros launcher
Height: 2.98 m (9.8 ft)
Width: 3.82 m (11.87 ft)
Length: 3.82 m (11.87 ft)
Weight (loaded): 8.5 t
Traverse: 360° at 45°/s
Elevation: −5 to +80° at 25°/s.

Manufacturer/Contractor

Riva-Calzoni, Rome, Italy.

Selenia Aspide missile

The system uses the Selenia (now Alenia) Aspide SAM, a missile developed by Selenia from the US Sparrow. Targets are detected by the ship's primary search radar and then allocated to the fire-control system. The target is acquired by the fire-control system radar and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews in the target's direction. The missile control system selects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds. When the decision is made to engage the target with missiles the reversible prelaunch commands are issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode. In the latter, two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at once may be controlled by the tracker, according to the manufacturer who also claims the system can engage horizontal targets at up to 15 km, vertical ones at 5 km and lateral ones at 8 km. A short reaction time gives the system the ability to destroy anti-ship missiles even when detection is late.

Specifications

Aspide missile
Length: 3.7 m (12.14 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 80 cm (31.5 in)
Weight: 220 kg (485 lb)
Speed: Mach 2.5
Range: 7 n miles (13 km)
Altitude: 15-5,000 m (49-16,405 ft)
Warhead: 33 kg (72.7 lb)
Guidance: Semi-active radar

Manufacturers/Contractors

Alenia Elsag Sistemi Navali, Rome, Italy (system/missile).
Riva-Calzoni, Bologna, Italy (launcher).

TORPEDOES

B515 anti-submarine torpedo launching system.

There are two triple B515 (ILAS) torpedo tubes in the waist. The tubes are manually loaded and trained but remotely operated from the combat information centre, although emergency local operation is possible.

Specifications

Length: 3.4 m (11.15 ft)
Height: 1.2 m (3.9 ft)
Width: 1.285 m (4.2 ft)
Weight: 1,050 kg (2,315 lb) (unloaded)

Manufacturer/Contractor

Whitehead, Division of Gilardini SpA, Salviano, Italy.

A244/S lightweight air-/surface-launched anti-submarine weapon

The torpedo used in these ships is believed to be the Whitehead A244/S. The seeker in the A244/S is the Alenia CIACIO-S which is capable of active, passive or mixed modes for closing on to its target and can discriminate between decoys and real targets in the presence of heavy reverberations by specially emitted pulses and signal processing. It also discriminates between target noise and reverberations, as well as having a series preset of programmable search patterns and tactical manoeuvres (including re-attack procedures). The seeker has a large search volume covered by multiple preformed beams following a number of self-adaptive search patterns and is reported capable of target detection at −5 dB in good acoustic conditions. The computerised homing system also provides for presettable combinations of signal processing, spatial filtering and tactical torpedo manoeuvring. The software may be reprogrammed by the customer to meet new tactical conditions. Upon launching, the A244/S initially steers a straight course and, if the target is not detected, it then begins a search pattern which may be either a spiral between preselected depths or a helix pattern.

Specifications

Length: 2.7 m (8.85 ft)
Diameter: 324 mm (12.75 in)
Weight: 215 kg (474 lb) (warshot version)
Warhead: 34 kg (75 lb) shaped charge HBX-3 HE
Propulsion: Electric; silver/zinc batteries
Range: 3.5 n miles (6 km)
Speed: 30 kts
Guidance: Active/passive sonar, self-adaptive programmed patterns

Manufacturer/Contractor

Whitehead SpA, Salviano, Italy.

GUNS

OTOBREDA 127 mm/54 Compatto

There is one OTOBREDA 127 mm/54 Compatto mounting in 'A' position. This weapon is designed to provide naval gunfire support, to engage surface targets and to engage air targets, including anti-ship missiles and fixed-wing aircraft which do not have standoff weapons. The turret is unmanned and is enclosed by a glass fibre shield. Much of the turret and the lower part of the mounting are made of aluminium alloy. The below-deck element of the mounting consists of three drums each containing 22 rounds, which are stocked automatically from two chain-driven lower hoists which lead to the magazines and are loaded manually. The gun captain uses his control to select which drums are to be replenished and with what ammunition. The weapon is compatible with all US 5 in L/54 ammunition.

Specifications

Gun
Calibre: 127 mm (5.0 in)
Length of barrel: 54 calibres
Muzzle velocity: 808 m/s (2,625 ft/s)
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 13,600 m (45,000 ft)
Rate of fire: 45 rds/min
Weight of shell: 32 kg (70 lb)

Mounting
Compatto
Training: 330° at 40°/s
Elevation: −15 to +85° at 30°/s
Crew: 5

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm L/70 Compact (Type 70) twin mounting

Two twin 40 mm turrets are mounted aft, either side of the hangar, on a plinth which brings them up to the 01 deck level.

Specifications

Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 600 rds/min/mount
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

NS-9003A ESM system

The NS-9003A naval ESM system operates in a dense environment to carry out ESM and is able to cope with frequency agility, frequency-hopping, and staggered or wobbulated PRI emitters. The system automatically receives, analyses and identifies over-the-horizon radar signals with a 100 per cent probability of intercept over the frequency range from 2 to 18 GHz (0.5 to 40 GHz optional). The direction of arrival is instantaneously measured per pulse, using an accurate multibeam antenna array. This instantaneous direction-finding enables the system to locate any exotic type radar signal in the reception range within a fraction of a second. The analysed information is presented on a 19 in graphic situation display in several operator-selected modes for various EW tasks. The system has built-in power management provisions for ECM and chaff/flare activation. The NS-9003A antenna assembly includes a multibeam static antenna array with associated RF video and digital DF processing hardware, and an omnidirectional antenna array. Other units in the system are: receiving and processing equipment, and an operator console. Interface to radar blankers, gyro equipment, weapon system, ECM jamming and deception system, chaff/flare equipment and satellite navigation system can also be provided.

Although an integrated EW suite consisting of the NS-9003A and the NS-9005 jamming and deception system is available it does not appear that the Venezuelan Navy has availed itself of the additional ECM capability.

Specifications

Frequency range: 2-18 GHz (0.5-40 GHz optional)
DF accuracy: 1° I- and J-bands; 2° E/F- and G/H-bands
Sensitivity: −70 dBm
Frequency measurement: Instantaneous 2 MHz resolution

Manufacturer/Contractor

Elisra Electronic Systems, Bene Beraq, Israel.

DECOYS

OTOBREDA SCLAR rocket launchers

Two 20-tube, 105 mm OTOBREDA SCLAR, multipurpose, rocket launchers are sited beneath the bridge wings. The control unit is linked to the ship's radar and a control panel in the ECM compartment to provide the necessary operating signals, with the data needed to stabilise the two launchers against pitch and roll being provided by the ship's gyrocompass. The system provides defence against radar and IR homing missiles, confuses enemy radars, and provides illumination for visual fire control at night. Provision is made to load different types of rockets in various arrangements (long-range chaff, medium-range chaff, illuminating) to permit mixed salvos. Automatic selection of the rockets to

be fired is possible from the remote fire-control unit and the time fuzes and launch sequence may be similarly controlled. The rockets all have double-base propellant motors with folding fins and electronic fuzes, while their speed to burnout is 260-645 m/s (853-2,116 ft/s).

Specifications

Launcher weight: 1.15 t (empty); 1.75 t (with 20 rockets)
Trunnion height: 1.17 m (3.83 ft)
Traverse: 300° at 60°/s
Elevation: −5 to +60° at 30°/s
Rate of fire: 1 rd/s

Chaff distraction rocket
Type: SNIA 105 LR-C
Length: 1.85 m (6.0 ft)
Diameter: 105 mm (4 in)
Max range: 12 km
Weight: 27 kg (59.5 ft)
Payload: 10.2 kg (22.49 lb)

Chaff seduction rocket
Type: SNIA 105 MR-C
Length: 1.83 m (6.0 ft)
Diameter: 105 mm (4 in)
Max range: 4.7 km
Weight: 29 kg (64 lb) (SNIA 105 MR)
Payload: 17.4 kg (38.4 lb)

Infra-red seduction
Type: SNIA 105 MR-IR

Illumination
Type: SNIA 105 LR-I
Payload: 10.2 kg (22.49 lb)
Range: 4 km

Manufacturers/Contractors

Breda Meccanica Bresciana SpA (launcher).
SNIA BPD (rockets).

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

Tacan: SRN 15A

WEAPONS CONTROL

Argo NA21 Mod 2 fire control system

There are two NA 10 Argo systems, designed for surface engagement, air engagements or shore bombardments which can control three guns of two calibres simultaneously, using an RTN 10X fire-control radar. The system is operated through the Main Control Unit (MCU), a console with a ballistic computer, which is used for target acquisition, tracking and engagement either manually or automatically. Two periscopic sights may also be used to provide supplementary target data input to the radar and permit a second target to be engaged. In addition to target data input the MCU receives information from the true wind computer, and data on ship course and speed from the log and gyrocompass, while a vertical reference system provides roll and pitch information.

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Italy.

Dardo

There are two Dardo systems, each controlling one 40 mm gun. Dardo is an automatic CIWS, with manual override, designed to engage sea-skimming and diving missiles as well as manned aircraft. It is a mainframe system and consists of a digital data processing and interface unit (DPU), a supervisory console and the Orion RTN 20X radar. Each system controls a single twin 40 mm gun mounting and optional equipment includes optical designators. The DPU uses an 18-bit mini-computer with a 20 k memory, 82 different instructions and a maximum application time of 10.5 µs. Software is written in Assembler language. The DPU receives input from the gyrocompass, inertial reference, the log and the wind reference unit.

The Orion RTN 20X, J-band (10-12 GHz) radar has a stabilised, monopulse, cassegrain antenna with polarisation twist. The transmission frequency and PRF can be changed randomly on a pulse-to-pulse basis over a wide frequency spectrum. The fully digital receiver uses a multicanceller MTI and is equipped to reduce the effects of multipath on low-flying targets. An electro-optical unit (daylight or low-light level TV or infrared) can be installed to the right of the antenna which has maximum slewing speeds of 2.2 rad/s (training), 1.5 rad/s (elevation). The radar can detect missiles at ranges of >10 km.

Initial target acquisition is by the RAN 10S search radar which interfaces directly with the system. Once the RTN 20 radar has acquired the target or targets the system conducts automatic tracking, assigning target priorities where necessary. The operator may override the system to engage lower-priority targets where necessary. Targets can be engaged at distances of 300-3,500 m (984-11,483 ft) and up to 10 may be tracked simultaneously.

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome, Italy.

RADARS

Set*	RAN-10S (SPS-774)	SPQ-2F**	3 RM 20R (BPS-704)	RTN-10X (SPG-70) (2)	RTN-20X (SPG-74) (2)
Company	Selenia	SMA	SMA	Selenia	Selenia
Role	Air/surface search	Surface search	Navigation	Fire control (Argo)	Dardo fire-control system (40 mm)
Band	E/F	I	I	I/J	I/J
Range	85 n miles (155 km)	22 n miles (40 km)	40 n miles (73 km)	22 n miles (40 km)	8 n miles (15 km)
Beam	1.5 × 17°	—	2 × 26°		—
Peak power	140 kW	200 kW	7/20 kW	200 kW	200 kW
Gain	28 dB		<27 dB		—
Pulsewidth	0.4 µs	1.5 µs	0.05/0.15/ 0.5/1.5 µs	1.5 µs	1.5 µs
PRF	900 pps	450-550 pps	6,000/3,000/ 1,500/750 pps	450-550 pps	450-550 pps
Scan rate	15/30 rpm	40 rpm	25 rpm	—	—

Notes:
* Set numbers in first row are Italian export designations; numbers in brackets are national MM (Marina Militare) designations.
** This set is actually two separate sets, using one antenna group, divided horizontally.

SONARS

EDO Model 610E hull-mounted active sonar system

The EDO Model 610E sonar is an all solid-state low-frequency (6, 7 and 8 kHz) sonar and is designed for the long-range (up to 29,000 m (32,000 yd)) detection of submarines in deep and shallow water. The hull-mounted transducer has 36 staves and is 1.25 m (4.1 ft) in diameter. It is a scanning sonar with two active consoles, enabling it to perform a search-while-track function. Facilities offered include a search capability in three 120° sectors, passive correlation, and reverberation processing. The transmitter and receiver beams are preformed. Output is available for a fire-control system. All mode changes and range scale changes are controlled by console push-buttons, and displays include a Doppler display on each of the active consoles and a passive sonar bearing time recorder display.

Manufacturer/Contractor

EDO Corporation, Government Systems Division, College Point, New York, USA.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 25.2 × 11.3 m (83 × 37 ft)
Hangar: The hangar was originally a telescopic design but has been fixed in the Venezuelan ships.

HELICOPTERS

One Agusta-Bell AB 212ASW.

Specifications

Dimensions:
main rotor diameter: 14.63 m (48.0 ft)
height to rotor head: 3.91 m (12.82 ft)
rotor disc area: 168.1 m² (1,809 sq ft)
Weight:
max take-off weight: 5,070 kg (11,177 lb)

Performance:
max speed (never exceed): 130 kts (240 km/h)
typical cruising speed: 100 kts (185 km/h)
hovering ceiling (out of ground effect): 396 m (1,300 ft)
Engine: 1 Pratt & Whitney Canada PT6T-6 Turbo Twin-Pac rated at 1,398 kW (1,875 shp)
Role equipment: Selenia (now Alenia) radar, Bendix ASQ-18 dipping sonar, ECM. Two Mk 46 or 244/S torpedoes or depth bombs.

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 Fiat/General Electric LM-2500 gas turbines; 37.3 MW (50,000 hp) sustained; two GMT BL 230.20 M diesels; 7.3 MW (10,000 hp(m)) sustained
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

These six ships were all ordered from Fincantieri on 24 October 1975. They were built in Italy and delivered between 1980 and 1982.

DESIGN

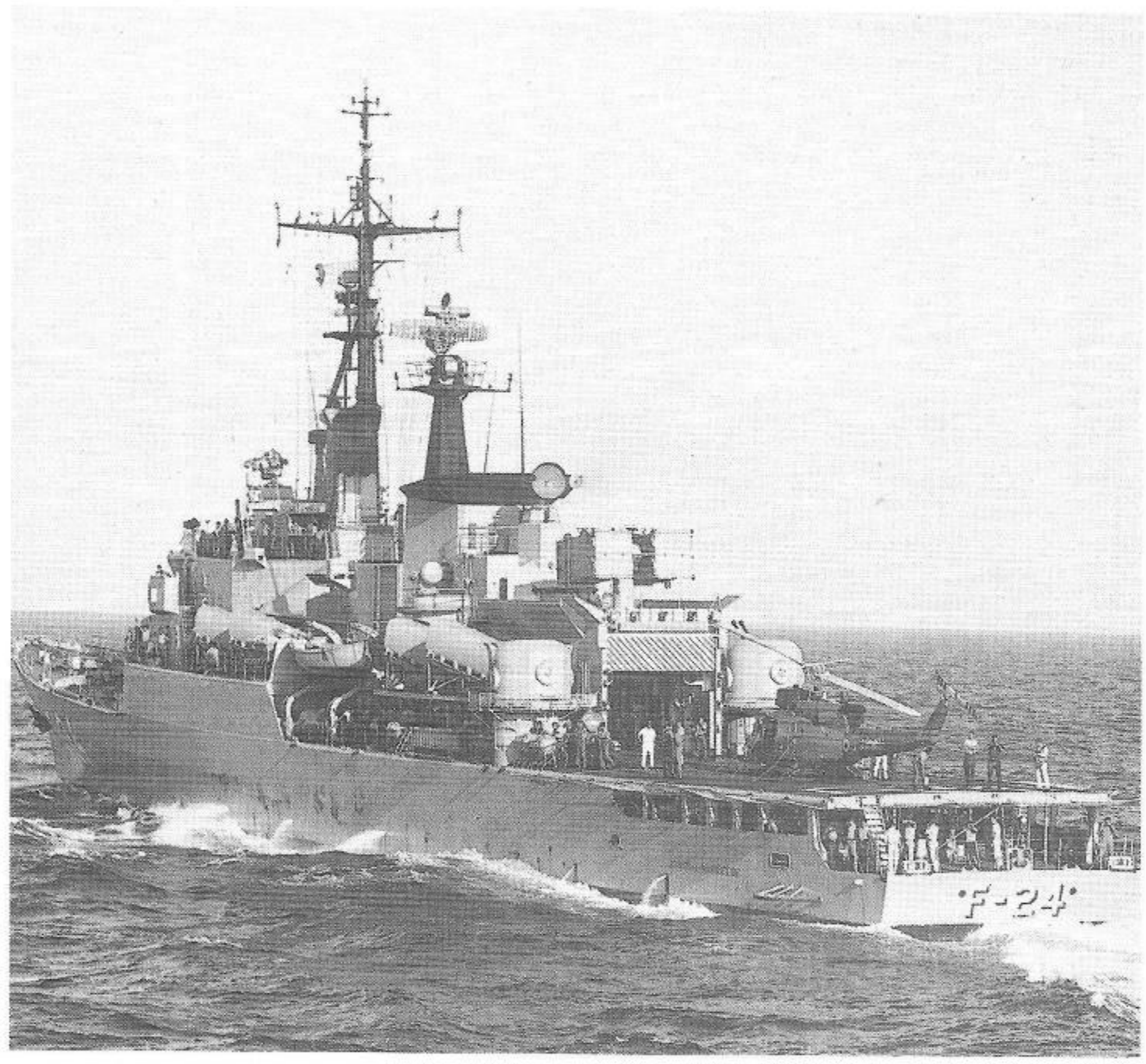
The Venezuelan ships are similar to the other Lupos in the Italian and Peruvian navies, but appear to incorporate virtually all the modifications made to the Peruvian ships:

- The hangar is fixed.
- The flight deck has been enlarged, but does not extend back to the transom.
- The automatic reloading facility for the Albatros missile system has been deleted, reducing the number of Aspide missiles carried to the eight in the launcher.
- The two twin OTOBREDA 40 mm mountings are on a platform at the 01 deck level, rather than on the main deck, as in the Italian ships.

MODERNISATION

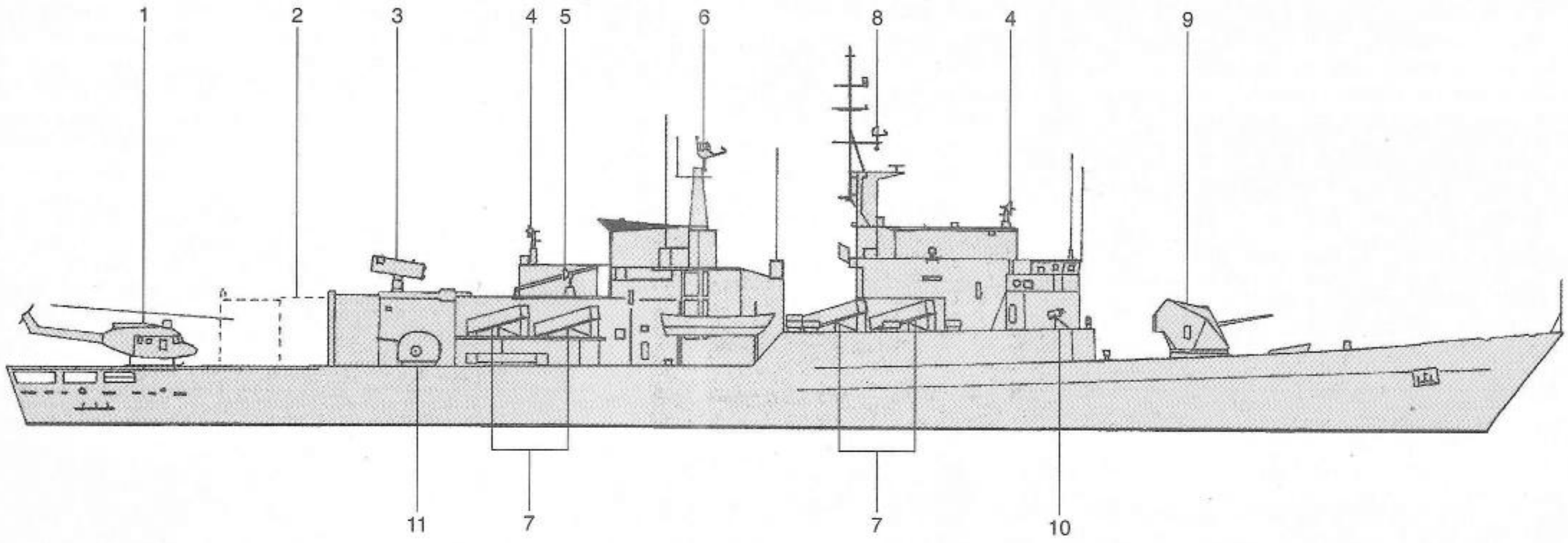
Sucre (F 21) and *Brion* (F 22) were scheduled to start a refit at Litton's Ingalls Shipyard in September 1992. The arrangement was eventually suspended in October 1994 due to 'contractual problems.' (There were similar difficulties and at much the same time, over the refit of the Venezuelan submarines — see 'Cabalo' class under 'Type 209'.)

The Venezuelan Navy still has plans to fit new communications, EW and datalink equipment and to upgrade the helicopter.



General Soublette *(F 24)*

ARTIGLIERE (LUPO)



Artigliere (Ian Sturton)
1 *AB212 ASW helicopter* **2** *Telescopic hangar* **3** *Albatros launcher for Aspide SAM* **4** *SPG 70 fire-control radar (part of Argo system)* **5** *Selenia SPG 74 fire-control radar (part of Dardo system)* **6** *Selenia SPS 774 air search radar* **7** *OTOBREDA Teseo Mk 2 anti-ship missiles (two launchers)* **8** *Selenia SPQ 712 surface search radar* **9** *OTOBREDA 127 mm (5 in)/54 Compact automatic gun* **10** *OTOBREDA 105 mm SCLAR chaff launcher* **11** *OTOBREDA twin 40 mm/70 Compact (part of Dardo system)*

GENERAL SPECIFICATIONS

Operator: Italy
Type: Lupo

Class: ARTIGLIERE

Built: 4
Active: 4

Displacement:
standard: 2,208 t
full load: 2,525 t

Dimensions:
Length: 113.23 m (371.3 ft)
Beam: 11.3 m (37.1 ft)

Draught: 3.7 m (12.1 ft)

Speed: 35 kts (turbines); 21 kts (diesels)
Range: 4,350 n miles at 16 kts on diesels

Complement: 185 (16 officers)

SHIPS

ARTIGLIERE (F 582)
Builder Fincantieri, Ancona, Italy
Laid down (Iraqi Navy) 31 Mar 1982 (*Hittin* (F 14))
Launched 27 Jul 1983
Commissioned 6 Oct 1994

AVIERE (F 583)
Builder Fincantieri, Ancona, Italy
Laid down (Iraqi Navy) 3 Sep 1982 (*Thi Qar* (F 15))
Launched 19 Dec 1984
Commissioned 4 Jan 1995

BERSAGLIERE (F 584)
Builder Fincantieri, Ancona, Italy
Laid down (Iraqi Navy) 1 Dec 1983 (*Al Qadisiya* (F 16))
Launched 1 Jun 1985
Commissioned Nov 1995

GRANATIERE (F 585)
Builder Fincantieri, Riva Trigoso, Italy
Laid down (Iraqi Navy) 12 Mar 1984 (*Al Yarmouk* (F 17))
Launched 18 Apr 1985
Commissioned Feb 1996

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

OTOBREDA Teseo Mk 2 (TG 2)

There are eight missiles, housed in four pairs of individual launcher-containers: two pairs are mounted at the after end of the bridge structure, while the other two pairs are mounted on a platform deck abreast the forward end of the hangar. All the tubes face outward at about 30° to the ship's centreline. The Teseo system is based on the Otomat missile, which has folding wings and is powered by a turbojet with solid fuel rocket boosters. The warhead is a semi-armour-piercing type, which is claimed to penetrate up to 8 cm of nickel-chromium armour. The Mk 2 system is designed for over-the-horizon targeting using a co-operating Agusta-Bell AB 212ASW helicopter with SMA MM/APS-705 I-band radar and PRT-405 tracking and datalink system. On the first leg, the missile flies directly towards the helicopter and only when it passes under the helicopter does the latter transmit target location data.

The target may be acquired by the ship's radar, by the radars of friendly ships or by helicopter radars. Data on the target's location are transmitted to the missile's autopilot and the turbojet is started. Once it has reached full power the boosters are ignited and the missile is launched, but as the missile can turn through angles of up to ±200° the warship does not have to be facing the target during the launch phase.

Once launched, the missile climbs to 150 m (492 ft) accelerated by the boosters which burn for 4 seconds until it reaches cruising speed at a distance of some 2.15 n miles (4 km) from the launch point, where the boosters are jettisoned. The missile then descends to a cruising altitude of 15-20 m (49.2-65.6 ft), a compromise between ensuring good communications with the mothership and the need to make it difficult for the target to detect it. The missile continues towards the target with mid-course guidance correction until the radar seeker, which is azimuth only, is activated at a predetermined point and scans a 40° sector, then acquires the target at a range of about 6.5 n miles (12 km). For the terminal phase the Otomat drops to sea-skimming height.

The Otomat system is capable of engaging two separate targets simultaneously in sea states up to Force 7.

Specifications

Length: 4.46 m (14.6 ft)
Diameter: 46 cm (18.1 in)
Wing span: 1.36 m (4.46 ft)
Weight:
with booster: 770 kg (1,698 lb)
without booster: 762 kg (1,680 lb)
Range: 86 n miles (160 km)
Speed: Mach 0.9
Guidance: Inertial and active radar homing
Propulsion: Turbomeca TR 281 Arbizon III turbojet; 400 kg st
Booster: Two SNPE solid propellant boosters; 3,500 kg st each.
Warhead: Semi-armour-piercing; 210 kg (463 lb); HE 65 kg (143 lb)
Fuzes: Impact, proximity

Manufacturer/Contractor

OTOBREDA, Italy.

SURFACE-TO-AIR MISSILES (SAM)

The Albatros Mk 2 Mod 9 system comprises two elements:
Riva-Calzoni launcher
Aspide missile

Riva-Calzoni Albatros launcher

The single, eight-cell Albatros launcher is located on the hangar roof in 'X' position. Produced by Riva-Calzoni, it has eight launch cells, four on each side of the mounting, each with a frangible front and rear cover. Each cell contains a loading guide to which the launching rail of the missile is electrically and mechanically connected. Sixteen reload missiles are stored horizontally in a hydraulically operated store and reload system in the deckhouse forward of the launcher; they

are in four rows of four missiles each, their location corresponding to that of the launcher cells, and each storage cell has an autonomous missile travel device.

Specifications
(Albatros launcher)
Height: 2.98 m (9.8 ft)
Width: 3.82 m (11.87 ft)
Length: 3.82 m (11.87 ft)
Weight (loaded): 8.5 t
Traverse: 360° at 45°/s
Elevation: −5 to +80° at 25°/s.

Manufacturer/Contractor
Riva-Calzoni, Rome, Italy.

Selenia Aspide missile
The system uses the Selenia (now Alenia) Aspide SAM, a missile developed by Selenia from the US Sparrow. Targets are detected by the ship's primary search radar and then allocated to the fire-control system. The target is acquired by the fire-control system radar and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews in the target's direction. The missile control system selects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds. When the decision is made to engage the target with missiles the reversible prelaunch commands are issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode. In the latter, two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at once may be controlled by the tracker, according to the manufacturer. They also claim the system can engage horizontal targets at up to 15 km, vertical ones at 5 km and lateral ones at 8 km. A short reaction time gives the system the ability to destroy anti-ship missiles even when detection is late.

Specifications
(Aspide missile)
Length: 3.7 m (12 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 80 cm (31.5 in)
Weight: 220 kg (485 lb)
Speed: Mach 2.5
Range: 7 n miles (13 km)
Altitude: 15-5,000 m (49-16,405 ft)
Warhead: 33 kg (72.7 lb)
Guidance: Semi-active radar

Manufacturers/Contractors
Alenia Elsag Sistemi Navali, Rome, Italy (system/missile).
Riva-Calzoni, Bologna, Italy (launcher).

TORPEDOES

It should be noted that these ships have no torpedo armament.

GUNS

OTOBREDA 127 mm/54 Compatto
There is one OTOBREDA 127 mm/54 Compatto mounting in 'A' position. This weapon is designed to provide naval gunfire support, to engage surface targets and to engage air targets, including anti-ship missiles and fixed-wing aircraft which do not have standoff weapons. The turret is unmanned and is enclosed by a glass fibre shield. Much of the turret and the lower part of the mounting are made of aluminium alloy. The below-deck element of the mounting consists of three drums each containing 22 rounds, which are stocked automatically from two chain-driven lower hoists which lead to the magazines and are loaded manually. The gun captain uses his control to select which drums are to be replenished and with what ammunition. The weapon is compatible with all US 5 in L/54 ammunition.

Specifications
Gun
Calibre: 127 mm
Length of barrel: 54 calibres
Muzzle velocity: 808 m/s (2,625 ft/s)
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 13,600 m (45,000 ft)
Rate of fire: 45 rds/min
Weight of shell: 32 kg (70 lb)
Mounting
Compatto
Training: 330° at 40°/s
Elevation: −15 to +85° at 30°/s
Crew: 5

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm L/70 Compact (Type 70) twin mounting
Two twin 40 mm turrets are mounted aft, either side of the hangar.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 600 rds/min/mount
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

Oerlikon 20 mm cannon
Two single, manually operated Oerlikon 20 mm cannon can be mounted, if required.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 0.8 n miles (1.5 km)
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +90°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

INS-3 ESM/ECM system
INS-3 (INS = Integrated Naval System) is an Elettronica ESM/ECM system. The main components are the RQN-3, a 1-18 GHz radar warning system, with a 3,000 emitter library. The ECM system is the Elettronica TQN-2 jammer. INS-3 is used to trigger jamming and the OTOBREDA SCLAR countermeasures system.

Manufacturer/Contractor
Elettronica SpA, Rome, Italy.

DECOYS

OTOBREDA SCLAR rocket launchers
Two 20-tube, 105 mm OTOBREDA SCLAR, multipurpose, rocket launchers are sited beneath the bridge wings. The control unit is linked to the ship's radar and a control panel in the ECM compartment to provide the necessary operating signals, with the data needed to stabilise the two launchers against pitch and roll being provided by the ship's gyrocompass. The system provides defence against radar and IR homing missiles, confuses enemy radars, and provides illumination for visual fire control at night. Provision is made to load different types of rockets in various arrangements (long-range chaff, medium-range chaff, illuminating) to permit mixed salvos. Automatic selection of the rockets to be fired is possible from the remote fire-control unit and the time fuzes and launch sequence may be similarly controlled. The rockets all have double-base propellant motors with folding fins and electronic fuzes while their speed to burnout is 260-645 m/s (853-2,116 ft/s).

Specifications
Launcher weight: 1.15 t (empty); 1.75 t (with 20 rockets)
Trunnion height: 1.17 m (3.83 ft)
Traverse: 300° at 60°/s
Elevation: −5 to +60° at 30°/s
Rate of fire: 1 rd/s

Chaff distraction rocket
Type: SNIA 105 LR-C
Length: 1.85 m (6.0 ft)
Diameter: 105 mm (4 in)
Max range: 12 km
Weight: 27 kg (59.5 lb)
Payload: 10.2 kg (22.5 lb)

Chaff seduction rocket
Type: SNIA 105 MR-C
Length: 1.83 m (6.0 ft)
Diameter: 105 mm (4 in)
Max range: 4.7 km
Weight: 29 kg (64 lb) (SNIA 105 MR)
Payload: 17.4 kg (38.36 lb)

Infra-red seduction
Type: SNIA 105 MR-IR

Illumination
Type: SNIA 105 LR-I
Payload: 10.2 kg (22.5 lb)
Range: 4 km

Manufacturers/Contractors
Breda Meccanica Bresciana SpA (launcher).
SNIA BPD (rockets).

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

IPN 10 mini SADOC action data automation

IPN 10 is a basic version of the SADOC action data system, which was developed specifically for export.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11
Satcom: Satcom
IFF: Mk XII

WEAPONS CONTROL

Argo NA21 Mod 2 fire-control system

There are two NA 10 Argo systems, designed for surface engagement, air engagements or shore bombardments which can control three guns of two calibres simultaneously, using an RTN 10X fire-control radar. The system is operated through the Main Control Unit (MCU), a console with a ballistic computer, which is used for target acquisition, tracking and engagement either manually or automatically. Two periscopic sights may also be used to provide supplementary target data input to the radar and permit a second target to be engaged. In addition to target data input the MCU receives information from the true wind computer, and data on ship course and speed from the log and gyrocompass, while a vertical reference system provides roll and pitch information.

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome, Italy.

Dardo

There are two Dardo systems, each controlling one 40 mm gun. Dardo is an automatic CIWS, with manual override, designed to engage sea-skimming and diving missiles as well as manned aircraft. It is a mainframe system and consists of a digital data processing and interface unit (DPU), a supervisory console and the Orion RTN 20X radar. Each system controls a single twin 40 mm gun mounting and optional equipment includes optical designators. The DPU uses an 18-bit mini-computer with a 20 k memory, 82 different instructions and a maximum application time of 10.5 µs. Software is written in Assembler language. The DPU receives input from the gyrocompass, inertial reference, the log and the wind reference unit.

The Orion RTN 20X, J-band (10-12 GHz) radar has a stabilised, monopulse, cassegrain antenna with polarisation twist. The transmission frequency and PRF can be changed randomly on a pulse-to-pulse basis over a wide frequency spectrum. The fully digital receiver uses a multicanceller MTI and is equipped to reduce the effects of multipath on low-flying targets. An electro-optical unit (daylight or low-light level TV or infrared) can be installed to the right of the antenna which has maximum slewing speeds of 2.2 rad/s (training), 1.5 rad/s (elevation). The radar can detect missiles at ranges of >10 km.

Initial target acquisition is by the RAN 10S search radar which interfaces directly with the system. Once the RTN 20 radar has acquired the target or targets the system conducts automatic tracking, assigning target priorities where necessary. The operator may override the system to engage lower priority targets where necessary. Targets can be engaged at distances of 300-3,500 m (984-11,483 ft) and up to 10 may be tracked simultaneously.

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome, Italy.

RADARS

Set	SPS-774 (RAN-10S)	SPQ-712 (RAN-12L/X)*	SPN-703	SPG-70 (RTN-10X)	SPG-74 (RTN-20X) (two)
Company	Selenia	Selenia	SMA	Selenia	Selenia
Role	Air/surface search	Surface search	Navigation	Fire control (Argo)	Dardo fire-control system (40 mm)
Band	E/F	B and H	I	I/J	I/J
Range	85 n miles (155 km)	Low-altitude target >20 n miles medium-altitude target >14 n miles		22 n miles (40km)	8 n miles (15 km)
Beam	1.5 × 17°	B: 6.6 × 16° H: 1.1 × 6°			—
Peak power	140 kW	B: 1.1 kW H:180 kW		200 kW	200 kW
Gain	28 dB	B: 22 dB H: 35 dB			—
Pulsewidth	0.4 µs	B: 2.9 µs H:1.5/0.15 µs		1.5 µs	1.5 µs
PRF	900 pps-	H:450-550 pps		450-550 pps	450-550 pps
Scan rate	15/30 rpm	15/30 rpm		—	—

Notes:
* This set is actually two separate sets, using one antenna group, divided horizontally.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 24 × 11.3 m (79 × 37 ft)
Hangar: The hangar is a telescopic design which extends by some 8 m (28 ft) to enclose the helicopter for protection and maintenance.

HELICOPTERS

One Agusta-Bell AB 212ASW.

Specifications

Dimensions:
main rotor diameter: 14.63 m (48.0 ft)
height to rotor head: 3.91 m (12.82 ft)
rotor disc area: 168.1 m² (1,809 sq ft)
Weight:
max take-off weight: 5,070 kg (11,177 lb)
Performance:
max speed (never exceed): 130 kts (240 km/h)
typical cruising speed: 100 kts (185 km/h)
hovering ceiling (out of ground effect): 396 m (1,300 ft)
range (max standard fuel): 2 n miles (615 km)
Engine: 1 Pratt & Whitney Canada PT6T-6 Turbo Twin-Pac rated at 1,398 kW (1,875 shp)
Role equipment: Torpedoes, AS-12 ASMs or Elettronica Gufo 2000 EW intercept equipment

PROPULSION

Specifications

System: combined diesel or gas turbine (CODOG)
Main machinery: 2 Fiat/General Electric LM-2500 gas turbines; 37.3 MW (50,000 hp) sustained; 2 GMT BL 230.20 M diesels; 7.3 MW (10,000 hp(m)) sustained
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

The Iraqi Government placed an order for four 'Lupo' class frigates in February 1981 with (the then) Cantieri Navali Riuniti (CNR). The design ordered was a ship very similar to those ordered by Peru and Venezuela, but with a fixed helicopter hangar. The first problem arose when the US Government objected to the sale of some of the components of the LM 2500 gas turbines. Then the Iraqi Government experienced some difficulty in financing the purchase, following which the Iran-Iraq war gave rise to an embargo on exporting warlike goods to the combat zone. Finally, the Gulf War resulted in another embargo. By this time the ships had been completed and had run trials.

There then followed some considerable political manoeuvring in Italy as the Italian Government sought to compel the Italian Navy to accept the ships. Eventually, and with some reluctance, the Italian Navy did so, but insisted on a complete overhaul as the ships had been lying idle for some three to four years, and on some replacement of equipment to bring them as nearly as possible to the same standard as its own four Lupos.

Artigliere *(F 582), one of four Lupo class frigates built for Iraq, but which were not delivered due to the UN arms embargo. They were accepted under protest by the Italian Navy and have had to undergo a substantial refit. They have no ASW capability and are designated 'Fleet Patrol Ship'*

MODERNISATION

The details given are for the ships on completion of modernisation for Italian service. All ASW equipment has been removed and new combat systems and communications to Italian fleet standards have been installed. There has also been a major upgrading of the damage control and accommodation facilities.

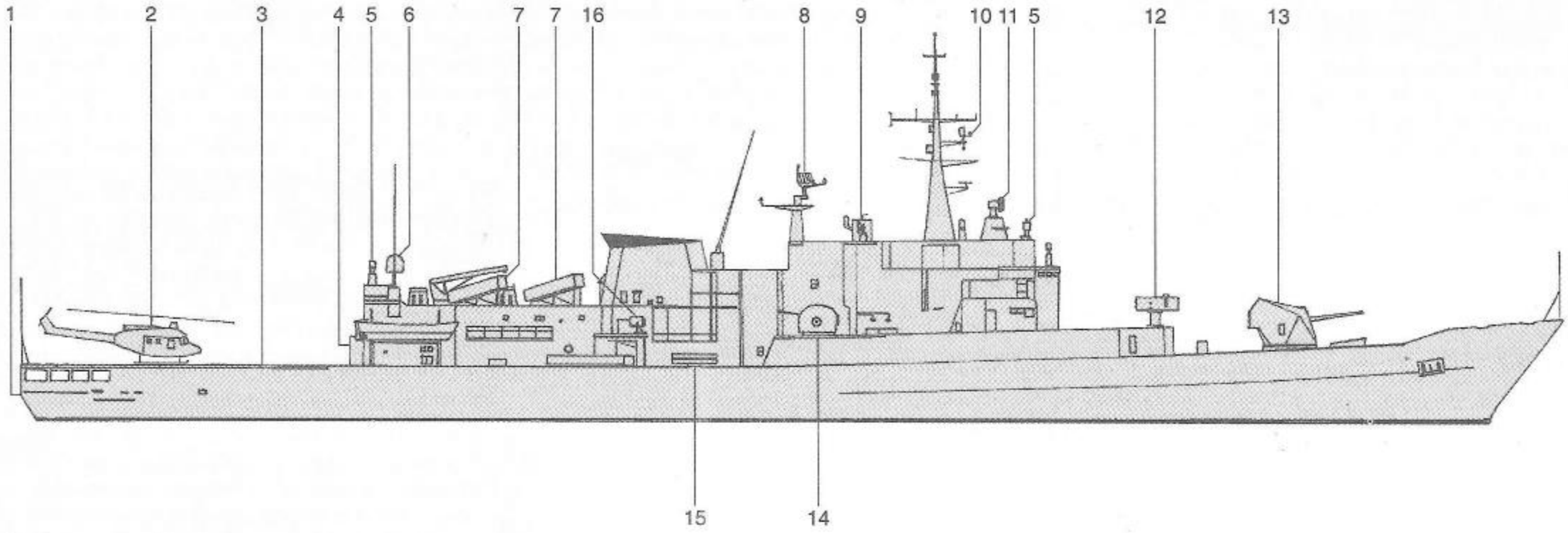
In the event, the first two ships commissioned with only machinery, damage control and accommodation upgraded and had to return to dock in 1995 for the weapon systems changes to be implemented. The second pair, however, entered service fully modified.

DEPLOYMENT

The ships have been accepted into the Italian Navy as 'Fleet Patrol Ships' although they could be used as frigates in war, if required to do so. However, they lack any form of ASW sensor or weaponry, which would impose severe limitations on their tactical usefulness.

Two are based at Augusta and two at Brindisi.

MAESTRALE



Maestrale (Ian Sturton)
1 *Two B516 533 mm (21 in) torpedo tubes* **2** *AB 212ASW helicopter* **3** *Flight deck* **4** *Hangar* **5** *Officine Galileo OG 30 electro-optical director* **6** *Satcom* **7** *OTOBREDA Teseo Mk 2 anti-ship missile (four)* **8** *Selenia SPS-774 air search radar* **9** *Selenia SPG-74 fire director (part of Dardo system)* **10** *SMA SPS-702 surface search radar* **11** *Selenia SPG-75 fire-control radar (part of Dardo-E system)* **12** *Eight-cell Albatros launcher for Aspide SAM* **13** *OTOBREDA 127 mm (5 in)/54 automatic gun* **14** *Twin OTOBREDA 40 mm/70 Compact* **15** *Triple 324 mm Mk 32 torpedo tubes* **16** *OTOBREDA SCLAR chaff launcher*

GENERAL SPECIFICATIONS

Operator: Italy

Class: MAESTRALE

Built: 8
Active: 8

Displacement:
standard: 2,500 t
full load: 3,200 t

Dimensions
Length: 122.7 m (405 ft)
Beam: 12.9 m (42.5 ft)

Draught: 4.6 m (15.1 ft)

Speed: 32 kts on gas turbines; 21 kts on diesels
Range: 6,000 n miles at 16 kts

Complement: 232 (24 officers)

SHIPS

MAESTRALE (F 570)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 8 Mar 1978
Launched 2 Feb 1981
Commissioned 6 Mar 1982

GRECALE (F 571)
Builder Fincantieri, Muggiano, Italy
Laid down 21 Mar 1979
Launched 12 Sep 1981
Commissioned 5 Feb 1983

LIBECCIO (F 572)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 1 Aug 1979
Launched 7 Sep 1981
Commissioned 5 Feb 1983

SCIROCCO (F 573)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 26 Feb 1980
Launched 17 Apr 1982
Commissioned 20 Sep 1983

ALISEO (F 574)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 10 Aug 1980
Launched 29 Oct 1982
Commissioned 7 Sep 1983

EURO (F 575)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 15 Apr 1981
Launched 25 Apr 1983
Commissioned 24 Jan 1984

ESPERO (F 576)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 29 Jul 1982
Launched 19 Nov 1983
Commissioned 4 May 1984

ZEFFIRO (F 577)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 15 Mar 1983
Launched 19 May 1984
Commissioned 4 May 1985

Euro *(F 575). Main armament comprises one 127 mm/5 in automatic gun ('A' position), one eight-cell launcher for Aspide SAMs ('B' position) and four Teseo Mk 2 launchers ('Y' position). There are also full flight deck and hangar facilities for an AB 212ASW helicopter* (H & L van Ginderen Collection)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

OTOBREDA Teseo Mk 2 (TG 2)

There are four missiles, housed in two pairs of individual launcher-containers, mounted abaft the stack and facing outward at about 30° to the ship's centreline. The Teseo system is based on the Otomat missile, which has folding wings and is powered by a turbojet with solid fuel rocket boosters. The warhead is a semi-armour-piercing type, which is claimed to penetrate up to 8 cm of nickel-chromium armour. The Mk 2 system is designed for over-the-horizon targeting using a co-operating Agusta-Bell AB 212ASW helicopter with SMA MM/APS-705 I-band radar and PRT-405 tracking and datalink system. On the first leg, the missile flies directly towards the helicopter and only when it passes under the helicopter does the latter transmit target location data.

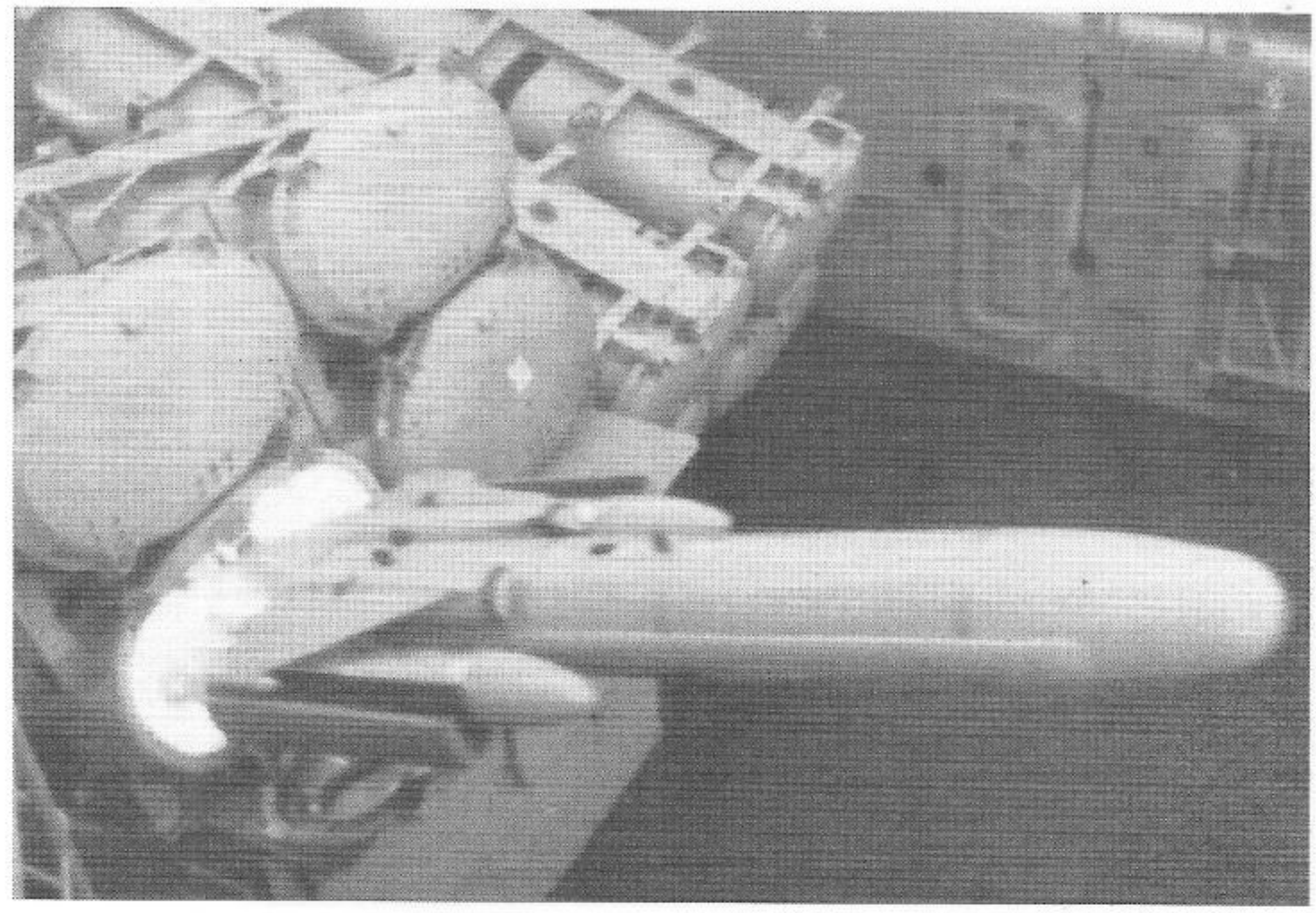
The target may be acquired by the ship's radar, by the radars of friendly ships or by helicopter radars. Data on the target's location are transmitted to the missile's autopilot and the turbojet is started. Once it has reached full power the boosters are ignited and the missile is launched, but as the missile can turn through angles of up to ±200° the warship does not have to be facing the target during the launch phase.

Once launched, the missile climbs to 150 m (492 ft) accelerated by the boosters which burn for 4 seconds until it reaches cruising speed at a distance of some 2.15 n miles (4 km) from the launch point, where the boosters are jettisoned. The missile then descends to a cruising altitude of 15-20 m (49-65 ft), a compromise between ensuring good communications with the mothership and the need to make it difficult for the target to detect it. The missile continues towards the target with mid-course guidance correction until the radar seeker, which is azimuth only, is activated at a predetermined point and scans a 40° sector, then acquires the target at a range of about 6.5 n miles (12 km). For the terminal phase the Otomat drops to sea-skimming height.

The Otomat system is capable of engaging two separate targets simultaneously in sea states up to Force 7.

Specifications

Length: 4.46 m (14.6 ft)
Diameter: 46 cm (18 in)
Wing span: 1.36 m (4.5 ft)
Weight: 762 kg (1,680 lb) without boosters); 770 kg (1,697 lb with boosters)
Range: 86 n miles (160 km)
Speed: Mach 0.9
Guidance: Inertial and active radar homing
Propulsion: Turbomeca TR 281 Arbizon III turbojet; 400 kg st



Otomat Mk 2 at launch (SMA)

Boosters: 2 SNPE solid propellant boosters; 3,500 kg st each
Warhead: Semi-armour-piercing; 210 kg (463 lb); HE 65 kg (143 lb)
Fuzes: Impact, proximity

Manufacturer/Contractor

OTOBREDA, Italy.

SURFACE-TO-AIR MISSILES (SAM)

The Albatros Mk 2 Mod 9 system comprises two elements:

Riva-Calzoni launcher
Aspide missile

Riva-Calzoni Albatros launcher

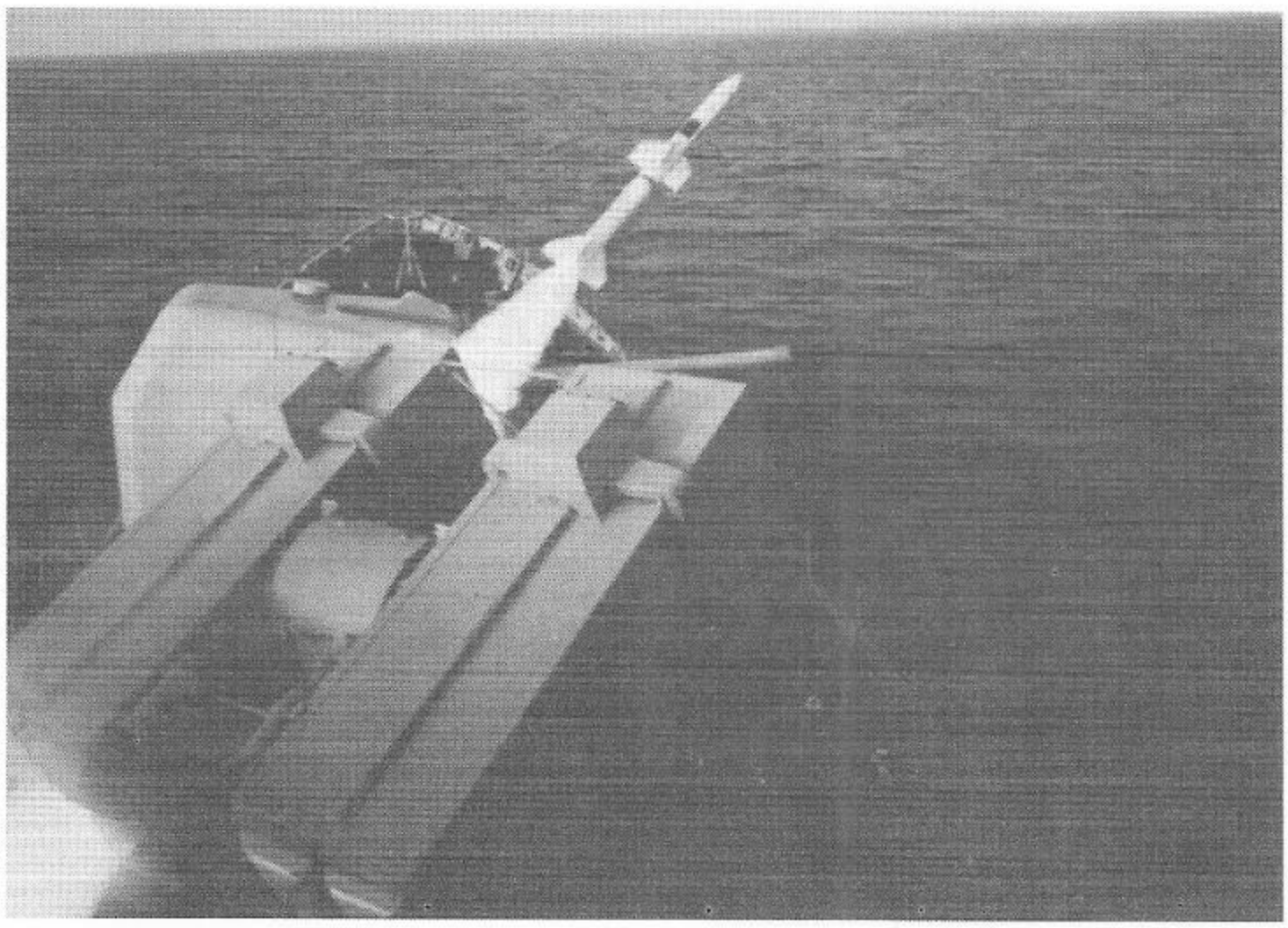
The single, eight-cell Albatros launcher is located on the foredeck in 'B' position. Produced by Riva-Calzoni, it has eight launch cells, four on each side of the mounting, each with a frangible front and rear cover. Each cell contains a loading guide to which the launching rail of the missile is electrically and mechanically connected. Sixteen reload missiles are stored horizontally in a hydraulically operated store and reload system in the deckhouse forward of the launcher; they are in four rows of four missiles each, their location corresponding to that of the launcher cells, and each storage cell has an autonomous missile travel device.

Specifications

Albatros launcher
Height: 2.98 m (9.8 ft)
Width: 3.82 m (12.5 ft)
Length: 3.82 m (12.5 ft)
Weight (loaded): 8.5 t
Traverse: 360° at 45°/s
Elevation: −5 to +80° at 25°/s

Alenia Aspide missile

The system uses the Selenia (now Alenia) Aspide SAM, a missile developed by Selenia from the US Sparrow. Targets are detected by the ship's primary search radar and then allocated to the Signaal WM25 fire-control system. The target is acquired by the fire-control system radar and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews in the target's direction. The missile control system selects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds. When the decision is made to engage the target with missiles the reversible pre-launch commands are issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode. In the latter, two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at once may be controlled by the tracker, according to the manufacturer. They also claim the system can engage horizontal targets at up to 15 km, vertical ones at 5 km and lateral ones at 8 km. A short reaction time gives the system the ability to destroy anti-ship missiles even when detection is late.



Aspide SAM is launched from Albatros eight-cell launcher (Selenia)

Specifications

Aspide missile
Length: 3.7 m (12 ft)
Diameter: 20.3 cm (8 in)
Wing span: 80 cm (31 in)
Weight: 220 kg (485 lb)
Speed: Mach 2.5
Range: 7 n miles (13 km)
Altitude: 15-5,000 m (49-16,405 ft)
Warhead: 33 kg (73 lb)
Guidance: Semi-active radar

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome, Italy (system/missile).
Riva-Calzoni, Bologna, Italy (launcher).

TUBES

There are two separate types of torpedo tubes:

Two triple 324 mm US Mk 32 torpedo tubes are sited in the waist below the stack.

Two Whitehead 533 mm (21 in) B516 tubes are located on the quarterdeck, firing aft over the transom

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications

Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

Whitehead A184 surface-launched dual-role heavyweight weapons

Specifications

Length: 6 m (19.7 ft)
Diameter: 533 mm (21 in)
Weight: 1,265 kg (2,789 lb)
Warhead: 250 kg (551 lb) HBX HE
Propulsion: Electric
Range: 4.5-10 n miles (10-20 km) (under wire guidance)
Speed: 24 or 36 kts

Manufacturer/Contractor

Whitehead SpA, Salviano, Italy.

GUNS

OTOBREDA 127 mm/54 Compatto

There is one OTOBREDA 127 mm/54 Compatto mounting in 'A' position. This weapon is designed to provide naval gunfire support, to engage surface targets and air targets, including anti-ship missiles and fixed-wing aircraft which do not have standoff weapons. The turret is unmanned and is enclosed by a glass fibre shield. Much of the turret and the lower part of the mounting are made of aluminium alloy. The below-deck element of the mounting consists of three drums each containing 22 rounds, which are stocked automatically from two chain-driven lower hoists which lead to the magazines and are loaded manually. The gun captain uses his control to select which drums are to be replenished and with what ammunition. The weapon is compatible with all US 5 in L/54 ammunition.

Specifications

Gun
Calibre: 127 mm (5 in)
Length of barrel: 54 calibres
Muzzle velocity: 808 m/s (2,625 ft/s)
Range:
anti-air: 13,600 m (45,000 ft)
anti-surface: 8.6 n miles (16 km)
Rate of fire: 45 rds/min
Weight of shell: 32 kg (70 lb)

Mounting Compatto
Training: 330° at 40°/s
Elevation: −15 to +85° at 30°/s
Crew: 5

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm L/70 Compact (Type 70) twin mounting

Two twin 40 mm turrets are mounted in the waist.

Specifications

Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 600 rds/min/mount
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

Manufactuer/Contractor

OTOBREDA, La Spezia, Italy.

Oerlikon 20 mm cannon

Two single, manually operated Oerlikon 20 mm cannon were fitted as a temporary measure during Gulf deployments in 1990-91.

Specifications

Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +90°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

SLR-4/SLQ-D EW system

The EW system in these ships is a combination of the Elettronica SLR-4 radar warning and SLQ-D jammer suites. The ESM section is SLR-4, which provides 100 per cent intercept probability, passive surveillance, automatic instantaneous warning of programmed threat, automatic analysis of threat parameters, automatic identification and tracking of threats, a synthetic data display, instantaneous DF, and broad frequency coverage.

The SLQ-D ECM section provides self-protection by using jammers. An assessment of antennas in the ship suggests that included in the suite are the ELT 521 deception jammer and ELT 318 noise jammer.

This system has been exported as the LAMBDA system.

Manufacturer/Contractor

Elettronica SpA, Rome, Italy.

CO-NEWS ESM system

These ships are fitted with CO-NEWS (COmmunications Naval Electronic Warfare System) communications ESM equipment, which provides full monitoring and analysis of communications in the VHF/UHF frequency band. The system is completely automated to achieve very high intercept probability and to handle high-density traffic. It comprises a lightweight antenna assembly, normally mounted at the masthead, consisting of three co-planar dipole arrays and a switching matrix, and an operator console located below decks. The equipment is modular in design to cater for expansion and for additional units.

CO-NEWS automatically carries out continuous surveillance of the communications band, technical analysis and bearing of the intercepted emissions and real-time data processing and presentation. The intercepted signals can also be demodulated for monitoring purposes. The system operates automatically under the supervision of an operator who can also override the system's automatic operation to solve ambiguous situations or to monitor the emissions.

Manufacturer/Contractor

Elettronica SpA, Rome, Italy.

DECOYS

OTOBREDA SCLAR rocket launchers

Two 20-tube, 105 mm OTOBREDA SCLAR, multipurpose rocket launchers are sited in the waist below the stack. The control unit is linked to the ship's radar and a control panel in the ECM compartment to provide the necessary operating signals, with the data needed to stabilise the two launchers against pitch and roll being provided by the ship's gyrocompass. The system provides defence against radar and IR homing missiles, confuses enemy radars, and provides illumination for visual fire control at night. Provision is made to load different types of rockets in various arrangements (long-range chaff, medium-range chaff, illuminating) to permit mixed salvos. Automatic selection of the rockets to be fired is possible from the remote fire-control unit and the time fuzes and launch sequence may be similarly controlled. The rockets all have double-base propellant motors with folding fins and electronic fuzes while their speed to burnout is 260-645 m/s (853-2,116 ft/s).

Specifications

Launcher weight: 1.15 t (empty); 1.75 t (with 20 rockets)
Trunnion height: 1.17 m (3.8 ft)
Traverse: 300° at 60°/s
Elevation: −5 to +60° at 30°/s
Rate of fire: 1 rd/s

Chaff distraction rocket
Type: SNIA 105 LR-C
Length: 1.85 m (6.0 ft)
Diameter: 105 mm (4 in)
Max range: 12 km
Weight: 27 kg (59 lb)
Payload: 10.2 kg (22 lb)

Chaff seduction rocket
Type: SNIA 105 MR-C
Length: 1.83 m (6.0 ft)
Diameter: 105 mm (4 in)
Max range: 4.7 km
Weight: 29 kg (64 lb) (SNIA 105 MR)
Payload: 17.4 kg (38 lb)

Infra-red seduction
Type: SNIA 105 MR-IR

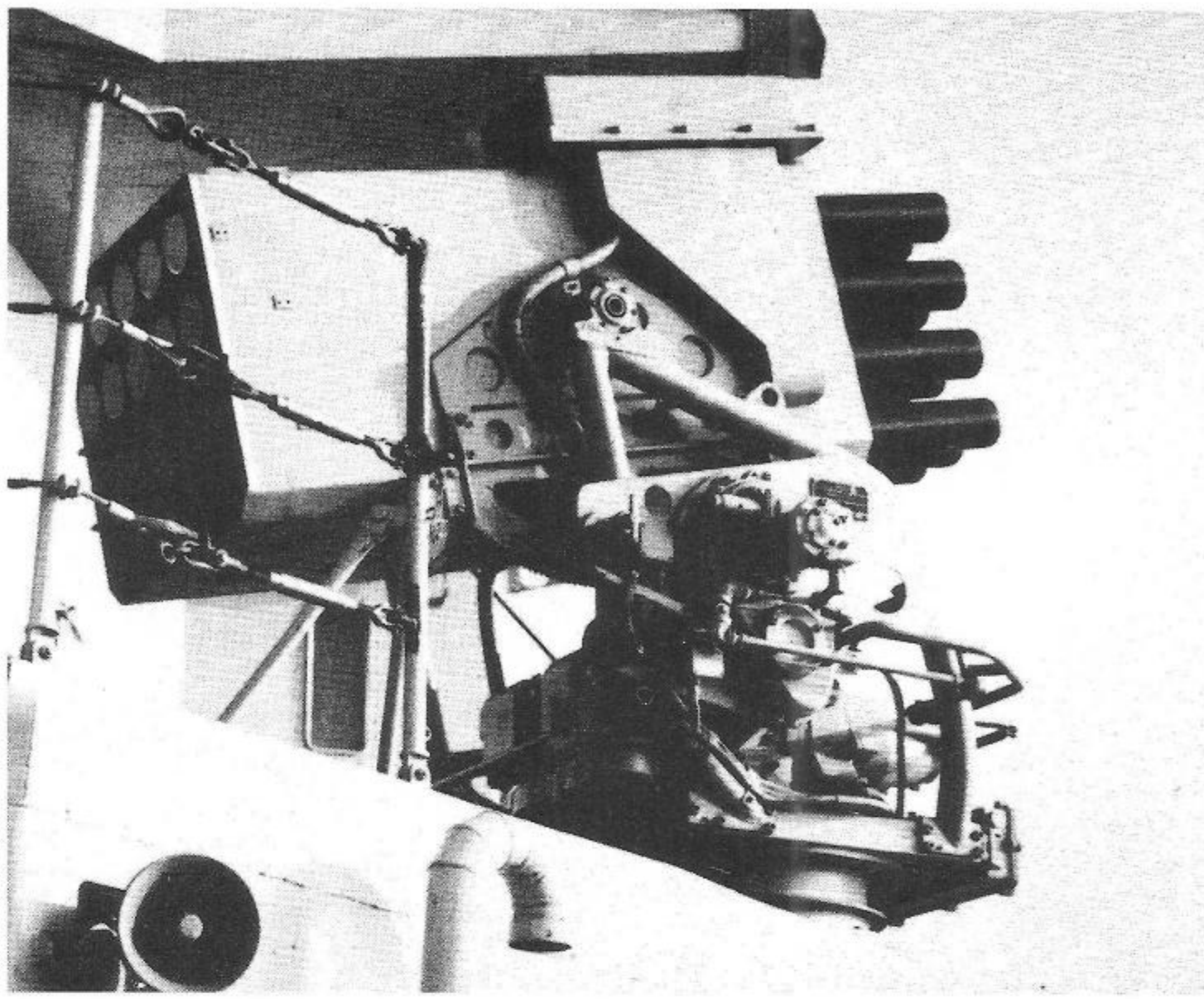
Illumination
Type: SNIA 105 LR-I
Payload: 10.2 kg (22 lb)
Range: 4 km

Manufacturers/Contractors

Breda Meccanica Bresciana SpA (launcher).
SNIA BPD (rockets).

AN/SLQ-25 Nixie noisemaker

One AN/SLQ-25 Nixie (Phase 1), solid-state, modular design electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom or in a partially or totally enclosed location on the main deck. Immediately forward of the winch compartment is the



SCLAR launcher (OTOBREDA)

Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm (3.10 ft) long, 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor

Aerojet ElectroSystems, Sacramento, California, USA.

Masker/Prairie Masker noise suppression systems

The ships are fitted with both Masker and Prairie-Masker radiated noise suppression systems. In Masker, high-pressure air is bled off from either the ship's gas turbine or dedicated compressors and ejected from a pipe placed laterally across the ship's hull just forward of the machinery spaces. The forward motion of the ship causes the air to form a layer separating the hull from the water and thus masking the machinery noises which would otherwise be radiated directly into the water. Such a system is less effective at slow speeds where the air bubbles tend to rise to the surface rather than remain attached to the hull.

In Prairie Masker air is passed down the propeller shaft and ejected from a groove in the leading edge of the blade, thus delaying the onset of cavitation.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SADOC 2

SADOC 2/IPN 10 (SADOC = *Systema Direzione della Operazioni di Combattimento)* is a mainframe architecture system designed to acquire, process and present data acquired by sensors. It can also be used for a number of other functions, including threat evaluation and weapons control, ECM management, aircraft control, conducting ASW operations, as well as datalink and databank management. Data are received from onboard and offboard sensors via datalinks. The system has two or three Central Processing Units (CPU) mini-computers (Alenia 32-bit CDG-3032 with a 128 k memory), one of which usually acts as the immediate back-up in the event of system failure. Within the consoles are Alenia 16-bit NDC-160 processors, with 64 k memories. Both possess mass memory modules for handling programs and large amounts of data and an interface with a 10 Mbit/s serial databus. Programming language is Ada.

There are two TAVITAC operating systems; the disk operating system and a time-sharing executive. The system uses a 10 Mbit/s serial bus. This system is designated SADOC2 in the Italian Navy and IPN-10 for export.

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome, Italy.

COMMUNICATIONS AND DATALINKS

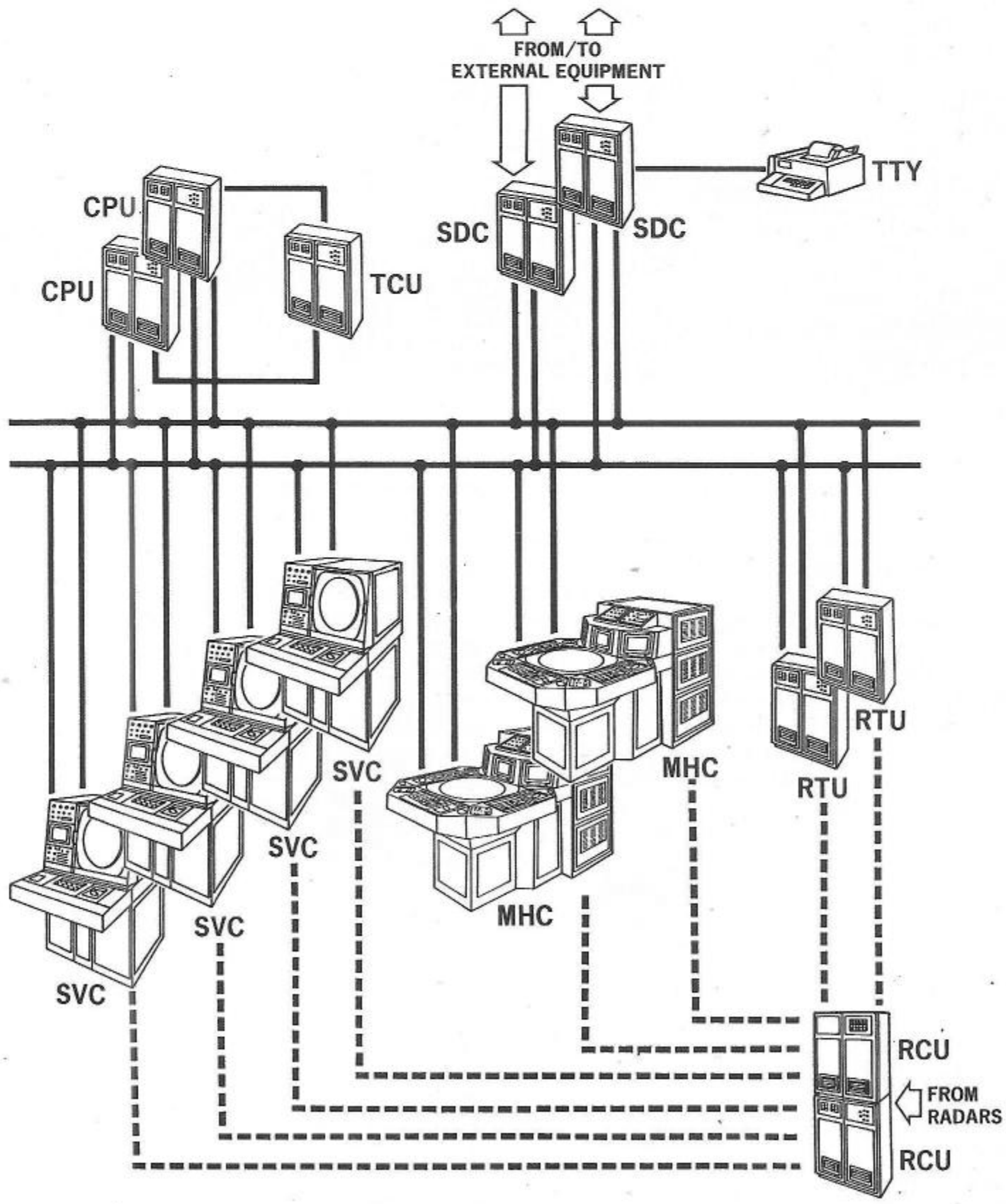
Datalinks: Link 11.
Satcom: Satcom antennas are fitted.
IFF: Mk XII

WEAPONS CONTROL

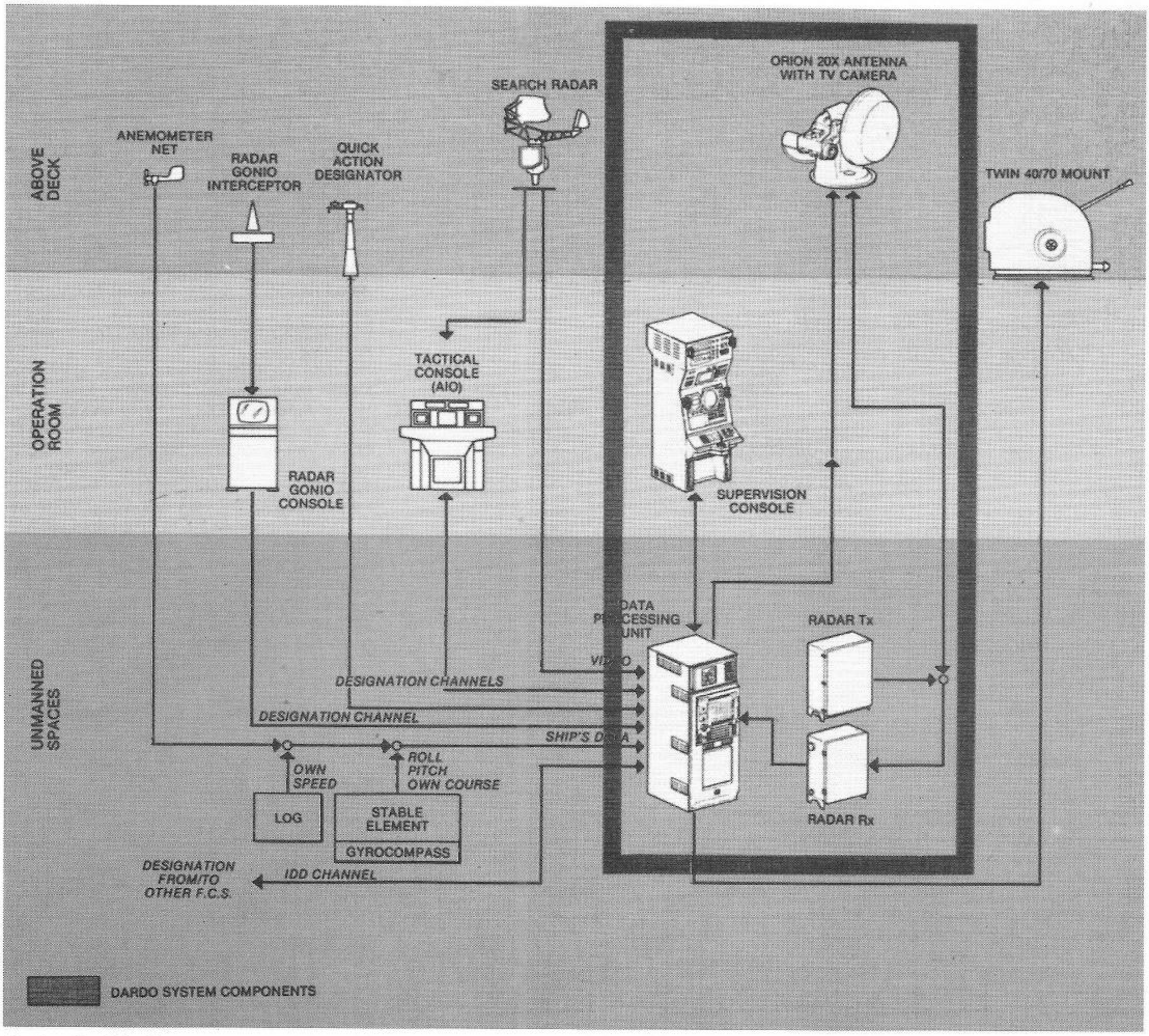
NA 30/Dardo-E

NA 30 (also known as Dardo — Extended) is a multipurpose fire-control system designed to control the guns as well as Albatros point defence surface-to-air missiles and the anti-ship missiles. It consists of a DPU, a supervisory console and the Orion RTN 30X fire-control radar. The DPU is based upon the Selenia (now Alenia) ESA 24 24-bit microprocessor with a memory access time of 250 µs and up to 21 I/O channels. The MCI consists of a multifunction keyboard, numeric keyboard, rollerball and joystick. A missile operating panel is also included.

The RTN 30 is an I-band (8-10 GHz) radar whose above-deck equipment consists of the stabilised director with radar antenna, an infra-red thermal camera and a daylight TV camera. The director covers −30 to +85° in elevation and has slewing speeds of 126°/s (training) and 86°/s (elevation). The IR camera is either



SADOC configured for use aboard a frigate (Alenia)



Dardo system (Alenia)

a 3-5 µm pointer or an 8-12 µm imager with Sprite detectors. The silicon target TV camera can operate in light conditions down to 2 lux and has a field of view of 3.01°. Below-decks equipment includes the transmitter and receiver cabinets as well as the servo unit. The range against missiles is >25 km. The antenna is of the monopulse horn cassegrain type with polarisation twist. The transmission chain is fully coherent and uses a high-average power transmitter with a peak power of 12 kW. This can operate in two modes; long pulse with coded waveform (0.5 µs compressed, 6.5 µs uncompressed) and short, single pulse (0.5 µs). In both, the final amplification is accomplished by a TWT. A multi-canceller MTI and a data processor are in the receiver to perform accurate tracking in all conditions. Accuracy is enhanced by a special anti-nodding and air defence spotting devices.

The engagement process is completely automatic following target acquisition either through the ship's search radar or through the RTN 30 director. The system is capable of engaging targets up to Mach 3 and travelling only 3 m (10 ft) above the surface.

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

Dardo
There are two Dardo systems, each controlling one 40 mm gun. Dardo is an automatic CIWS, with manual override, designed to engage sea-skimming and diving missiles as well as manned aircraft. It is a mainframe system and consists of a digital data processing and interface unit (DPU), a supervisory console and the Orion RTN 20X radar. Each system controls a single twin 40 mm gun mounting and optional equipment includes optical designators. The DPU uses an 18-bit mini-computer with a 20 k memory, 82 different instructions and a maximum application time of 10.5 µs. Software is written in Assembler language. The DPU receives input from the gyrocompass, inertial reference, the log and the wind reference unit.

The Orion RTN 20X, J-band (10-12 GHz) radar has a stabilised, monopulse, cassegrain antenna with polarisation twist. The transmission frequency and PRF can be changed randomly on a pulse-to-pulse basis over a wide frequency spectrum. The fully digital receiver uses a multicanceller MTI and is equipped to reduce the effects of multipath on low-flying targets. An electro-optical unit (daylight or low-light level TV or infrared) can be installed to the right of the antenna which has maximum slewing speeds of 2.2 rad/s (training), 1.5 rad/s (elevation). The radar can detect missiles at ranges of >10 km.

Initial target acquisition is by the RAN 10S search radar which interfaces directly with the system. Once the RTN 20 radar has acquired the target or targets the system conducts automatic tracking, assigning target priorities where necessary. The operator may override the system to engage lower-priority targets where necessary. Targets can be engaged at distances of 300-3,500 m (984-11,483 ft) and up to 10 may be tracked simultaneously.

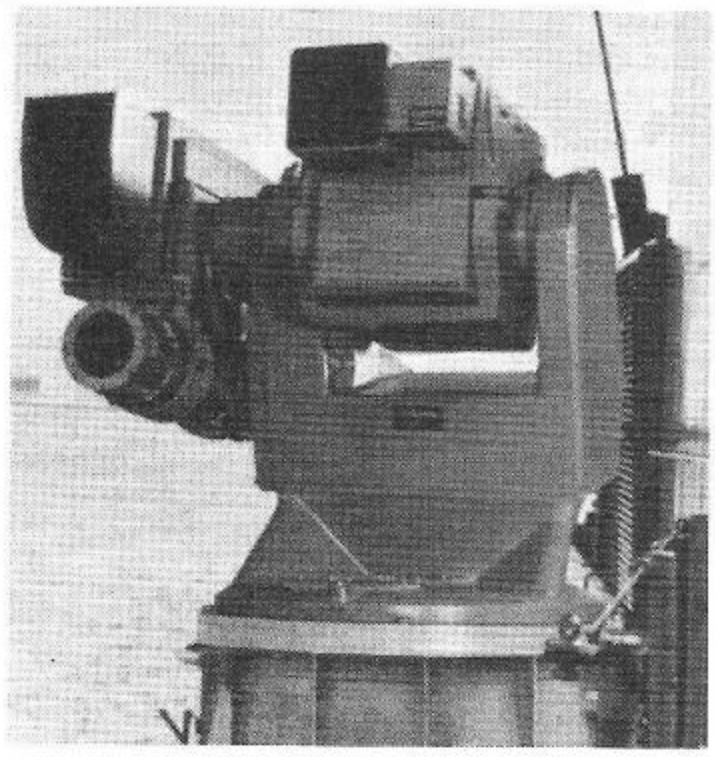
Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

Officine Galileo OGR7/2 optical directors
There are two OGR7/2 optical directors, which serve as standbys to back up the Dardo fire-control system and can be used to control the 40 mm gun against air and surface targets. The director consists of a tracking system, provided with a high-luminosity binocular telescope and open sight, and a computer through which the train and elevation lead angles and the super-elevation are computed with high accuracy. A single gunlayer/operator controls the speed in train and elevation by means of a joystick. The line of sight is stabilised so that the operator only has to account for the motion of the target. The OGR7/2s are located immediately forward of their associated 40 mm turret.

Specifications
Telescope
Magnification: ×2.3 and ×7
Optical field: 30° and 10°
Max train speed: 100°/s
Max elevation speed: 60°/s
Max train lead angle: ±25°
Max elevation lead angle: ±20°
Crossing range limits: 100-2,000 m (328-6,562 ft)
Target speed limits: 60-350 m/s (197-1,148 ft/s)

Manufacturer/Contractor
Officine Galileo SpA, Firenze, Italy.

Officine Galileo OG 30 electro-optical director
OG 30 serves as an electro-optical back-up to the NA 30 fire-control system, providing a means for panoramic surveillance, observation and identification, target acquisition and automatic tracking. It consists of the Officine Galileo thermal imaging camera, the FIAR P0700 laser rangefinder and the P4651 TV camera, mounted on a servo-controlled two-axis stabilised pedestal.



OG 30 electro-optic director (Officine Galileo)

Specifications
OG 30A
Daylight TV camera: P4651
Field of view: 1.8 × 2.4°
Image format: 3:4
Scanning standard: TV CCIR
Sensor: Vidicon tube (S18 Phosphor)
Minimum sensor resolution: 700 TV lines per picture height

Manufacturer/Contractor
Officine Galileo SpA, Firenze, Italy.

RADARS

Set	SPS-774 (RAN-10S)	SPS-702	SPN-703	RTN 30X	SPG-74 (RTN-20X) (two)
Company	Selenia	SMA	SMA	Selenia	Selenia
Role	Air/surface search	Surface search	Navigation	Fire control (Albatros/ 127 mm gun)	Fire control (Dardo)
Band	E/F	I	I	I/J	I/J
Range	85 n miles (155 km)	22 n miles (40 km)		22 n miles (40 km)	8 n miles (15 km)
Beam	1.5 × 17°	—	0.8 × 26°	—	—
Peak power	140 kW	200 kW	7/20 kW	12 kW	200 kW
Gain	28 dB	—	—	—	—
Pulsewidth	0.4 µs	1.5 µs	0.05/0.15/ 0.5/1.5 µs	0.5/6.5 µs	1.5 µs
PRF	900 pps	450-550 pps	6,000/3,000/ 1,500/750 pps	—	450-550 pps
Scan rate	15/30 rpm		25 rpm	—	—

SONAR

Raytheon DE1164 sonar

The DE1164 sonar system consists of two elements: Raytheon DE1160 (the commercial version of the AN/SQS/56) hull-mounted sonar; and a fully integrated variable depth sonar subsystem. All sonar functions of the DE1164 are identical to those of the DE1160, except that the DE1164 provides transmission and reception via various combinations of the hull-mounted and/or the towed Variable Depth Sonar (VDS) transducer arrays.

DE1160 is an active/passive, preformed beam, digital sonar providing panoramic echo ranging and panoramic (DIMUS) passive surveillance. All signal processing, except transducer-received signal amplification and linear transducer transmit drive, is accomplished in digital hardware. All visual data are presented on flicker-free, digitally refreshed television-type raster-scan CRT displays. System timing, control and interface communication are accomplished by a general purpose mini-computer which is a component of the basic system. Both 400 Hz synchro and MIL-STD-1397 Type A or C, category II digital interfaces are available in the basic sonar system. A single operator can search, track, classify and designate multiple targets from the active system while simultaneously maintaining anti-torpedo surveillance on the passive display. Computer-assisted system control permits the operator to concentrate on the sonar data being displayed rather than on the system control.

Addition of the VDS subsystem (which changes the designation from DE1160 to DE1164) improves overall sonar operational flexibility, and allows the VDS transducer array to operate at acoustically favourable depths and in a much quieter environment. In addition to the components of the full DE1160 hull-mounted system, the DE1164 includes one extra cabinet of electronics, a VDS towed body with associated cable, and the electrohydraulic mechanism associated with launching, towing, and retrieving the VDS body. The VDS handling equipment provides for one-man operation for launching and retrieving and unattended no-power towing. For reliability two independent hydraulic power supplies are provided, either of which may support the entire operation; an emergency retrieval system is available as an option. The towing cable is 300 m (984 ft) long and depth capability is some 300 m (984 ft) at 20 knots of ship's speed, while the maximum speed at which the VDS can be towed is 28 knots.

Both the hull-mounted and VDS arrays use the common set of DE1160 transmitting, receiving, and display electronics. Selection of the particular combination of transmit/receive array functions is ordered by the operator via the sonar console input keyboard; the system computer then sets up the required sequence. Alphanumeric symbols on the display inform the operator about which particular array is in use during any specific ping cycle. The hull-mounted sonar may be operated as a DE1160 when the VDS is stowed or being launched/ recovered.

The Italian version has been modified to include a mine detection capability.

Manufacturer/Contractor
Raytheon Company, Submarine Signal Division, Portsmouth, Rhode Island, USA.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 27 × 12 m (89 × 39 ft)

HELICOPTERS

Two Agusta-Bell AB 212ASW

Specifications
Dimensions:
main rotor diameter: 14.63 m (48.0 ft)
height to rotor head: 3.91 m (12.82 ft)
rotor disc area: 168.1 m² (1,809 sq ft)
Weight:
max take-off weight: 5,070 kg (11,177 lb)
Performance:
max speed (never exceed): 130 kts (240 km/h)
typical cruising speed: 100 kts (185 km/h)
hovering ceiling (out of ground effect): 396 m (1,300 ft)
Engine: 1 Pratt & Whitney Canada PT6T-6 Turbo Twin-Pac rated at 1,398 kW (1,875 shp)
Role equipment: AS-12 ASMs or Elettronica Gufo 2000 EW intercept equipment

Espero *(F 576). The AB 212ASW helicopter on the flight deck is an ASW development of the Bell 212 and is one of the few helicopter types with a skid undercarriage to operate regularly at sea. Note also the large recess in the transom for the Raytheon DE1164 VDS 'fish' which is flanked by the two 533 mm (21 in) torpedo tubes* (Jane's/H M Steele)

PROPULSION

Specification
System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 Fiat/General Electric LM-2500 gas turbines; 37.3 MW (50,000 hp) sustained; 2 GMT BL 230.20 DVM diesels; 9.3 MW (12,600 hp(m)) sustained
Shafts: 2
Propellers: cp
Auxiliary machinery: 4 GMT/Ansaldo diesel generator sets

FURTHER INFORMATION

PROGRAMME

The 'Maestrale' class was designed for ASW operations in the Mediterranean, one of the major roles allotted to the Italian Navy by NATO, where they would form part of task groups consisting of a helicopter carrier or cruisers, air defence destroyers and replenishment vessels. The first six ships were ordered in December 1976 followed by the last two in October 1980. The hulls were built at Riva Trigoso and Muggiano, but all were fitted out at Muggiano.

DESIGN

The design was based on that of the Lupo, but with an increase of 10.4 m (34 ft) in length and 1.5 m (5 ft) in beam to allow for a fixed hangar, a second helicopter and the VDS. The result has been a more comfortable ship and only a small loss in top speed, although at 32 knots, this is still well up to the usual Italian standards.

The superstructure is made of aluminium to save top weight, which was the usual practice in most navies before the Falklands (Malvinas) war. The ship is fitted with stabilisers.

Maestrale has four machinery spaces, with the furthest forward containing two of the four GMT/Ansaldo diesel generators, the second the two LM-2500 gas turbines, the third the two GEC Marine gearboxes, and the fourth the two GMT B.230 cruise diesels and the remaining two diesel generator sets. As the ships' primary role is ASW, strict limits were set on noise emissions, with particular attention being paid to the propellers. Those on the Maestrale are considerably larger in diameter than those on the Lupo and rotate more slowly for a given ship's speed: 208 rpm at 32 kts, for example, compared with 250 rpm at the same speed for the Lupo.

Maestrale also has both Prairie and Masker air emission systems, and has a very quiet gearbox.

DAMAGE CONTROL

There is an NBC citadel which includes both the torpedo room and the hangar, whose door can be fully sealed. Damage control teams are normally directed from the machinery control centre amidships but, if this is out of action, the ship is divided into three zones, each with its own damage control station at which fire-fighting teams have access to the ring main, as well as to an electrical motor and, as a last resort, a two-stroke petrol motor capable of pumping 60 t/h of water.

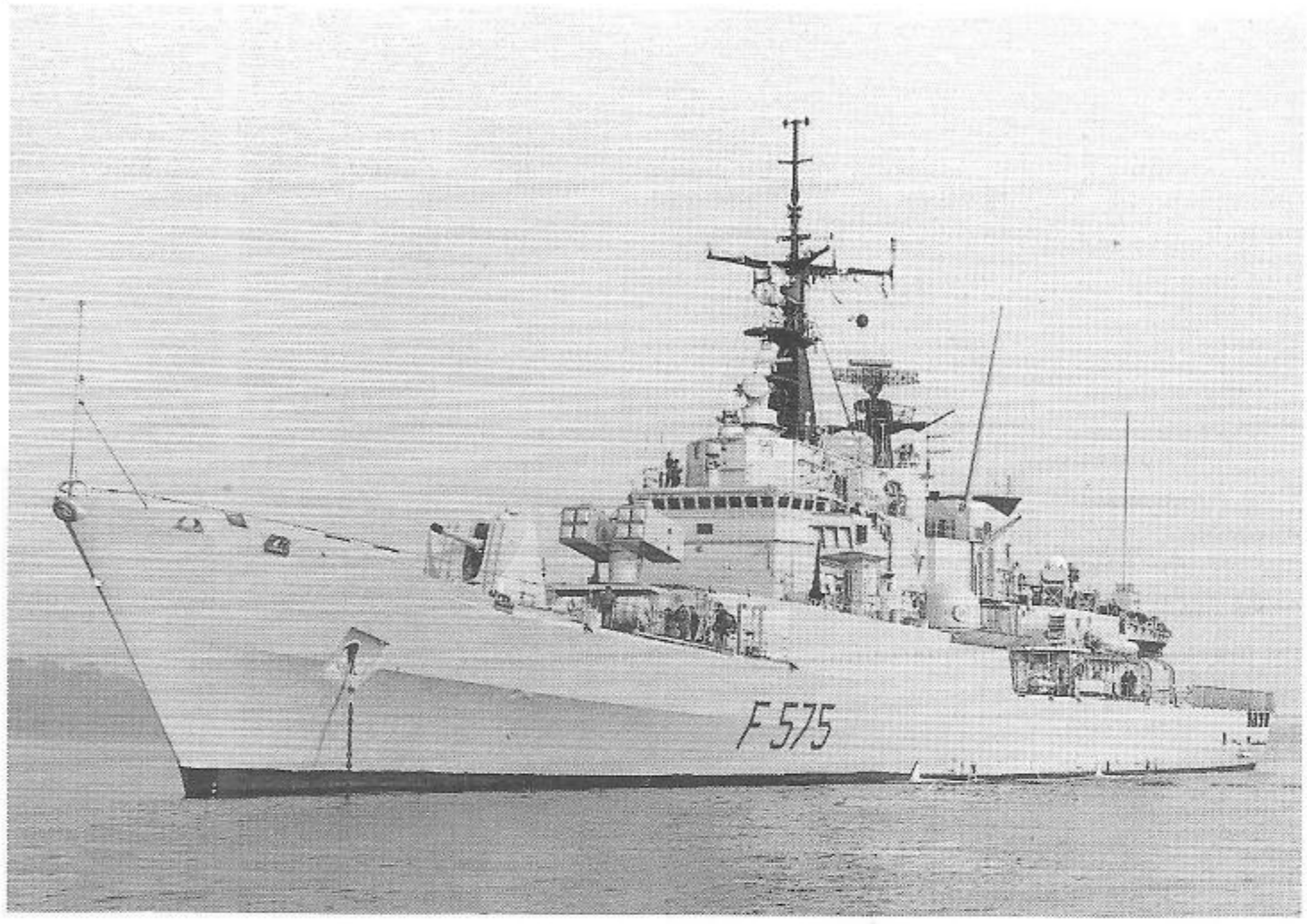
MODERNISATION

The ships were already under construction when the Falklands (Malvinas) war took place and so it was impossible to incorporate the lessons of that conflict in the design. Steps have, however, been taken to reduce fire hazards, by, for example, replacing the foam rubber which had been used to clad the water pipes to prevent condensation forming and dripping on electrical equipment.

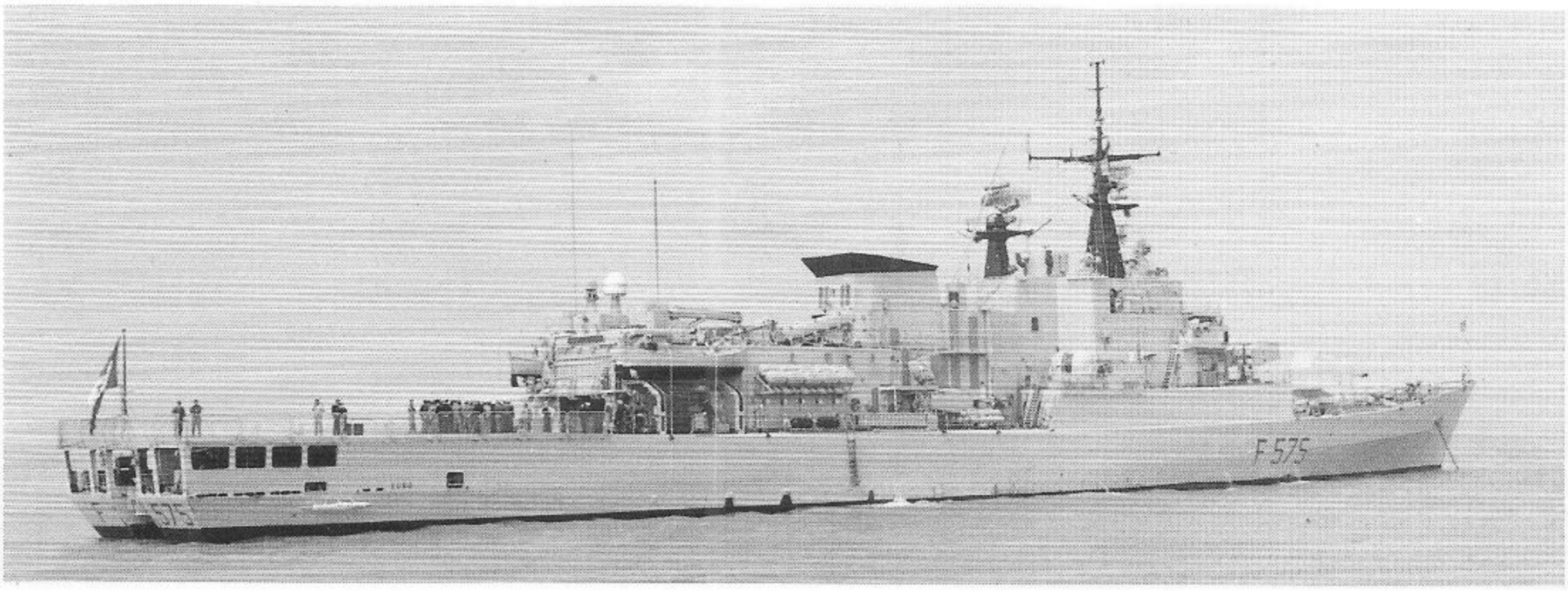
Consideration has been given for some time to improving the performance of the sonar. The preferred plan is believed to be lengthening the VDS towing cable from its present 600 m (1,969 ft) to 900 m (2,953 ft) and then streaming a low-frequency towed array from the VDS, which would be modified to serve as a depressor. No firm plan to implement this has yet been announced, however.

In the meantime, both the hull sonar and VDS were modified from 1994 onwards to give better shallow water performance and a mine detection capability.

Espero (F 576) was fitted with a twin Breda-Oerlikon 25 mm mounting for evaluation in 1991.

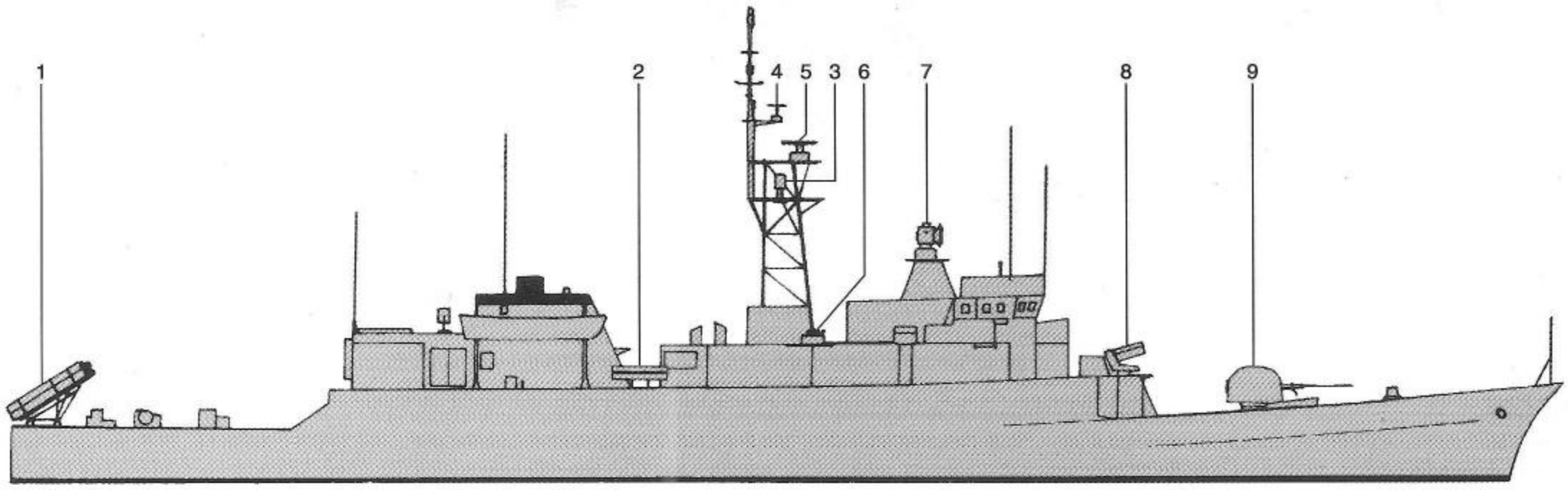


Euro *(F 575)* (H & L van Ginderen Collection)



Euro *(F 575)* (H & L van Ginderen Collection)

ISHIKARI



Ishikari (Ian Sturton)
1 *McDonnell Douglas Harpoon anti-ship missiles (eight)* **2** *Triple Type 62 324 mm ASW torpedo tubes (six total)* **3** *NEC NOLR-6C ESM system (radar intercept)* **4** *Fujitsu OPS-19B navigation radar* **5** *JRC OPS-28 surface search radar* **6** *Loral Hycor Mk 36 SRBOC six-barrel chaff/IR launcher* **7** *Type 2-21 fire-control system* **8** *Bofors four-barrel Type 71 375 mm ASW mortar* **9** *OTOBREDA 76 mm (3 in)/62 automatic gun*

GENERAL SPECIFICATIONS

Country: Japan

Class: ISHIKARI

Built: 1
Active: 1

Displacement:
standard: 1,290 t
full load: 1,450 t

Dimensions
Length: 85 m (278.8 ft)

Beam: 10.6 m (34.7 ft)
Draught: 3.5 m (11.5 ft)

Speed: 25 kts

Complement: 90

SHIPS

ISHIKARI (DE 226)
Builder Mitsui, Tamano, Japan
Laid down 17 May 1979
Launched 18 Mar 1980
Commissioned 28 Mar 1981

WEAPONS SYSTEMS

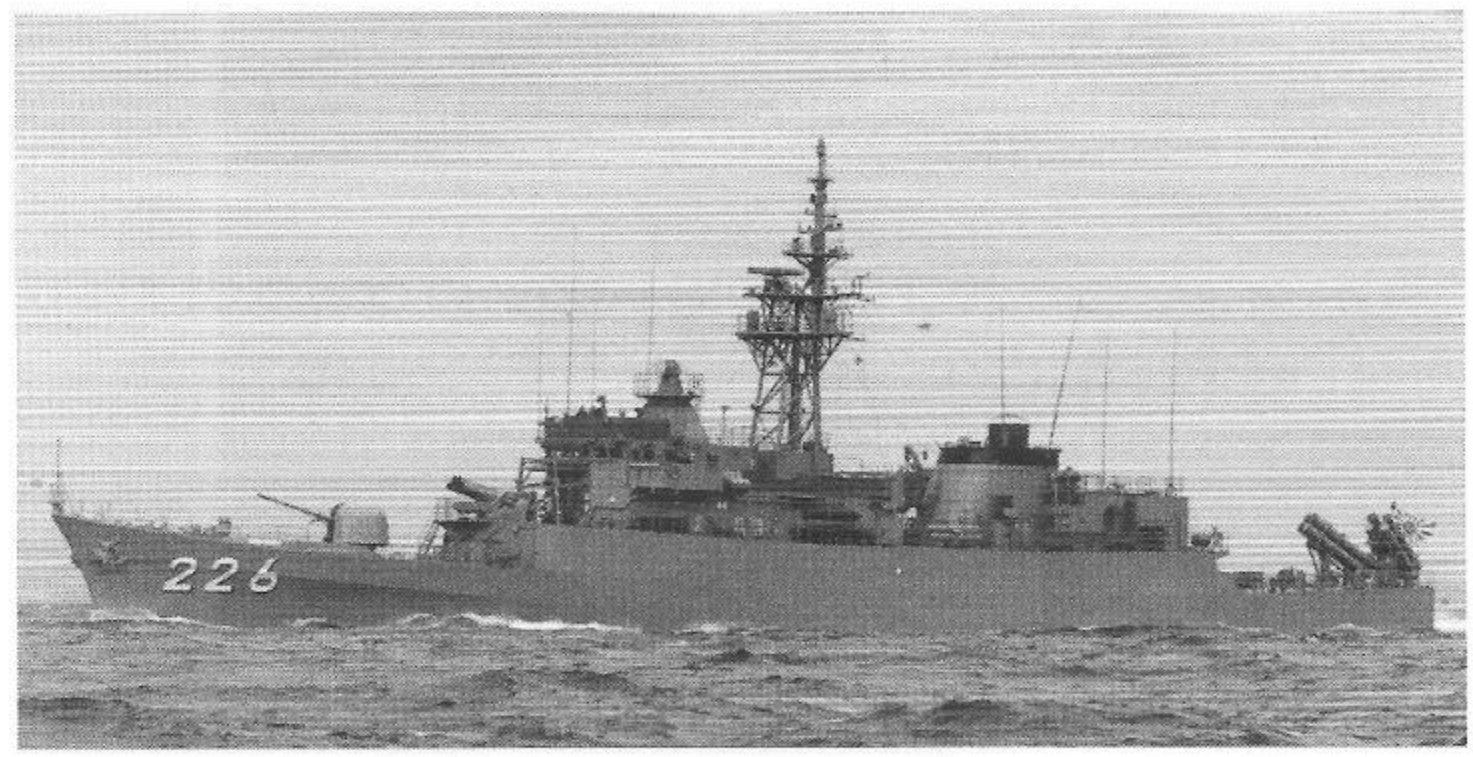
SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84B Harpoon

There are eight Harpoon missiles in two groups of four launcher-containers on the stern. This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low land-masses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns, and for the terminal phase, can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 kg)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg (11,904 lb) thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).



Ishikari *(DE 226). Note the four-barrel 375 mm Bofors ASW mortar, which was widely used in JMSDF destroyers and frigates in the 1970s and early 1980s* (Hachiro Nakai)

TUBES

Two triple 324 mm Type 68 torpedo tubes are sited amidships, one on either beam. This is a US Mk 32 installation, manufactured under licence in Japan.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 (Neartip) 324 mm torpedoes

Specification
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)

Warhead: 44 kg (97 lb) HE
Propulsion: liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Compact

There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications
Calibre: 76.2 mm (3.0 in)
Barrel length: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ASW MORTAR

Mitsubishi (Bofors) Type 71 375 mm ASW rocket system

There is a single, four-tube Type 71 ASW rocket launcher located in the 'B' gun position. This is the Bofors 375 mm rocket system, produced in Japan under licence by Mitsubishi Heavy Industries. The system consists of a rocket launcher, a handling system, the ship sonar and a fire-control system.

The four launch tubes are mounted on trunnions with an automatic contact device to connect the rockets with the fire-control system. The hydraulic laying machinery is in the front of the mounting and a flame deflector in the rear. Each system features an automatic electrohydraulic handling system. The rounds are stored vertically beneath the mounting and selected by an operator. A grab on a roof-mounted rail picks up the round by the nose and transfers it to the loading table. A hoist brings this through the deck hatch to where the launch tubes have been elevated to their loading position. The rounds are then inserted through the rear of the launch tube.

The magazine holds 48 rounds and reload time is three minutes, each tube being loaded separately. The rate of fire is one round a second and rockets may be fired singly or in salvos. There are two types of rocket, both with Hexotonal filling. The Type E (Erika) rocket has Stidar time and impact fuzes, while the Type N (Nelli) uses the Zambo proximity and impact fuzes.

Specifications
Launcher
Tubes: 4
Traverse: 260° at 18°/s
Elevation: −15 to +90° at 18°/s
Crew: 4

Rockets

	Type E	Type N
Weight	250 kg (551 lb)	230 kg (507 lb)
Muzzle velocity	130 m/s (427 ft/s)	205 m/s (673 ft/s)
Explosive weight	107 kg (236 lb)	80 kg (176 lb)
Range	0.35-0.87 n miles (0.65-1.63 km)	0.85-2.11 n miles (1.58-3.62 km)
Sinking speed	10.7 m/s (35.1 ft/s)	9.2 m/s (30.2 ft/s)

Manufacturer/Contractor
Mitsubishi Heavy Industries, Kobe, Japan.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

NEC NOLR-6C

NOLR-6C is a radar intercept system, which was developed from the NOLR-5 in order to counter anti-ship missiles. It uses two rotating DF antennas to cover the main radar frequencies, with a circular dipole array mounted on the foretop to carry out direction-finding in the VHF and UHF bands. It uses electronic scanning. It is reported to be similar in many respects to the US Navy's AN/WLR-8.

ELECTRONIC COUNTERMEASURES (ECM)

Fujitsu OLT-2

All ships are fitted with the Fijitsu OLT-2 jammer.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled chaff launchers

There are four Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Mitsubishi GFCS Type 2-21

Ishikazi is fitted with a Mitsubishi Electric GFCS Type 2-21 (also known as the Type 79) to control the fire of the OTOBREDA 76 mm gun. The radar director operates in the I/J band.

Manufacturer/Contractor
Mitsubishi Electric Corp (MELCO), Tokyo, Japan.

RADARS

JRC OPS 28C/D

OPS-28 is a surface search and short-range air search radar, operating in the G- and H-bands.

Fujitsu OPS 19B

OPS-19B is used for navigation. It operates in the I-band.

Type 2-21

The fire-control radar is the Type 2-21 operating in the I/J band.

SONAR

NEC OQS-4A

OQS-4A is a Japanese-designed, improved version of the OQS-3, which was a licence-produced version of the US Navy's SQS-23. OQS-4A is a hull-mounted, active search and attack sonar, operating at low frequencies.

PROPULSION

Specifications
System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 Kawasaki/Rolls-Royce Olympus TM3B gas turbine; 18.4 MW (24,700 hp); 1 Mitsubishi/MAN 6DRV diesel; 3.45 MW (4,700 hp(m))

Shafts: 2
Propellers: 2 Kawasaki-Escher Wyss, cp propellers

FURTHER INFORMATION

PROGRAMME

The JMSDF had not designed a destroyer escort (frigate) since the mid-1960s and it appears that this, allied to the numerous new systems becoming available, prompted the decision to construct what amounted to a prototype of a new design.

The original programme called for a class of 20 and two were actually authorised, the first in the 1977 estimates and the second in 1979. In the event, however, only one was built.

DESIGN

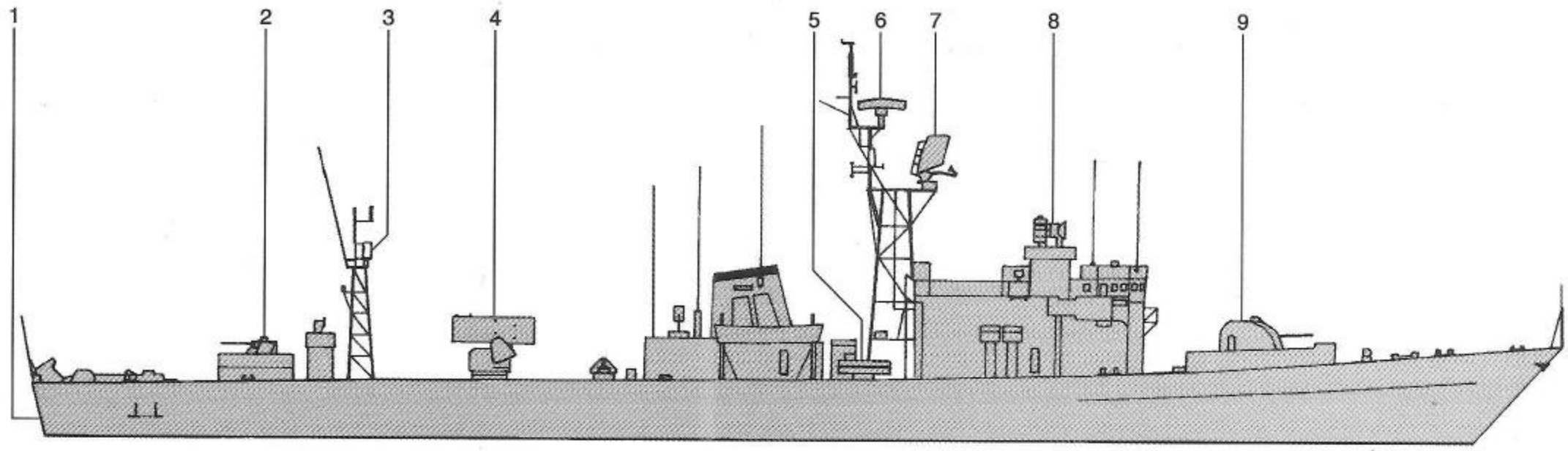
The Ishikari design was entirely new and seems to have owed little to the previous 'Chikuma' class. It seems clear, however, that too much was attempted on too small a hull, perhaps the most surprising feature being that, although the ship was intended primarily for the ASW mission, its actual ASW sensor and weapons fits were not particularly imposing, the weapons, for example, being confined to a Bofors four-barrelled rocket launcher and two triple torpedo tubes.

MODERNISATION

Despite its apparent shortcomings, *Ishikari* has remained in service and is to be fitted with a Mk 15 Vulcan Phalanx CIWS when a weapon is available.

Ishikari *(DE 226). This relatively small ship (full load displacement: 1,450 tonnes) was a prototype for the 'Yubari' class* (H & L van Ginderen Collection)

CHIKUGO



Chikugo (Ian Sturton)
1 *EDO SQS-35(J) VDS (last five ships only)* **2** *Bofors twin 40 mm/60 Mk 1 (open mount)* **3** *NEC NOLR-5 ESM (radar intercept)* **4** *ASROC Mk 112 eight-cell launcher* **5** *Triple Type 62 324 mm torpedo tubes (total: six)* **6** *JRC OPS-16 surface search radar* **7** *MELCO OPS-14 air search radar* **8** *Type 1B fire control* **9** *US Navy Mk 33 twin 3 in (76 mm)/50 guns*

GENERAL SPECIFICATIONS

Country: Japan

Class: CHIKUGO

Built: 11
Active: 11

Displacement:
standard: 1,470 t (DE 215, 217-219 and 221); 1,480 t (DE 216, 220); 1,500 t (DE 222-DE 225)
full load: 1,700-1,800 t

Dimensions
Length: 93 m (305 ft)
Beam: 10.8 m (35.5 ft)

Draught: 3.5 m (11.5 ft)

Speed: 25 kts
Range: 10,900 n miles at 12 kts

Complement: 165 (DE 215-221), 160 (DE 222 - DE 225); (12 officers)

SHIPS

CHIKUGO (DE 215)
Builder Mitsui, Tamano, Japan
Laid down 9 Dec 1968
Launched 13 Jan 1970
Commissioned 31 Jul 1970

AYASE (DE 216)
Builder Ishikawajima Harima, Tokyo, Japan
Laid down 5 Dec 1969
Launched 16 Sep 1970
Commissioned 20 May 1971

MIKUMA (DE 217)
Builder Mitsui, Tamano, Japan
Laid down 17 Mar 1970
Launched 16 Feb 1971
Commissioned: 26 Aug 1971

TOKACHI (DE 218)
Builder Mitsui, Tamano, Japan
Laid down 11 Dec 1970
Launched 25 Nov 1971
Commissioned 17 May 1972

IWASE (DE 219)
Builder Mitsui, Tamano, Japan
Laid down 6 Aug 1971
Launched 29 Jun 1972
Commissioned 12 Dec 1972

CHITOSE (DE 220)
Builder Hitachi, Maizuru, Japan
Laid down 7 Oct 1971
Launched 25 Jan 1973
Commissioned 31 Aug 1973

NIYODO (DE 221)
Builder Mitsui, Tamano, Japan
Laid down 20 Sep 1972
Launched 28 Aug 1973
Commissioned 8 Feb 1974

TESHIO (DE 222)
Builder Hitachi, Maizuru, Japan
Laid down 11 Jul 1973
Launched 29 May 1974
Commissioned 10 Jan 1975

YOSHINO (DE 223)
Builder Mitsui, Tamano, Japan
Laid down 28 Sep 1973
Launched 22 Aug 1974
Commissioned 6 Feb 1975

KUMANO (DE 224)
Builder Hitachi, Maizuru, Japan
Laid down 29 May 1974
Launched 24 Feb 1975
Commissioned 19 Nov 1975

NOSHIRO (DE 225)
Builder Mitsui, Tamano, Japan
Laid down 27 Jan 1976
Launched 23 Dec 1976
Commissioned 30 Jun 1977

WEAPONS SYSTEMS

ANTI-SUBMARINE MISSILES

Honeywell RUR-5A ASROC

The 'Chikugo' class has a single, eight-cell Mk 112 ASROC launcher amidships, but with no below-decks magazine or reloads. ASROC is a Mk 46 torpedo with strap-on aerodynamic surfaces and a rocket motor to enable it to fly to within range of its submarine target. Attached to the rear end of the torpedo is a short airframe assembly of clam-like construction, held together by a steel band, with a Naval Propulsion Plant solid propellant booster and four trapezoidal aerodynamic surfaces to provide stability in flight. The torpedo has a dome-shaped frangible plastic nose cap to protect the transducer as it enters the water. Payload is an Alliant Mk 46 Mod 5 torpedo, which has a seeker designed specifically to detect most types of target including submarines with anechoically coated hulls and has an estimated acquisition range of 460 m (1,509 ft).

When a submarine target is detected it is tracked and the attack console's fire-control computer predicts the target's position. The launcher is turned in the appropriate direction and elevated to an angle appropriate to the range. The fire-control computer then orders the launch and the booster burns for a programmed time of between 1 and 4 seconds, by which time the missile will have reached a height of between 60 (196) and 305 m (1,000 ft), although the aerodynamically stable airframe enables it to coast up to 600 m (1,968 ft). On reaching the programmed position, an explosive bolt cuts the steel band holding the airframe assembly sections together and, as they separate, the parachute deploys to retard the torpedo's fall, water entry taking place some 14 to 50 seconds after launch. As the torpedo enters the water the frangible nose cap breaks off and the torpedo begins its search for the target using a predetermined pattern.

Specifications

ASROC missile
Length: 4.6 m (15.1 ft)
Diameter: 32.5 cm (12.8 in)
Span: 84.5 cm (33.3 in)
Weight: 435 kg (959 lb)
Range: 0.86-5.39 n miles (1.6-10 km)
Speed: Mach 0.9

Mk 46 Mod 5 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)

Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Manufacturer/Contractor
Loral Defense Systems, Akron, Ohio, USA.

TUBES

Two triple 324 mm Type 68 torpedo tubes are sited amidships, one on either beam. This is a US Mk 32 installation, manufactured under licence in Japan.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 (Neartip) 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

Twin Mk 33 76 mm (3 in) L/50 gun mounting
There is one twin 76 mm mounting in 'A' position. The Mk 33 is a twin Mk 22 gun, power-driven, base-ring mount with local or remote control. The automatic loading mechanism is above each Mk 22 gun and is fed manually from either side, with motor-driven sprockets moving the shell into the centre of the loader from where it is dropped onto a transfer tray, which pushes it into the breech for ramming. The mounting operates with the Type 1B fire-control system.

Specifications
Gun
Calibre: 76.2 mm
Length of barrel: 50 calibres (4.05 m)
Muzzle velocity: 823 m/s (2,700 ft/s) (new gun, nominal); 808 m/s (2,651 ft/s) (mid-life)
Range: 7 n miles (13 km)
Altitude: 8,951 m (29,367 ft/s)
Weights:
complete round: 10.9 kg (24 lb)
projectile: 5.9 kg (13 lb)
Barrel life: 4,300 EFC (effective full charges)

Mk 33 mounting
Traverse: 360° at 30°/s
Elevation: −14/15° to +85° at 24°/s
Rate of fire: 50 rds/min/barrel

Bofors 40 mm/60
There is one twin Mk 1 40 mm gun mounting on the afterdeck.

Specification
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity:
new barrel: 881 m/s (2,890 ft/s)
mid-life: 850 m/s (2,789 ft/s)
Rate of fire: 120 rds/min (cyclic)
Max range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,638 ft)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC COUNTERMEASURES (ECM)

NEC NOLR-5
NOLR-5 is an early radar intercept set, with limited effectiveness against incoming anti-ship missiles. The antennas for this system are located under the cylindrical, flat-topped radomes at the end of the yard-arms atop the stubby main mast.

Manufacturer/Contractor
NEC, Tokyo, Japan.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

GFCS Model 1B
GFCS (Gun Fire Control System) Model 1B (also known as the Type 72) is the control system for the 76 mm (3 in) gun. The director is atop a small tower on the bridge roof.

Manufacturer/Contractor
Mitsubishi Electric, Japan.

GFCS Mk 51
The Mk 51 GFCS is a US Navy lead-computing gunsight for the 40 mm Bofors twin mounting.

COMMUNICATIONS AND DATALINKS

IFF: US Mk 10

RADARS

Mitsubishi OPS 14B
OPS-14B is a B/C-band air search radar. Peak power is 400 kW and beamwidth is 5°.

Manufacturer/Contractor
Mitsubishi Electric Corporation (MELCO), Tokyo, Japan.

Teshio *(DE 222)* (Hachiro Nakai)

JRC OPS 16
OPS-16 is a surface search radar, operating in the D band.

Type 1B
The radar associated with the GFCS Type 72 is the Type 1B. It operates in the I/J band.

SONARS

NEC OQS 3A
OQS-3A is a licence-built, Japanese version of the US Navy's hull-mounted, active search and attack, medium-frequency AN/SQS-23.

EDO SQS-35(J)
DE 221 to DE 225 only. The EDO AN/SQS-35 variable depth sonar (VDS) was installed in the last five ships only. This sonar is designed to detect submarines at medium ranges and has a large "fish" containing an array with 24 staves, operating at 13 kHz and with a peak power of 30 kW. The 'fish' is lowered over the stern on a large gantry and then streamed on a long cable. SQS-35 is a single console system with miniaturised vacuum-tube electronics.

PROPULSION

Specifications
System: Diesels
Main machinery:
DE 216, DE 220, DE 222, DE 224: 4 Mitsubishi-Burmeister & Wain 12UEV30/40N diesels; 11.8 MW (16,000 hp(m))
DE 215, DE 217, DE 218, DE 219, DE 221, DE 223, DE 225: 4 Matsui 1228 V 3BU-38V diesels; 11.8 MW (16,000 hp(m))
Shafts: 2

FURTHER INFORMATION

PROGRAMME

For many years following the end of the Second World War the JMSDF followed US Navy doctrine and practice. Thus, one of the types of ship developed was the 'destroyer escort' (DE), of which the first to be operated were former US 'Tacoma' and 'Cannon' class ships on loan from the US Navy. It should be noted, however, that despite the adoption by the US Navy of the 'frigate' category, the JMSDF continues to refer to these ships as 'destroyer escorts' and to give them 'DE' pennant numbers.

In the destroyer category there has been a consistent building policy with at least one (and sometimes two) classes under construction at a time, and a steady development in design and capability. The destroyer escort category, however, does not seem to have followed the same logical progress, with long gaps between classes and the development giving the outward appearance of an irregular progression.

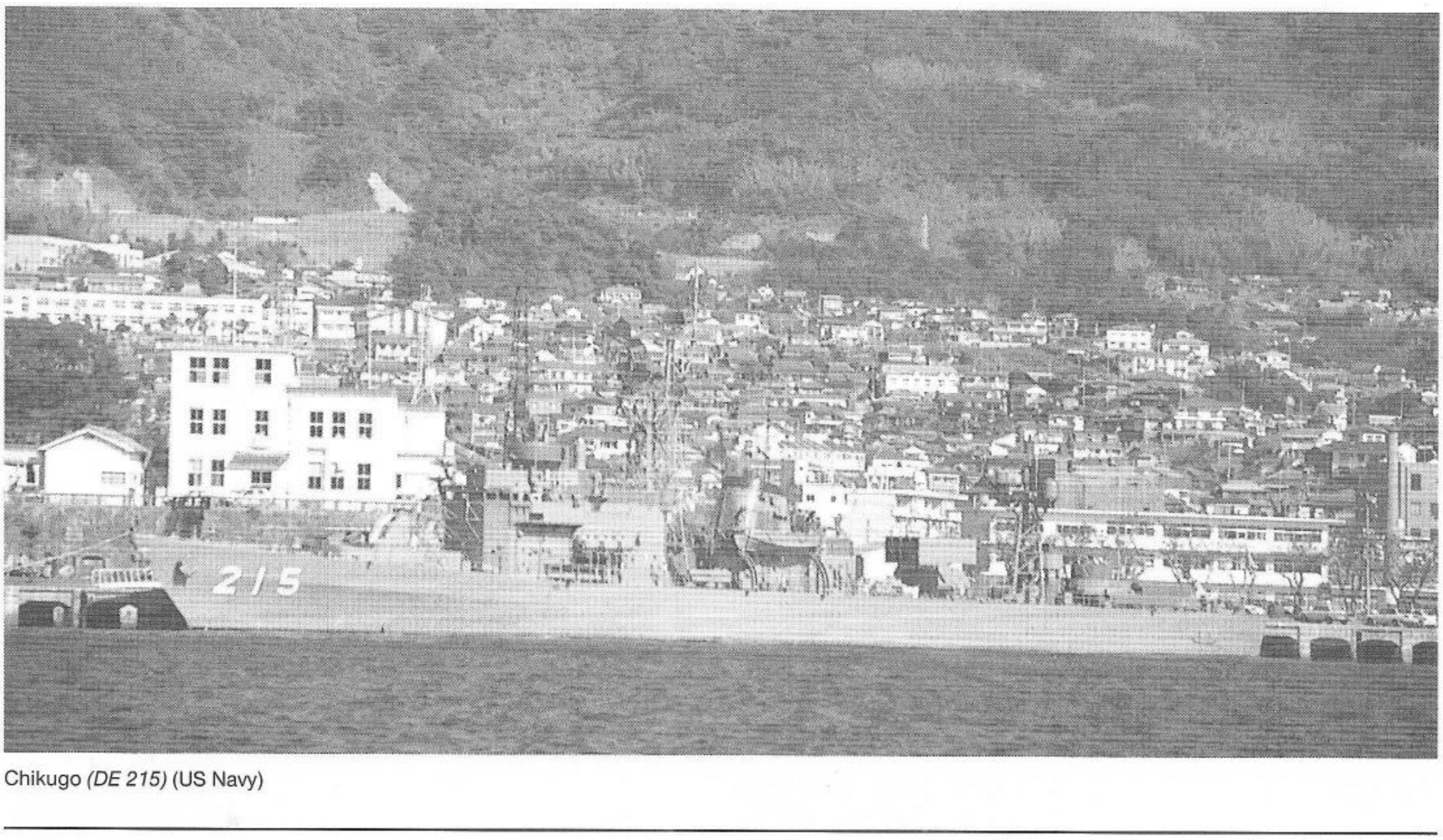
The 'Chikugo' class was designed in the early 1960s and constructed between 1968 and 1977. Eleven ships were built.

DESIGN

These ships were designed specifically for the anti-submarine mission and particular attention was paid to quiet operation and stability. Their surface and air defence armament is minimal, since it is planned that JMSDF ships would never operate further than 1,000 n miles from their home shores and would thus always be provided with air cover by Japanese fighters and long-range patrol aircraft. (Whether or not that is still a valid assumption in the post-Cold War era is a matter of debate in Japanese naval circles).

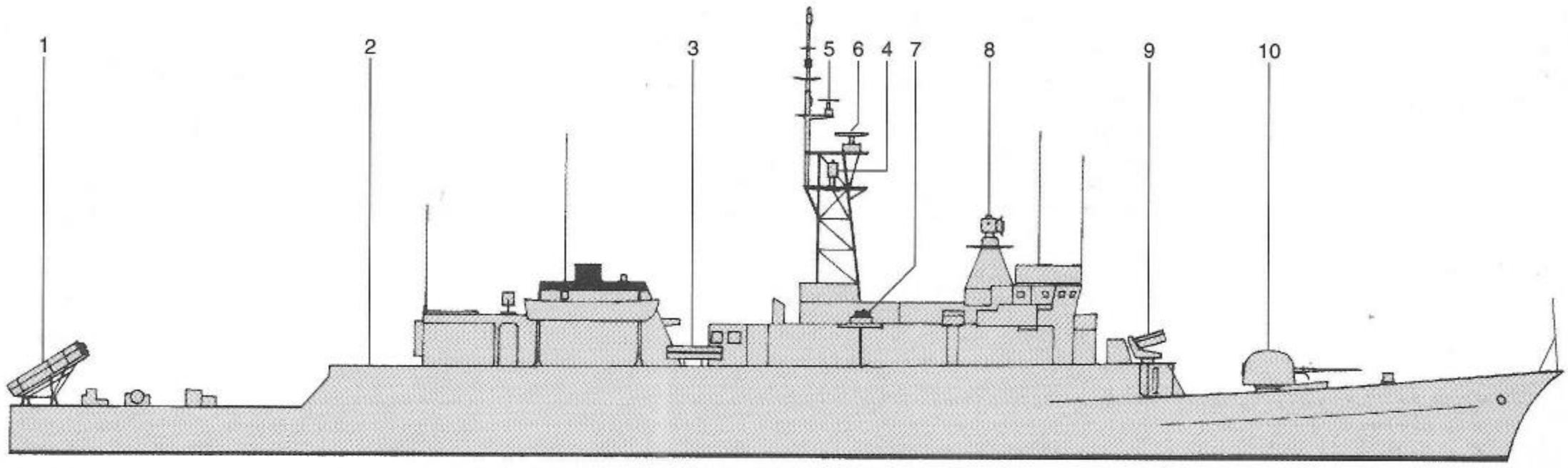
The ships' principle ASW weapon system is ASROC, and they are, in fact, the smallest platforms to carry the Mk 112 launcher.

These were the last JMSDF destroyer escorts to have an all-diesel propulsion system.



Chikugo *(DE 215)* (US Navy)

YUBARI



Yubari (Ian Sturton)
1 *McDonnell Douglas Harpoon anti-ship missiles (eight)* **2** *Fitted for but not with (FFBNW) one Hughes Mk 15 20 mm Phalanx CIWS* **3** *Triple Type 62 324 mm ASW torpedo tubes (total: six)* **4** *NEC NOLR-6C ESM system (radar intercept)* **5** *Fujitsu OPS-19B navigation radar* **6** *JRC OPS-28C surface search radar* **7** *Loral Hycor Mk 36 SRBOC chaff/IR launcher* **8** *Type 2-21 fire-control system* **9** *Bofors six-barrel Type 71 375 mm ASW mortar* **10** *OTOBREDA 76 mm (3 in)/62 automatic gun*

GENERAL SPECIFICATIONS

Country: Japan

Class: YUBARI

Built: 2
Active: 2

Displacement:
standard: 1,470 t
full load: 1,690 t

Dimensions
Length: 91 m (298.5 ft)

Beam: 10.8 m (35.4 ft)
Draught: 3.6 m (11.8 ft)

Speed: 25 kts

Complement: 95

SHIPS

YUBARI (DE 227)

Builder	Sumitomo, Uraga, Japan
Laid down	9 Feb 1981
Launched	22 Feb 1982
Commissioned	18 Mar 1983

YUBETSU (DE 228)

Builder	Hitachi, Maizuru, Japan
Laid down	14 Jan 1982
Launched	25 Jan 1983
Commissioned	14 Feb 1984

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84B Harpoon

There are eight Harpoon missiles in two groups of four launcher-containers on the stern. This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low land-masses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns and, for the terminal phase, can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 kg)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg (11,905 lb) thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

TUBES

Two triple 324 mm Type 68 torpedo tubes are sited amidships, one on either beam. This is a US Mk 32 installation, manufactured under licence in Japan.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 (Neartip) 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Compact

There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications
Calibre: 76.2 mm (3.0 in)
Barrel length: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ASW MORTAR

Mitsubishi (Bofors) Type 71 375 mm ASW rocket system

There is a single, four-tube Type 71 ASW rocket launcher located in the 'B' gun position. This is the Bofors 375 mm rocket system, produced in Japan under licence by Mitsubishi Heavy Industries. The system consists of a rocket launcher, a handling system, the ship sonar and a fire-control system.

The four launch tubes are mounted on trunnions with an automatic contact device to connect the rockets with the fire-control system. The hydraulic laying machinery is in the front of the mounting and a flame deflector in the rear. Each system features an automatic electrohydraulic handling system. The rounds are stored vertically beneath the mounting and selected by an operator. A grab on a roof-mounted rail picks up the round by the nose and transfers it to the loading table. A hoist brings this through the deck hatch to where the launch tubes have been elevated to their loading position. The rounds are then inserted through the rear of the launch tube.

The magazine holds 48 rounds and reload time is three minutes, each tube being loaded separately. The rate of fire is one round a second and rockets may be fired singly or in salvos. There are two types of rocket, both with Hexotonal filling. The Type E (Erika) rocket has Stidar time and impact fuzes, while the Type N (Nelli) uses the Zambo proximity and impact fuzes.

Yubari *(DE 227). Weapons include an OTOBREDA 76 mm gun, six-barrel Bofors ASW mortar, 324 mm torpedoes and Harpoon missiles (eight can be mounted, but only six in this picture). Space and weight have also been reserved for a Vulcan CIWS aft* (Hachiro Nakai)

Specifications

Launcher
Tubes: 4
Traverse: 260° at 18°/s
Elevation: −15 to +90° at 18°/s
Crew: 4

Rockets

	Type E	Type N
Weight	250 kg (551 lb)	230 kg (507 lb)
Muzzle velocity	130 m/s (427 ft/s)	205 m/s (673 ft/s)
Explosive weight	107 kg (236 lb)	80 kg (176 lb)
Range	0.35-0.87 n miles (0.65-1.63 km)	0.85-2.11 n miles (1.58-3.62 km)
Sinking speed	10.7 m/s (35.1 ft/s)	9.2 m/s (30.2 ft/s)

Manufacturer/Contractor

Mitsubishi Heavy Industries, Kobe, Japan.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

NEC NOLR-6C

NOLR-6C is a radar intercept system, which was developed from the NOLR-5 in order to counter anti-ship missiles. It uses two rotating DF antennas to cover the main radar frequencies, with a circular dipole array mounted on the foretop to carry out direction-finding in the VHF and UHF bands. It uses electronic scanning. It is reported to be similar in many respects to the US Navy's AN/WLR-8.

Fujitsu OLT 3

All ships are fitted with the OLT-3 jammer.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled chaff launchers

There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications

Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Mitsubishi GFCS Model 2-21

Both ships are fitted with a Mitsubishi Electric GFCS Model 2-21 (also known as the Type 79) to control the fire of the OTOBREDA 76 mm gun. The radar director operates in the I/J band.

Manufacturer/Contractor

Mitsubishi Electric Corp (MELCO), Tokyo, Japan.

RADARS

JRC OPS 28C/D

OPS-28 is a surface search and short-range air search radar, operating in the G- and H-bands.

Fujitsu OPS 19B

OPS-19B is used for navigation. It operates in the I-band.

Type 2-21

The fire-control radar is the Type 2-21 operating in the I/J band.

SONAR

NEC OQS-4A

OQS-4A is a Japanese-designed, improved version of the OQS-3, which was a licence-produced version of the US Navy's SQS-23. OQS-4A is a hull-mounted, active search and attack sonar, operating at low frequencies.

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 Kawasaki/Rolls-Royce Olympus TM3B gas turbine; 18.4 MW (24,700 hp) sustained; 1 Mitsubishi/MAN 6DRV diesel; 3.45 MW (4,700 hp(m))
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

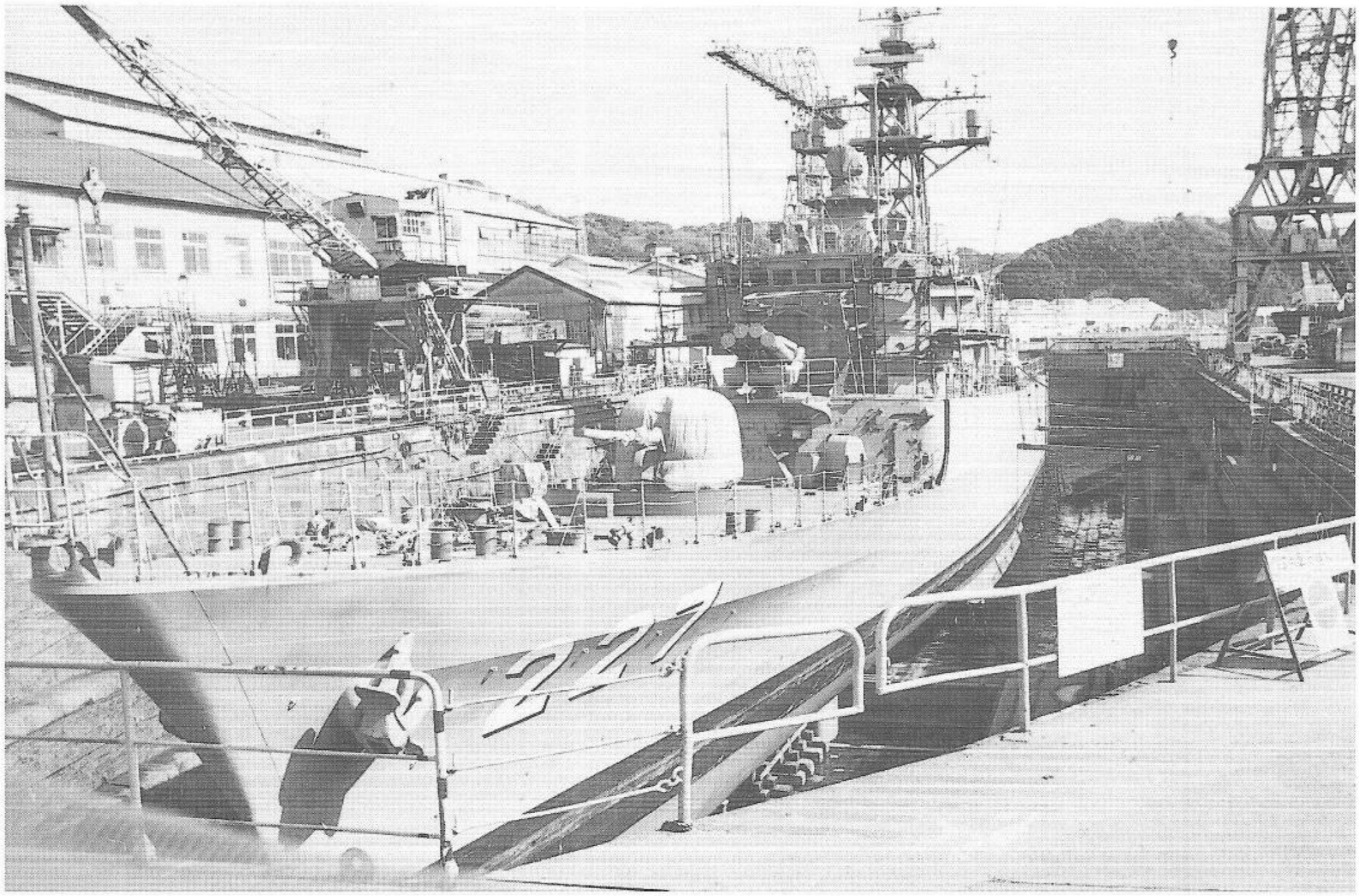
The Yubari is essentially an improved *Ishikari* (DE 226) but only two were built: the first joining the fleet in 1983 and the second in 1984.

DESIGN

The Yubari hull is 6.5 m (21 ft) longer than that of the *Ishikari,* but the weapons fit is essentially the same, enabling the accommodation arrangements to be improved and an increase in the size of the fuel oil bunkers.

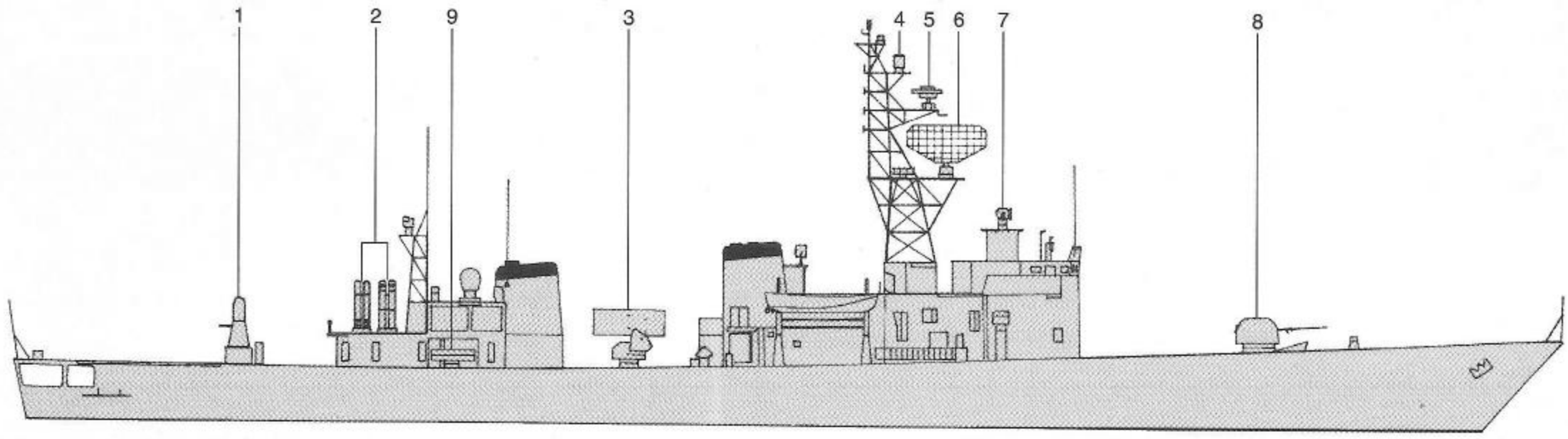
MODERNISATION

It was planned that a Hughes 20 mm Phalanx CIWS Mk15 would be fitted, but this has not yet happened.



Yubari *(DE 227) in drydock* (H & L van Ginderen Collection)

ABUKUMA



Abukuma (Ian Sturton)
1 *Hughes Mk 15 20 mm Phalanx CIWS* **2** *McDonnell Douglas Harpoon anti-ship missiles (eight)* **3** *ASROC Mk 112 eight-cell launcher* **4** *NEC NOLQ-6C ESM (radar intercept)* **5** *JRC OPS-28 surface search radar* **6** *MELCO OPS-14C air search radar* **7** *Type 2-21 fire-control system* **8** *OTOBREDA 76 mm (3 in)/62 Compact* **9** Triple Type 68 324 mm tubes (total: six)

GENERAL SPECIFICATIONS

Country: Japan

Class: ABUKUMA

Active: 6

Displacement
standard: 2,050 t
full load: 2,550 t

Dimensions
Length: 109 m (357.6 ft)

Beam: 13.4 m (44 ft)
Draught: 3.8 m (12.5 ft)

Speed: 27 kts

Complement: 120

SHIPS

ABUKUMA (DE 229)
Builder Mitsui, Tamano, Japan
Laid down 17 Mar 1988
Launched 21 Dec 1988
Commissioned 12 Dec 1989

JINTSU (DE 230)
Builder Hitachi, Maizuru, Japan
Laid down 14 Apr 1988
Launched 31 Jan 1989
Commissioned 28 Feb 1990

OHYODO (DE 231)
Builder Mitsui, Tamano, Japan
Laid down 8 Mar 1989
Launched 19 Dec 1989
Commissioned 23 Jan 1991

SENDAI (DE 232)
Builder Sumitomo, Uraga, Japan
Laid down 14 Apr 1989
Launched 26 Jan 1990
Commissioned 15 Mar 1991

CHIKUMA (DE 233)
Builder Hitachi, Maizuru, Japan
Laid down 14 Feb 1991
Launched 22 Jan 1992
Commissioned 24 Feb 1993

TONE (DE 234)
Builder Sumitomo, Uraga, Japan
Laid down 8 Feb 1991
Launched 6 Dec 1991
Commissioned 8 Feb 1993

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84B Harpoon

There are eight Harpoon missiles in two groups of four launcher-containers at the forward end of the flight deck. This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns and, for the terminal phase, can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications

Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 kg)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN s.t
Booster: Thiokol or Aerojet rocket; 5,400 kg (11,905 lb) thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

ANTI-SUBMARINE MISSILES

Honeywell RUR-5A ASROC

The 'Abukuma' class has a single, eight-cell Mk 112 ASROC launcher amidships, but without a magazine beneath it. ASROC is a Mk 46 torpedo with strap-on aerodynamic surfaces and a rocket motor to enable it to fly to within range of its submarine target. Attached to the rear end of the torpedo is a short airframe assembly of clam-like construction, held together by a steel band, with a Naval Propulsion Plant solid propellant booster and four trapezoidal aerodynamic surfaces to provide stability in flight. The torpedo has a dome-shaped frangible plastic nose cap to protect the transducer as it enters the water. Payload is an Alliant Mk 46 Mod 5 torpedo, which has a seeker designed specifically to detect most types of target including submarines with anechoically coated hulls and has an estimated acquisition range of 460 m (1,509 ft).

When a submarine target is detected it is tracked and the attack console's fire-control computer predicts the target's position. The launcher is turned in the appropriate direction and elevated to an angle appropriate to the range. The fire-control computer then orders the launch and the booster burns for a programmed time of between 1 and 4 seconds, by which time the missile will have reached a height of between 60 (197) and 305 m (1,000 ft), although the aerodynamically stable airframe enables it to coast up to 600 m (1,968 ft). On reaching the programmed position, an explosive bolt cuts the steel band holding the airframe assembly sections together and, as they separate, the parachute deploys to retard the torpedo's fall, water entry taking place some 14 to 50 seconds after launch. As the torpedo enters the water the frangible nose cap breaks off and the torpedo begins its search for the target using a predetermined pattern.

Specifications

ASROC missile
Length: 4.6 m (15.1 ft)
Diameter: 32.5 cm (12.8 in)
Span: 84.5 cm (33.3 in)
Weight: 435 kg (959 lb)
Range: 0.86-5.39 n miles (1.6-10 km)
Speed: Mach 0.9

Mk 46 Mod 5 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor

Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Manufacturer/Contractor
Loral Defense Systems, Akron, Ohio, USA.

TUBES

Two triple 324 mm Type 68 torpedo tubes are sited either side of the after deckhouse. This is a US Mk 32 equipment, manufactured under licence in Japan.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 (Neartip) 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Compact
There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications
Calibre: 76.2 mm (3.0 in)
Barrel length: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Hughes Mk 15 CIWS Phalanx
There is one Hughes Mk 15 Phalanx close in weapons system (CIWS) situated on the afterdeck. The mount consists of a 20 mm M61A1 Vulcan, six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications
Gun
Calibre: 20 mm
Barrel length: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min (Block 0, Block 1 Baseline 0), 4,500 rds/min (Block 1 Baseline 1)
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA (systems).

Japanese frigate Chikuma *(DE 233) of the 'Abukuma' class* (Hachiro Nakai)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

NEC NOLR-6C
NOLR-6C is a radar intercept system, which was developed from the NOLR-5 in order to counter anti-ship missiles. It uses two rotating DF antennas to cover the main radar frequencies, with a circular dipole array mounted on the foretop to carry out direction-finding in the VHF and UHF bands. It uses electronic scanning. It is reported to be similar in many respects to the US Navy's AN/WLR-8.

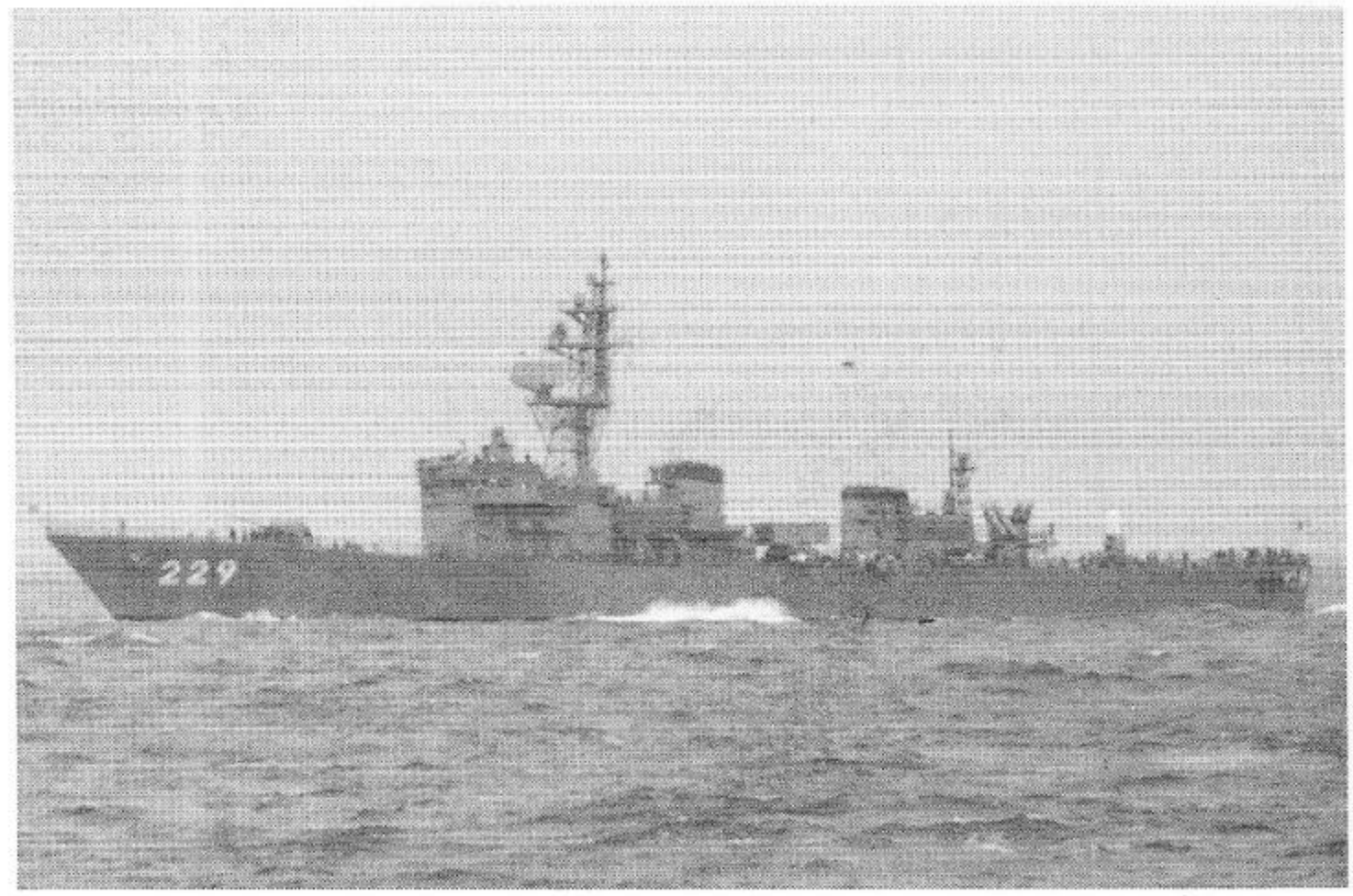
ELECTRONIC COUNTERMEASURES (ECM)

Fujitsu OLT 3
All ships are fitted with the OLT-3 jammer.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled chaff launchers
There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)



Abukuma *(DE 229)*

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

OYQ-6 action data automation

OYQ-6 is similar to the earlier OYQ-3 but has a Link 11 capability, enabling it to exchange encrypted digital data over HF and UHF links.

COMMUNICATIONS AND DATALINKS

Data links: Link 11
Satcom

WEAPONS CONTROL

Mitsubishi GFCS Type 2-21

The ships are fitted with a Mitsubishi Electric GFCS Type 2-21 (also known as the Type 79) to control the fire of the OTOBREDA 76 mm gun. The radar director operates in the I/J band.

RADARS

Mitsubishi OPS 14B

OPS-14B is a B/C-band air search radar. Peak power is 400 kW and beamwidth is 5°.

Manufacturer/Contractor

Mitsubishi Electric Corporation (MELCO), Tokyo, Japan.

JRC OPS 28

OPS-28 is a surface search and short-range air search radar, operating in the G- and H-bands.

Type 2-21

The fire-control radar is the Type 2-21 operating in the I/J band.

SONAR

Hitachi OQS-8

OQS-8 is a relatively new, Japanese-designed, hull-mounted, active search and attack sonar, operating at medium frequencies.

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 Rolls-Royce Spey SM1A gas turbines; 19.9 MW (26,650 hp) sustained; 2 Mitsubishi S12U-MTK diesels; 4.4 MW (6000 hp(m))
Shafts: 2
Propellers: 2 Kawasaki-Escher Wyss five-bladed, 3,550 mm diameter propellers

FURTHER INFORMATION

PROGRAMME

The first pair of this class was approved in the 1986 estimates, ordered in March 1987, and entered service in 1989/90. These were followed by four more, the last of which was commissioned in 1993.

DESIGN

These ships show the growth that seems an inevitable part of modern naval development and whereas previous Japanese destroyer escorts were quite small, the 'Abukuma' class is virtually the same size as the British 'broad-beamed Leander' and the US 'Bronstein' classes.

The Japanese ships feature some early 'stealth' features, such as sloping surfaces which would otherwise have been vertical and rounding corners.

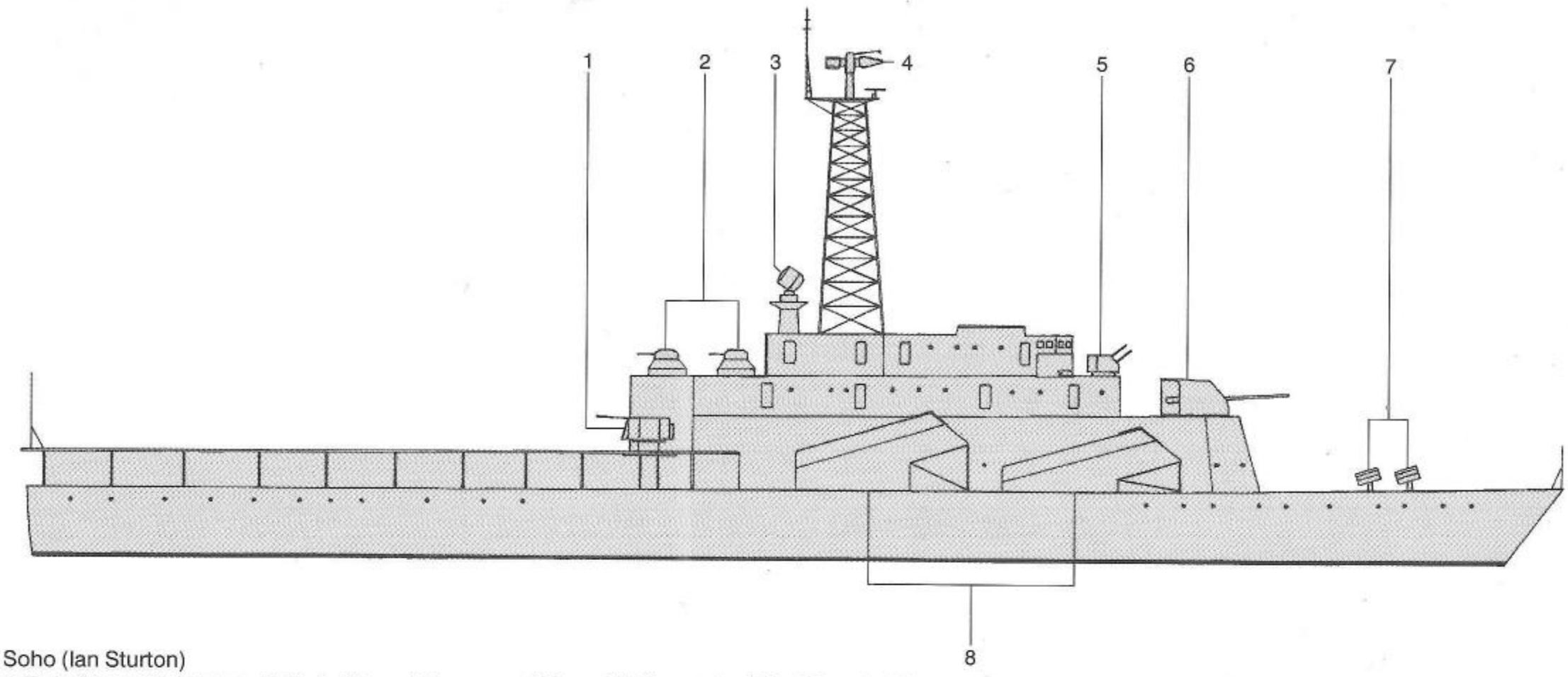
NAMES

All ships in this class carry names last used for cruisers in the Imperial Japanese Navy in the Second World War.

MODERNISATION

Improvements to the class are scheduled to include:
SQR 19A towed passive array
RAM PDMS

SOHO



Soho (Ian Sturton)

1 *Twin 37 mm/63 cannon* **2** *Twin 30 mm/65 cannon* **3** *Drum Tilt fire control (for 30 mm)* **4** *Square Tie surface search radar* **5** *Twin 25 mm/60 cannon* **6** *Single 100 m (3.9 in)/56* **7** *RBU-1200 fire tube anti-submarine/torpedo rocket launcher* **8** *CSS-N-2 Styx anti-ship missile*

GENERAL SPECIFICATIONS

Operator: Korea, Democratic People's Republic

Class: SOHO

Built: 1
Active: 1

Displacement:
standard: 1,600 t
full load: 1,845 t

Dimensions
Length: 75 m (246 ft)

Beam: 15 m (49.2 ft)
Draught: 3.8 m (12.5 ft)

Speed: 23 kts

Complement: 190

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

P-15 (SS-N-2a 'Styx') medium-range anti-ship missile

The principal armament of the Soho ship is the P-15 (NATO = SS-N-2a 'Styx') missile with two single launch-bins one behind the other on either side of the bridge structure. There are no reloads. The probable reason for using this very elderly missile is that North Korea has many of them in service aboard its numerous FACs.

Specifications

SS-N-2A
Length: 5.8 m (19.0 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.9 ft)
Speed: Mach 0.9
Weight (without booster): 2,300 kg (5,071 lb)
Warhead: 454 kg (1,000 lb) hollow-charge
Fuzes: Impact, proximity
Range: 3-24 n miles (5.5-45 km)
Guidance: Autopilot with active radar (supplemented in some with IR)

Manufacturer/Contractor

Raduga, Moscow, Russia.

GUNS

100 mm (3.9 in) L/70 gun

One Russian-pattern 100 mm (3.9 in) L/70 gun is in a turret on the foredeck. This weapon fires at 15 rounds per minute and is water-cooled, the hose running along the left of the barrel to the water reservoir, which is on the left of the mounting. The weapon fires fixed rounds, probably using a drum feed, with a total of about 80 rounds on the mounting. The turret is unmanned. There is an electro-optic sensor at the front to the left of the elevating mass and the L/70 is associated with the Kite Screech, G/I-band fire-control radar. It is probable that the radar compartment for this sensor also acts as the fire-control centre.

Specifications

Calibre: 100 mm (3.9 in)
Length of barrel: 70 calibres
Muzzle velocity: 850 m/s (2,789 ft/s)
Traverse: 360°
Elevation: −10 to +40°
Weight of projectile: 6.8 kg (15 lb)
Weight of complete round: 13.5 kg (30 lb)
Rate of fire: 15 rds/min
Range:
anti-surface: 8 n miles (15 km)
anti-air: 8,000 m (26,248 ft)

37 mm (W-11-M) Mountings

There are two twin 37 mm mounts at main deck level, sited at either side of the after end of the hangar. It seems most probable that these are Chinese-pattern open mounts. The 37 mm gun is a 62.8 calibre (generally referred to as '63 calibre') weapon with a flash suppressor with the barrels enclosed in separate water jackets with exposed spring recuperators, and a hydraulic recoil buffer underneath the barrel. The loading mechanism consists of guides for ammunition, which is in five-round clips, the clips being automatically removed on the loading tray. The first round is loaded manually into the breech. The breech block rises and the gun fires when the firing pin strikes the cartridge percussion cap. Upon recoil, the breech block opens and extractor arms propel the case along the loading tray and down an ejection chute. The recoil forces activate the loading mechanism and allow following rounds to be rammed automatically into the breech.

Specifications

Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 886 m/s (2,907 ft/s)
Traverse: 360° at 17°/s
Elevation: −10 to +85° at 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,843 ft)
Crew: 3

Ammunition (HE-T)
Projectile weight: 708 g (25 oz)
Explosive charge: 36 g (1.27 oz) (RDX/aluminium)

2-M-3 25 mm/60 (quad)

There are two twin 25 mm mounts immediately in front of the bridge. In the 2-M-3 mount the two guns are positioned one above the other in separate cradles and mounted on their sides so that they can be fed from their sides, which in the case of the Type 61 is the right-hand side. The 1.5 m (4.9 ft) long air-cooled barrels have a flash suppressor and an exposed spring recuperator wrapped around the barrel near the breech, with a hydraulic recoil buffer on the underside.

Specifications

2-M-3
Calibre: 25 mm
Length of barrel: 60 calibres
Traverse: 360° at 25°/s
Elevation: −10 to +85°at 15°/s
Rate of fire: 450 rds/min/barrel
Projectile: 0.28 kg HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,187 ft)

ANTI-SUBMARINE MORTARS

RBU 1200

There are two RBU 1200 ASW rocket launchers in the bows. RBU 1200 is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either

side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm, is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (75 lb) warhead and a range of about 0.8 n miles. The RBU 1200 is associated with the old short-range HF (25-30 kHz), 'searchlight' attack sonar which was given the NATO codename Stag Ear and has the Soviet designation Tamir.

Specifications
RBU 1200
Calibre: 250 mm
Tubes: 5
Elevation: +65°
Warhead: 34 kg (75 lb)
Range: 0.8 n miles (2.7 km)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

RW-23 Jug Pair (Watch Dog)
There are two small domes which are designated Jug Pair under the US Navy system, and appear to be a Chinese-produced version of the Russian Watch Dog radar warning equipment.

COMMAND AND CONTROL SYSTEMS

RADARS

Type 254
The search radar is the Type 254, an I-band (8-10 GHz) set which appears to be a Chinese copy of the Russian Square Tie radar. Type 254 is characterised by an elliptical parabolic array, which is illuminated by an overhung horn feed. Maximum range is estimated to be approximately 70 n miles (130 km).

Drum Tilt
Drum Tilt is the H/I band radar used in the fire-control system for the 30 mm guns. Normally there is one Drum Tilt to each pair of AK-630s, but it appears that in this ship the single Drum Tilt controls both pairs.

Kite Screech
The 100 mm mount requires a Kite Screech gun control system unless it is fired under local control. This is a G/I-band radar which appears to incorporate monopulse tracking. It features a circular dish antenna, with central feed, behind which are transmitter, receiver, turning and stabilisation gear housings. All are mounted upon a pedestal which is about 2 m (6.5 ft) high. It could well be that the radar compartment for this sensor also acts as the fire-control centre.

AVIATION

AVIATION FACILITIES

Flight deck: There is a very large flight deck approximately 29 × 15 m (96 × 51 ft)

HELICOPTERS

The platform is reported to be used by one medium helicopter although it seems large enough to operate two smaller helicopters without any great difficulty.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 diesels; 11.03 MW (15,000 hp(m))
Shafts: 2

FURTHER INFORMATION

PROGRAMME

One of the characteristics of failing regimes seems to be a desire to build grandiose warships for which there is little strategic or tactical justification. Examples are the Romanian 'Marasesti' class and the Russian 'Kirov' class, both dubbed 'battlecruisers'. The North Korean equivalent is this 'Soho' class twin-hulled frigate. It is a matter for speculation as to why such a small navy, operating a large number of very elderly fast attack craft, should seek to build such an unusual design.

The ship was built at the naval yard at Najin. It was laid down in June 1980, launched in November 1981 and commissioned in May 1982.

DESIGN

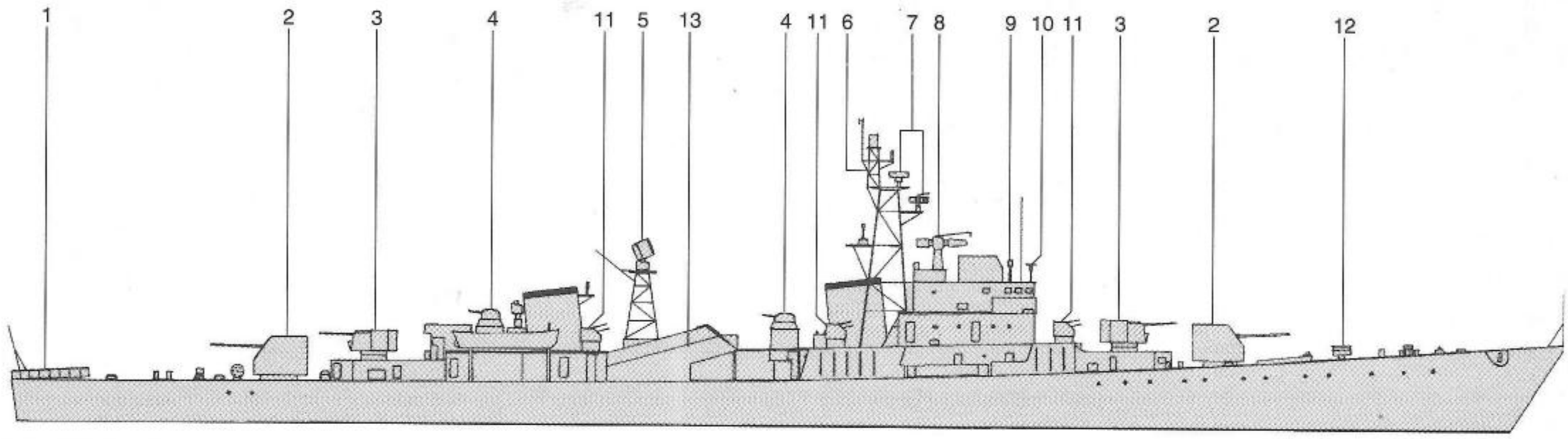
This is by no means the largest twin-hull ship in service; the US Military Sealight Command's 'Victorious' class AGOS is about the same size and the 'Impeccable' class AGOS is rather larger. But, the Soho is certainly one of the largest twin-hull warships yet built.

The weapon fit is bizarre and is essentially a collection of the elderly weapons already available to the North Korean Navy — SS-N-1; 100 mm guns; 37 mm and 30 mm cannon; and RBU-1200s — which would be of limited use in any modern naval engagement. In addition, the sensors would have little effect in a contemporary ECM/ECCM environment. The one possible tactical justification for the design is the large helicopter deck aft, although North Korea has few helicopters and virtually no experience of operating them at sea.

DEPLOYMENT

It is reported that this vessel is now spending more time at sea, suggesting that earlier problems may have been resolved.

NAJIN



Najin 531 (Ian Sturton)
1 *Depth-charge racks* **2** *100 mm (3.9 in)/56 single mounts* **3** *ZIF-72 57 mm/75 twin mountings* **4** *AK-230 30 mm/65 twin mountings* **5** *Drum Tilt fire control (for AK-230)* **6** *Watch Dog ESM* **7** *Pot Head surface search radar* **8** *Square Tie air search radar* **9** *Optical director* **10** *Navigation radar* **11** *Quad 14.5 mm machine guns* **12** *RBU-1200 anti-submarine/torpedo rocket launchers* **13** *CSS-N-1 Styx anti-ship missiles*

GENERAL SPECIFICATIONS

Operator: Korea, Democratic People's Republic

Class: NAJIN

Built: 2
Active: 2

Displacement
full load: 1,500 t full load

Dimensions
Length: 102 m (334.6 ft)
Beam: 10 m (32.8 ft)
Draught: 2.7 m (8.9 ft)

Speed: 24 kts
Range: 4,000 n miles at 13 kts

Complement: 180

SHIPS

531 631

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

P-15 (SS-N-2a 'Styx') medium-range anti-ship missile

The principal armament of the 'Najin' class is the P-15 (NATO = SS-N-2a 'Styx') missile with two single launch-bins one behind the other on either side of the bridge structure. There are no reloads. The probable reason for using this very elderly missile is that North Korea has many of them in service aboard its numerous FACs.

Specifications
SS-N-2a
Length: 5.8 m (19.0 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.9 ft)
Speed: Mach 0.9
Weight (without booster): 2,300 kg (5,071 lb)
Warhead: 454 kg (1,000 lb) hollow-charge
Fuzes: Impact, proximity
Range: 3-24 n miles (5.5-45 km)
Guidance: Autopilot with active radar (supplemented in some with IR)

Manufacturer/Contractor
Raduga, Moscow, Russia.

Najin *No: 531. These ships carry many weapons but virtually all mounts are open and fire-control arrangements minimal. Their combat potential must, therefore, be very low* (JMSDF)

GUNS

100 mm (3.9 in) L/56 gun

Two Russian-pattern 100 mm (3.9 in) L/56 guns are mounted in turrets in 'A' and 'Y' positions. This weapon fires at 15 rounds per minute. The weapon fires fixed rounds, probably using a drum feed, with a total of about 80 rounds on the mounting.

Specifications
Calibre: 100 mm (3.9 in)
Length of barrel: 56 calibres
Muzzle velocity: 900 m/s (2,952 m/s)
Traverse: 360°
Elevation: −10 to +85°
Weight of projectile: 6.31 kg (13.9 lb)
Rate of fire: 15 rds/min
Range:
anti-surface: 8.5 n miles (15.7 km)
anti-air: 15,000 m (26,248 ft)

57 mm twin L/75 (ZIF-72/AK 725)

There are two twin 57 mm L/75 mountings in open mounts in 'B' and 'X' positions. This Russian weapon was designed for prolonged air defence engagements, but can also be used against seaborne and land targets. The 4.275 m (14 ft) long barrels are water cooled and the mounting consists of the elevating mass with two automatic weapons and the cradle, the rotating structure for the elevating mass with gun drives, firing system and other elements, all on a slip ring with two arrays of ball-bearings. Below decks are the ammunition handling system and the magazine.

The 550-round linked belt is initially threaded into the feeder mechanism by hand and is advanced by the cocking mechanism; thereafter, the hydraulic mechanism takes over. The feeder system is capable of operating in bursts or in a sustained form with automatic interruption when only 50 rounds remain in the belt. Each round weighs 6.61 kg (14.6 lb) and the feeder mechanism has 15 rounds per barrel within the turret.

Specifications
Length of barrel: 75 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Traverse: ±200°
Elevation: −10 to +85°
Range:
anti-surface: 3.25 n miles (6 km)
anti-air: 6,000 m (19,686 ft)
Rate of fire: 120 rds/min/barrel
Projectile weight: 6.61 kg (14.6 lb)
Power requirements: 220 or 380 V, three phase

30 mm/65 AK-230 close in weapons system

There are two 30 mm Gatling-type AK-230, one abaft each stack. These have five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore.

Specifications
Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 2
Muzzle velocity: 1,050 m/s (3,440 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: ±100° at 55°/s
Crew: 1 (off mount)
Range: 4,000 m (13,120 ft) (radar fire control), 5,000 m (16,400 ft) (electro-optic fire control)
Rate of fire: 400-480 rds/min

14.5 mm KPV heavy machine gun

There are 12,14.5 mm KPV heavy machine guns in six twin mounts. The KPV (Vladimirov Heavy Machine Gun) was designed during the Second World War but is still an effective short-range weapon. It is short-recoil operated with gas assistance supplied by a muzzle booster. The body is a simple metal cylinder to which various attachments are riveted. The barrel is chromium plated with a flash suppressor. API, API-T and I-T rounds are available.

Specifications
KPV
Weight: 49.1 kg (108 lb)
Length: 2 m (6.5 ft)
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 600 rds/min (cyclical)

DEPTH CHARGES

There are two projectors and two racks for depth charges.

MINES

North Korea makes considerable use of mines both on land and at sea, and these ships are capable of carrying up to 30 mines.

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

IFF: Ski Pole

WEAPONS CONTROL

There is an optical director on the bridge roof. No details are available.

RADARS

Slim Net

Slim Net is an E/F band (2,840 MHz) set, which is used for both air and surface search. In the (then) Soviet Navy it was mounted on many 1950/1960-vintage destroyers, frigates and corvettes.

Pot Head

Pot Head is an I-band surface search radar, operating in the I-band (9,275 - 9,460 MHz). The antenna is mounted in a large diameter, low-height radome.

Pot Drum

Pot Drum is generally similar to Pot Head and appears to be used in this instance as a navigation radar.

Drum Tilt

There is one 'Rys' (NATO = Drum Tilt) fire-control system for the AK-230. This is an I/J-band system with a pedestal-mounted director whose antenna is in a weatherproof container and is mounted atop a small tower just forward of the after stack. Maximum acquisition range is approximately 22 n miles (40 km).

SONAR

There is a hull-mounted, active search, high-frequency sonar.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 diesels; 11.03 MW (15,000 hp(m))
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These two ships entered service in the early 1970s. Built at Najin and Nampo shipyards. First completed 1973, second 1975.

DESIGN

Apart from the two SS-N-2 missiles, which are 1950s-vintage weapons, these two ships are essentially designed to Second World War concepts. They are certainly heavily armed but the weapons are short ranged, most of the mounts are open, giving the gun crews scant protection, and the fire-control arrangements appear to be non-existent.

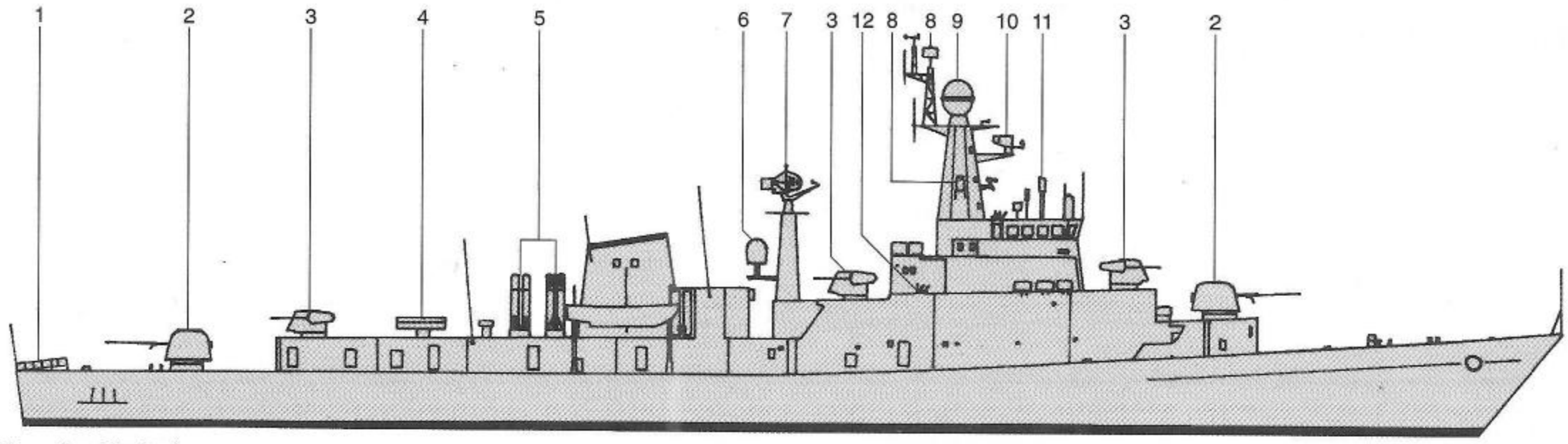
One extraordinary feature is that the two SS-N-2A launchers are fixed and face forwards. Thus, the slightest deviation in the first 50 m (164 ft) would result in a major disaster; indeed, the bridge wing appears to be actually within the flight path, which might affect the captain's wish to use the weapon.

There is some resemblance to the 'Kola' class, which was built for the (then) Soviet Navy in the early 1950s. The dimensions are very similar, as is the weapon fit, the main difference being that the Kolas were powered by steam turbines, while these Korean ships are diesel-powered.

MODERNISATION

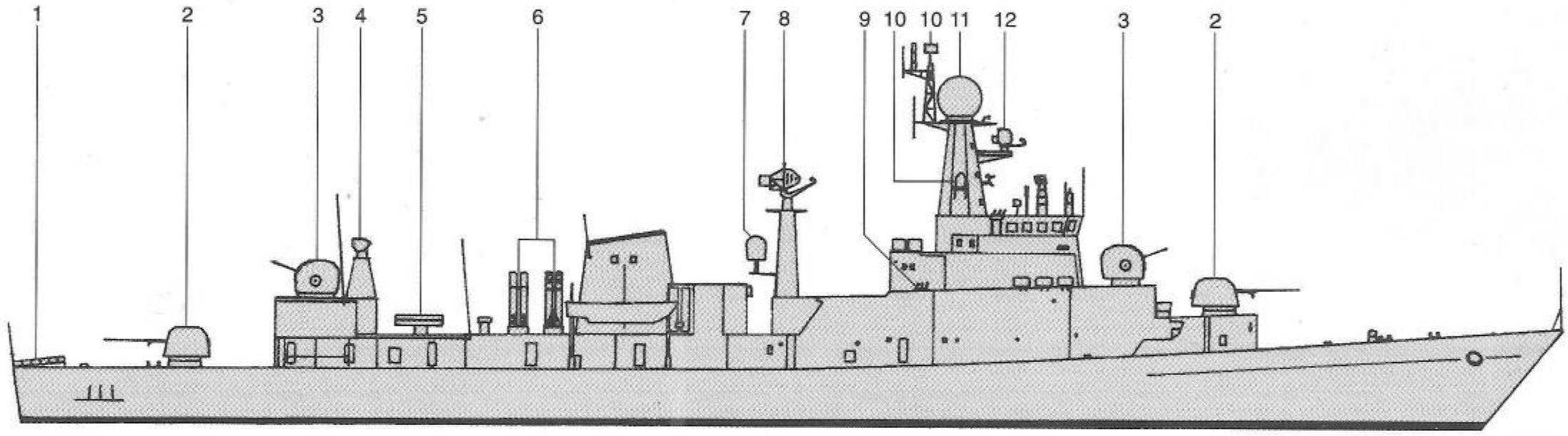
The weapons fits in these ships have varied over their years of service. The original torpedo tubes were first replaced by trainable Styx missile launchers and then by the present fixed mounts. The various lighter guns have been changed repeatedly and the RBU 1200 mortars have been removed in at least one of the class.

ULSAN



Ulsan (Ian Sturton)

1 *Depth charges* **2** *OTOBREDA 76 mm (3 in)/60 Compact* **3** *ESCO twin 30 mm cannon* **4** *Triple Mk 32 324 mm torpedo tubes* **5** *McDonnell Douglas Harpoon anti-ship missiles (eight)* **6** *Satcom* **7** *Signaal DA 05 air/surface search* **8** *Goldstar ULQ-11K radar intercept* **9** *Signaal WM28 fire-control radar* **10** *Signaal ZW06 surface search radar* **11** *Signaal LIROD electro-optic director* **12** *Two Loral Hycor Mk 36 SRBOC chaff/IR launchers*



Che Ju (Ian Sturton)

1 *Depth charges* **2** *OTOBREDA 76 mm (3 in)/62 Compact* **3** *OTOBREDA twin 40 mm/70 (Fast Forty)* **4** *GEC-Marconi ST1802 fire director* **5** *Triple Mk 32 324 mm torpedo tubes* **6** *McDonnell Douglas Harpoon anti-ship missiles* **7** *Satcom* **8** *Signaal DA05 air/surface search radar* **8** *Two Mk 36 six-barrel Loral Hycor SRBOC Chaff/IR launchers* **10** *Gold Star ULQ-11K radar intercept* **11** *GEC-Marconi S1810 surface search radar* **12** *Raytheon SPS 10C navigation radar*

GENERAL SPECIFICATIONS

Operator: Korea, Republic

Class: ULSAN

Built: 9
Active: 9

Displacement:
light: 1,496 t
full load: FF 951 to FF 956: 2,180 t;
FF 957 to FF 961: 2,300 t

Dimensions
Length: 102.0 m (334.6 ft)

Beam: 11.5 m (37.7 ft)
Draught: 3.5 m (11.5 ft)

Speed: 34 kts; 18 kts (diesels)
Range: 4,000 n miles at 15 kts

Complement: 150 (16 officers)

SHIPS

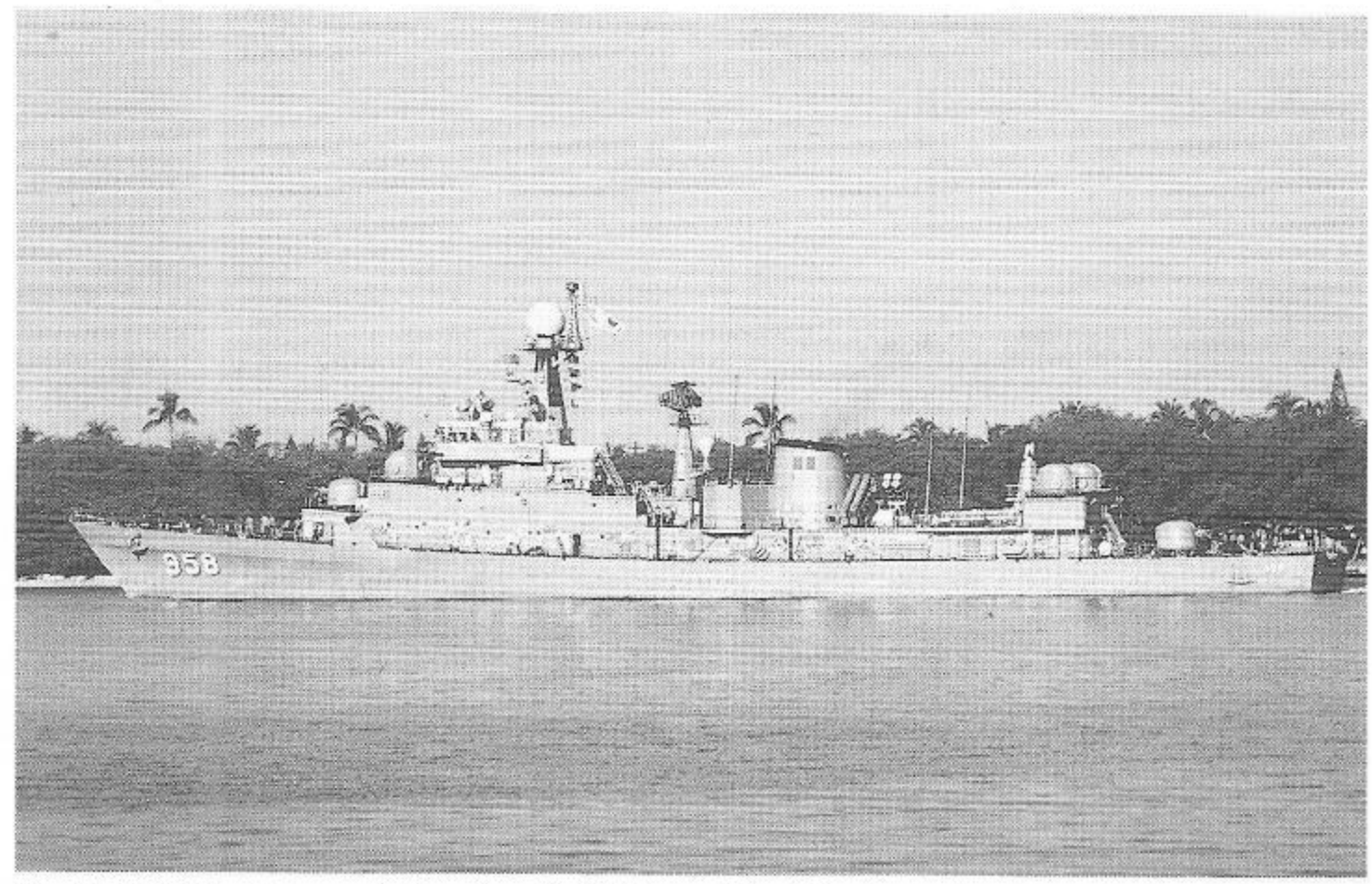
ULSAN (FF 951)
Builder Hyundai, Ulsan, South Korea
Laid down 1979
Launched 8 Apr 1980
Commissioned 1 Jan 1981

SEOUL (FF 952)
Builder Hyundai, Ulsan, South Korea
Laid down 1982
Launched 1984
Commissioned 30 Jun 1985

CHUNG NAM (FF 953)
Builder Korean SEC, Pusan, South Korea
Laid down 1984
Launched 1985
Commissioned 1 Jun 1986

MASAN (FF 955)
Builder Korea Tacoma, Masan, South Korea
Laid down 1983
Launched 26 Oct 1984
Commissioned 20 Jul 1985

KYONG BUK (FF 956)
Builder Daewoo, Okpo, South Korea



Che Ju *(FF 958), a Korean-designed and built frigate of the 'Ulsan' class* (H & L van Ginderen Collection)

Laid down 1984
Launched 15 Jan 1986
Commissioned 30 May 1986

CHON NAM (FF 957)
Builder Hyundai, Ulsan, South Korea
Laid down 1986
Launched 19 Apr 1988
Commissioned 17 Jun 1989

CHE JU (FF 958)
Builder Daewoo, Okpo, South Korea
Laid down 1986
Launched 3 May 1988
Commissioned 1 Jan 1990

BUSAN (FF 959)
Builder Hyundai, Ulsan, South Korea
Laid down 1990
Launched 20 Feb 1992
Commissioned 1 Jan 1993

CHUNG JU (FF 961)
Builder Daewoo, Okpo, South Korea
Laid down 1990
Launched 20 Mar 1992
Commissioned 1 Jun 1993

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84B Harpoon

Eight Harpoon anti-ship missile canisters are mounted immediately abaft the stack. The missiles are the Block 1C version with additional options, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications

Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

TUBES

Six 324 mm US Mk 32 torpedo tubes in two triple mounts are located on the after superstructure aft of the Harpoon launchers.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

Manufacturer/Contractor

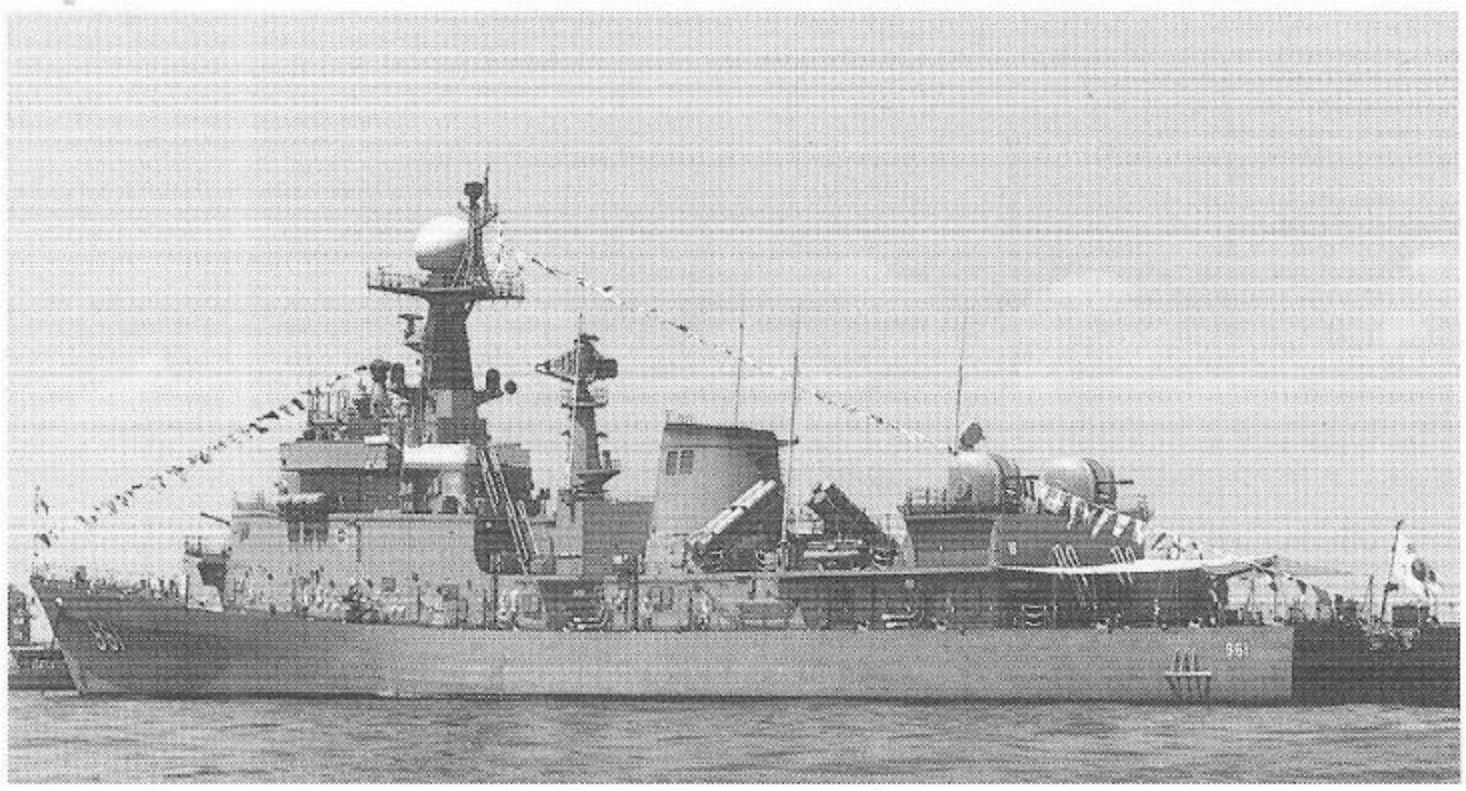
GEC-Marconi Naval Systems, UK.

TORPEDOES

Specifications

Mk 46 Mod 1 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Masan *(FF-955). The fairleads in the transom are for Nixie torpedo decoys. The gun on the quarterdeck is an OTOBREDA 76 mm/62 Compact and behind it (underneath the temporary canopy) is a ESCO (formerly Emerson Electronic) twin 30 mm with the gunner's cabin between the two guns* (Jane's/HM Steele)



Chung Ju *(FF 961). Last of the class of nine,* Chung Ju *has revised armament. The ESCO twin 30 mm has been deleted and replaced by two twin OTOBREDA 'Fast Forties' and a GEC-Marconi ST 1802 fire director, all mounted atop a new deckhouse* (H & L van Ginderen Collection)

Manufacturer/Contractor
Loral Defense Systems, Akron, Ohio, USA.

GUNS

OTOBREDA 76 mm (3 in)/62 Compact
There are two OTOBREDA 76 mm (3 in) guns sited in the 'A' and 'Y' positions for use in either air defence or anti-surface roles. If the weapon is designated to the air defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications
Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ESCO 30 twin 30 mm mounting
FF 951 to FF 953 and FF 955 only. The first four ships carry four twin ESCO 30—30 mm cannon: one immediately before the bridge, two in the waist and one aft in 'X' position. The ESCO 30 is a twin 30 mm, 70 calibre weapon designed for air defence, surface engagement and anti-missile operations, using either local or remote control.

The ESCO 30 employs two Oerlikon KCB positively locked, gas-operated cannon with a cabin between them, and forward of the elevating mass. Behind the cabin, and in a sealed compartment, are the elevating and training drives together with flexible chutes to channel ammunition from the magazine.

The gunner's cabin is equipped with a daylight reflex, or an image-intensifier, sight, together with gyro-assisted line of sight stabilisation. Ready-use ammunition is stored in an integral, below-deck, drum magazine with a capacity of 985 rounds for each barrel in a continuous, disintegrating-link belt. These are transferred to the guns through separate chutes by means of electrically operated drives which automatically respond to the individual demand for ammunition supply. Normally, the mount uses ship's power supplies, but this is backed up by an on-mount battery, providing sufficient power to fire a full complement of ammunition, and, finally, there is the traditional hand-crank mechanism operated by the gunner.

Specifications
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Traverse: 360° at 80°/s
Elevation: −15 to +80° at 80°/s
Crew: 1
Range: 3.25 n miles (6 km) (anti-ship) (max)
Rate of fire: 600 rds/min/barrel (nominal) or 140 rds/min/barrel (nominal)
Ammunition: 870 g (HEI/HEI-T, SAPHEI, TP/TP-T)

Manufacturer/Contractor
Electronics & Space Corporation (ESCO), St Louis, Missouri, USA.

OTOBREDA 40 mm L/70 Compact (Type 70) twin mounting
FF 956 to FF 959 and FF 961 only. The last five ships are armed with three twin OTOBREDA 40 mm/70 in place of the ELCO 30: one mount is in 'B' position and two are side by side atop a new after deckhouse, which is considerably higher than in the first four ships, possibly to give the 40 mm mounts a better field of fire.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 600 rds/min/mount
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

DEPTH CHARGES

There is a rack in the stern for 12 depth charges.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Goldstar ULQ-11K
ULQ-11K is a South Korean radar intercept (ESM) equipment. (This would appear to be a South Korean designation and unrelated to the United States' AN/ULQ-11 equipment (also known as Cefirm Leader), which is a US Army system, involving RU-21 aircraft.)

DECOYS

Loral Hycor SRBOC
There are four Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm
Weight: 173 kg (381.4 lb)
Range: 4 km (2.2 n miles)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiran III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturer/Contractor
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

AN/SLQ-25 Nixie noisemaker
One AN/SLQ-25 Nixie (Phase 1), a soild-state, modular design electro-acoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. The two ports are in the starboard side of the transom. Nixie consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system

Che Ju *(FF 958). The two black radomes immediately above the bridge are part of the ULQ-11K ESM system* (Jane's/H M Steele)

include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom or in a partially or totally enclosed location on the main deck. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm long (3.10 ft), 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body is deployed at a time.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Signaal WM28 'mini' command system
FF 951 to FF 953, FF 955 to FF 956. The first five ships have a 'mini' command system based on an expansion of the Signaal WM28 fire-control system (a similar system is installed in South Korean 'Corvette' classes). The system includes a LIROD electro-optic director.

Samsung/Ferranti WSA 423 action data automation
FF 957 to FF 959, FF 961 only. The last four ships of the 'Ulsan' class have the Ferranti/Samsung WSA 423 command and weapon control system in place of the earlier Signaal system. This system has a federated architecture based upon a single FM1600E computer and the associated radars are the GEC-Marconi S1801 search radar and the GEC-Marconi ST1802 fire-control radar, together with a Radamec 2400 electro-optic director.

The Ferranti FM1600E is a 24-bit computer, with an operating speed of 650 Kops (thousand operations per second) and a memory of 1.2 million words, and in this federated system there is one computer housed in each console. Programming is carried out using Coral 66.

WSA 423 controls two types of gun (76 mm and 40 mm) and the Harpoon anti-ship missile. The system can track up to 120 targets of which up to 100 are automatic and is compatible with Link Y and Link 14. It is also capable of ECM direction and helicopter control.

Three 'Ulsan' class vessels have supplemented their WSA 423 systems with the Litton Tactical Display Console (TDC) as part of the Korean Navy Tactical Data System (KNTDS). The TDC will be capable of receiving, processing and displaying data from the KNTDS and Link 11 systems and transmitting data through either link.

Manufacturers/Contractors
Ferranti International Plc, Defence Systems Integration.
Samsung, Seoul, South Korea

Korean Naval Tactical Data System (KNTDS)
Three ships only. The Korean Naval Tactical Data System (KNTDS) is not, as the name suggests, an action data automation system for ships at sea, but is a national, joint-service system for seaward defence against infiltration operations, particularly from North Korea. KNTDS is designed to improve naval and coastal defence through the real-time exchange of tactical information among various land-based and shipboard sensors. A shore-based command centre co-ordinates the system, providing the co-ordination necessary to bring the most effective response to bear on the enemy. To achieve this, the system collects, analyses, evaluates and displays tactical information from radar sites, warships, patrol aircraft and the national Air Defence Ground Environment (ADGE) system to assist the commander in making decisions. The KNTDS also exchanges evaluated track information with participating naval units and provides a medium for ordering or commanding naval forces and tactical air and weapon systems in accomplishing the mission.

The seaborne element of KNTDS are three 'Ulsan' class frigates, each of which has one KNTDS console and is linked via Link 11 to the Fleet Command Centre (FCC) ashore, where there are seven consoles. The frigates lead groups of smaller craft in carrying out their mission to detect and intercept small coastal craft trying to penetrate South Korean coastal waters. Five shore-based radars, the main air control centre and the South Korean marines also feed the FCC over two systems: Link 11 and the high-frequency Inter-Site DataLink (ISDL). (It is not known which are the three ships fitted with KNTDS, but presumably they are included in the four ships fitted with WSA 423.)

Manufacturers/Contractors
Litton Data Systems, Agoura Hills, California, USA.
Samsung, Seoul, South Korea.

RADARS

FF 951 to FF 953, FF 955, FF 956.

Type	DA-05	ZW-06	WM28
Maker	Signaal	Signaal	Signaal
Role	Air/surface search	Surface search/ navigation	Fire control
Band	E/F	I	H/I
Beam	1.5 × 8°	0.9 × 19°	1.5 × 4/7° (search) 2.4° (track)
Peak power	1,200 kW	60 kW	200 kW
Gain	32.2 dB	32 dB	33.5 dB
Pulsewidth	1.3/2.6 µs	0.06/0.6 µs	0.22/4.5 µs
PRF	1,000/500 pps	4,000/2,000 pps	3,600/1,800 pps
Scan rate	10/20 rpm	24 rpm	60 rpm
Typical range	air target: 2 m² at 84 n miles (156 km) at 18,000 m (60,000 ft)	14 n miles (26 km)	25 n miles (46 km)

FF 957 to FF 959, FF 961

Type	DA-05	S 1810	ST 1802	AN/SPS-10C
Maker	Signaal	Samsung/ GEC-Marconi	Samsung/ GEC-Marconi	Raytheon
Role	Air/surface search	Surface search	Fire control	Navigation
Band	E/F	I	I/J	I
Beam	1.5 × 8°	1.1 × cos² 5-30°	2.4°	1.5 × 16°
Peak power	1,200 kW	50 kW	50 kW	500 kW
Gain	32.2 dB	36 dB	37 dB	30 dB
Pulsewidth	1.3/2.6 µs	air search: 1 µs surface search: 0.2 µs	0.67/0.3/1.0 µs	0.25/1.3 µs
PRF	1,000/500 pps	2,000/4,000 pps	Non-MTI: 3,000 pps MTI: 4,000 pps	625-650 pps
Scan rate	10/20 rpm	24 rpm	—	15 rpm
Typical range	air target: 2m² at 84 n miles (156 km) at 18,000 m (60,000 ft)	air: 24 n miles (45 km) small vessels: 16 n miles (30 km)	22 n miles (40 km)	

COMMUNICATIONS AND DATALINKS

Datalinks: Litton Link 11
Tacan: SRN 15

WEAPONS CONTROL

Signaal LIROD electro-optic director
FF 951 to FF 953, FF 955, FF 956. The first five ships (those fitted with the Signaal WM28-based 'mini' command system) have a LIROD (Lightweight Radar Optronic Director) on the bridge roof. LIROD is a lightweight fire-control system based upon a K-band tracking radar and a TV camera, and is designed for simultaneous control of two dual-purpose guns while tracking one air and one surface target. The system reaction time from detection to the beginning of the engagement is about 4.5 seconds. It is based upon a 0.6 m (1.97 ft) diameter parabolic antenna with

monopulse cluster. It has a very narrow pencil beam and is resistant to clutter through the application of pulse Doppler tracking combined with FFT techniques. There are also sophisticated ECCM facilities. The radar can track fighter-size targets up to 18 km away and is capable of tracking targets with a maximum speed of 1,000 m/s (3,280 ft/s). In addition to the radar there is a militarised TV camera with CCIR standard video format, which can detect fighter-size targets at about 5.44 n miles (10 km) and large surface ships at about 10.9 n miles (20 km).

Specifications

Director
Traverse: 360° at 120°/s
Elevation: −25 to +150° at 80°/s
Radar: K-band
Field of view:
TV camera: 3-30° (2-20°)
IR camera: 3°

Laser rangefinder
Pulse length: 20 ns
Max repetition frequency: 10 Hz
Beam divergency: 1.2-1.5 mrad

Laser tracker
Max repetition frequency: 25 Hz
Beam divergency: 1.5 and 6 mrad

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Netherlands.

Radamec System 2400 electro-optic director

FF 957 to FF 959, FF 961. The ships with the Samsung/Ferranti WSA 423 command system have a Radamec 2400 electro-optic director in place of the Signaal LIROD. System 2400 is an electro-optical surveillance system with a stabilised, remotely operated, director. It has a full sector auto-scan facility and is used for target identification. It may be integrated with display systems of the customer's choice. Sensors include the HK 203 low-light TV cameras and a thermal imager. The HK 203 can detect a 10 m² target at 4 km, while the thermal imager can detect such a target at 13-18 km.

Manufacturer/Contractor

Radamec Defence Systems, Chertsey, Surrey, UK.

SONAR

Signaal PHS-32 hull-mounted search and attack sonar system

PHS-32 is a medium-range, high-performance search and attack sonar which includes signal processing facilities for fast Fourier transformation processing of all preformed beam receiving channels. All data are presented on a single TV-type display, while operation has been much simplified by the use of light pen control. The system can track up to four targets automatically. A circular transducer permits all-round coverage in various modes of transmission such as: Omni, TRDT, MCC (wide vertical beam), LISTEN (passive with time/bearing recorder presentation). An audio beam is also available.

Specifications

Frequencies: 3
Pulse lengths: 12.5, 25, 50, 100 ms and 400 ms long pulse (CW or FM)
Detection range: >10,000 yd
Vertical beamwidth: 12 or 20°
Bearing accuracy: 1° RMS
Range accuracy: ±0.5-2%
Notch filtering: Selectable rejection bandwidth
Own Doppler correction: On all 60 channels
Roll and pitch performance: Automatic co-ordination of transmitting pulse and vertical beamwidth in rough weather

Manufacturer/Contractor

Hollandse Signaalapparaten, Hengelo, Netherlands.

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 General Electric LM-2500 gas turbines; 40 MW (53,640 hp) sustained; 2 MTU 16V 538 TB82 diesels; 4/37 MW (5,940 hp(m)) sustained

Shafts: 2
Propellers: Hyundai/Escher Wyss five-bladed, 3,660 mm diameter, cp

FURTHER INFORMATION

PROGRAMME

South Korea has one of the most sophisticated and capable shipbuilding industries in Asia which has followed a policy of steady expansion. The 'Ulsan' class were the first major surface combatants to be designed and built in the country and have proved very successful. They were ordered in three batches and their construction was spread between a number of yards.

DESIGN

This is a well-armed and fast design, intended for a variety of missions. The hull is constructed of steel, with an aluminium alloy superstructure. The design is, in general, well-balanced, although the lack of a helicopter places a limit on their overall tactical capabilities (it should be noted that the 'Ulsan' variant designed for India has a large flight deck and hangar).

The basic design is the same for all nine South Korean ships, but there are a number of variations in weapons and sensor fits:

Weapons. All ships have two 76 mm guns and eight Harpoon launchers. The first four ships, however, have four twin ESCO 30 mm mounts, while the last five have three twin OTOBREDA 40 mm mounts.

Sensors. All have the Signaal DA-05 air/surface search radar, but there are differences in the other sets. The first five ships have Signaal equipment including ZW-06, WM28 and the LIROD electro-optic director. The last four ships, however, have GEC-Marconi sets for surface surveillance and fire direction, a Raytheon set for navigation and a Radamec electro-optic director.

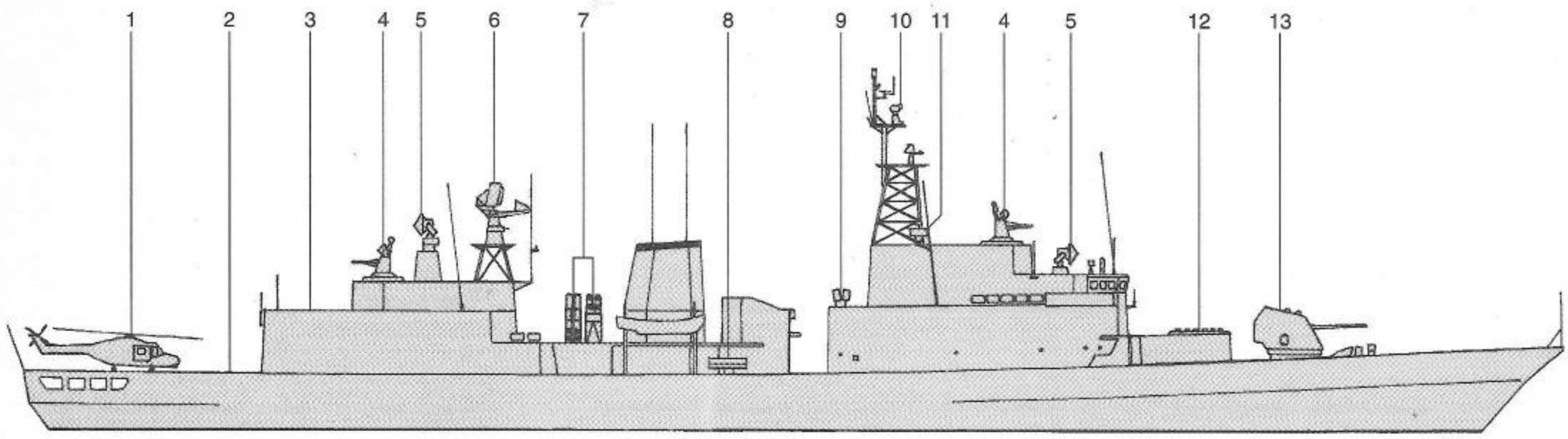
Command systems. The first five ships have a 'mini' command system, based on an expanded version of the Signaal WM28 weapons control system. The last four ships, however, have a Samsung/Ferranti WSA-423 action automation system.

Pennant numbers
It should be noted that the pennant numbers do not run consecutively, there being no 954 or 960. The two missing numbers have not been allocated to other ships and the reason for their omission is not known.

EXPORTS

The Ulsan design has achieved one export order, with seven being built for the Indian Navy and three for the Indian coastguard 'Sukanya' class. These are patrol ships used for EEZ protection and have much lighter armament and a large helicopter flight deck and hangar. Three were built in South Korea, the remainder in India.

OKPO (KDX-2000)



Okpo (KDX 2000) (Ian Sturton)

1 Westland Super Lynx Mk 99 2 Flight deck 3 Hangar 4 Signaal SGE-30 30 mm Goalkeeper seven-barrel CIWS 5 Signaal STJR 180 fire control 6 Raytheon SPS-4G(V) 7 McDonnell Douglas Harpoon anti-ship missiles (eight) 8 Triple Mk 32 324 mm torpedo tubes 9 CSEE Défense Dagaie Mk 2 chaff/IR launchers 10 Signaal MW-08 surface search radar 11 ARGOSystems APECS II (AR 700) ESM/ECM system 12 Raytheon Mk 48 Mod 2A vertical launchers for Sea Sparrow SAM (16 cells) 13 OTOBREDA 127 mm (5 in)/54 automatic gun

GENERAL SPECIFICATIONS

Operator: Korea, Republic (South Korea)
Type: KDX-2000 (DW 400D)

Class: OKPO

Active: 0
Building: 3

Displacement:
full load: 3,900 t

Dimensions
Length: 135.4 m (444.2 ft)
Beam: 14.2 m (46.6 ft)
Draught: 4.2 m (13.8 ft)

Speed: 30 kts
Range: 4,000 n miles at 18 kts

Complement: 170 (15 officers)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84B Harpoon

Eight Harpoon anti-ship missile canisters will be mounted in the gap between the stack and the hangar.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

GMVLS Mk 48 Mod 2A missile launching system

Two Guided Missile Vertical Launch Systems (GMVLS) Mk 48 Mod 2 will be mounted in the foredeck. Each system consists of two sets, each of four pairs of Mk 164 vertical launcher groups, a Mk 220 missile launch controller and a Mk 63 shipboard mounting interface-electrical (SMI-E). The Mk 164 launcher group consists of pairs of aluminium honeycomb launcher canisters, each 3.97 m (13.0 ft) long, attached to an aluminium framework, with each container having its own vertical efflux system with the exhaust gases vented up pipes running alongside the containers. The Mod 2 system is mounted inside the superstructure in four lines of four canisters with vertical efflux pipes in pairs between canisters. There is one Mk 220 launch controller for every 16 missiles and one bulkhead-mounted Mk 62 SMI-E for every four missiles.

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime).
NEA-Lindberg, Denmark (SMI-E).
EBCO, Canada (SMI-M).
Bronswerk, Belgium (Mk 20 canister).
MBLE, Netherlands (Mk 220 missile launch controller).

Raytheon Sea Sparrow point-defence missile system

The SAM is the RIM-7M Sea Sparrow missile. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications
RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

TUBES

Two 324 mm US Mk 32 torpedo tubes will be mounted in the waist.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 127 mm/54 Compatto

There will be one OTOBREDA 127 mm/54 Compatto mounting in 'A' position. This weapon is designed to provide naval gunfire support, to engage surface targets and to engage air targets, including anti-ship missiles and fixed-wing aircraft which do not have standoff weapons. The turret is unmanned and is enclosed by a glass fibre shield. Much of the turret and the lower part of the mounting are made of aluminium alloy. The below-deck element of the mounting consists of three drums each containing 22 rounds, which are stocked automatically from two chain-driven lower hoists which lead to the magazines and are loaded manually. The gun captain uses his control to select which drums are

to be replenished and with what ammunition. The weapon is compatible with all US 5 in L/54 ammunition.

Specifications
Gun
Calibre: 127 mm
Length of barrel: 54 calibres
Muzzle velocity: 808 m/s (2,625 ft/s)
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 13,600 m (45,000 ft)
Rate of fire: 45 rds/min
Weight of shell: 32 kg (70 lb)

Mounting Compatto
Training: 330° at 40°/s
Elevation: −15 to +85° at 30°/s
Crew: 5

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Signaal/General Electric SGE-30, 30 mm Goalkeeper close in weapons system
Two Signaal/General Electric 30 mm 7-barrelled Gatling Goalkeeper close in weapons systems will be mounted, one on the hangar roof, the other on the bridge roof. Goalkeeper is an autonomous, fully automatic system, consisting of a General Electric Sea Vulcan 30 gun, I-band search radar, I/K-band tracking radar, TV camera, and ancillaries. The Sea Vulcan 30 is based upon the electrohydraulically powered GAU-8/A 30 mm seven-barrel, Gatling gun, with each barrel firing once during each revolution of the barrel cluster. The gun is very reliable, with 33,000 mean rounds between stoppages. The mounting has an ammunition capacity of 1,190 rounds carried in a linkless system using a feed and storage drum, which is claimed to be sufficient for several target engagements before reloading is necessary. The warhead kill capability of Goalkeeper against anti-ship missiles is achieved by use of MPDS rounds which have high-density, tungsten-alloy penetrators. For 'soft' targets, HEI and TP types of ammunition can be used.

Specifications
Calibre: 30 mm
Muzzle velocity: 1,020 m/s (3,347 ft/s) (TP, HEI); 1,150 m/s (3,773 ft/s) (APDS)
Traverse: 360°
Elevation: −25 to +85°

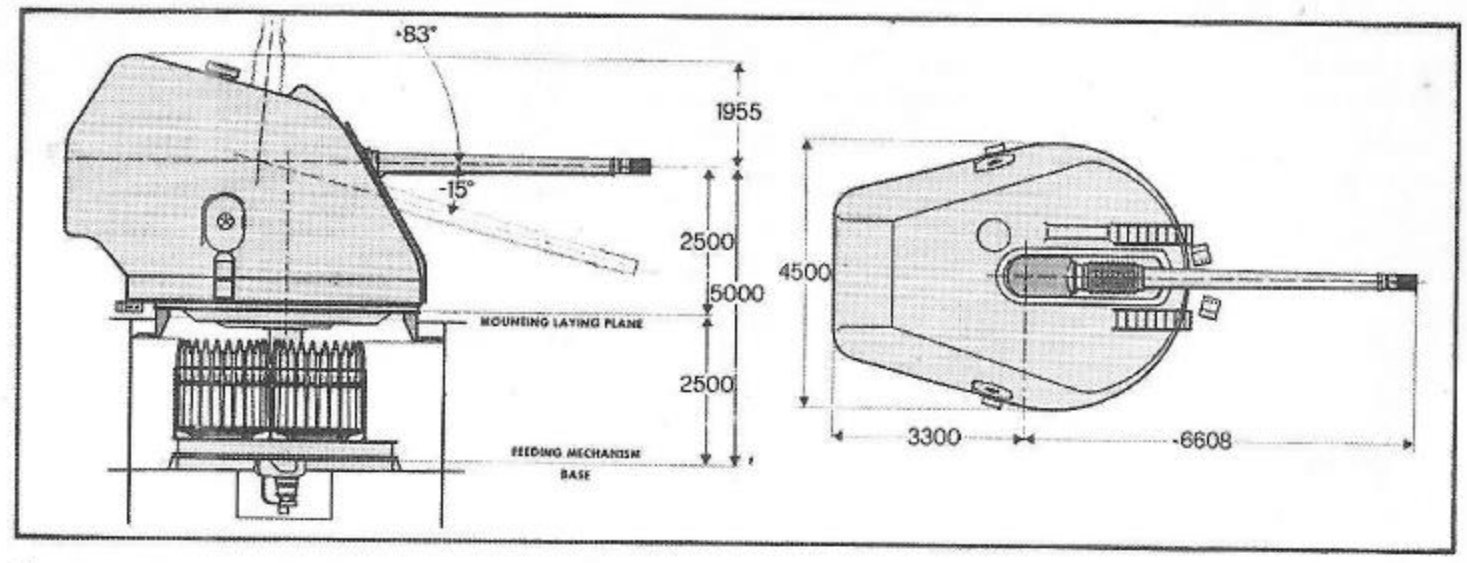
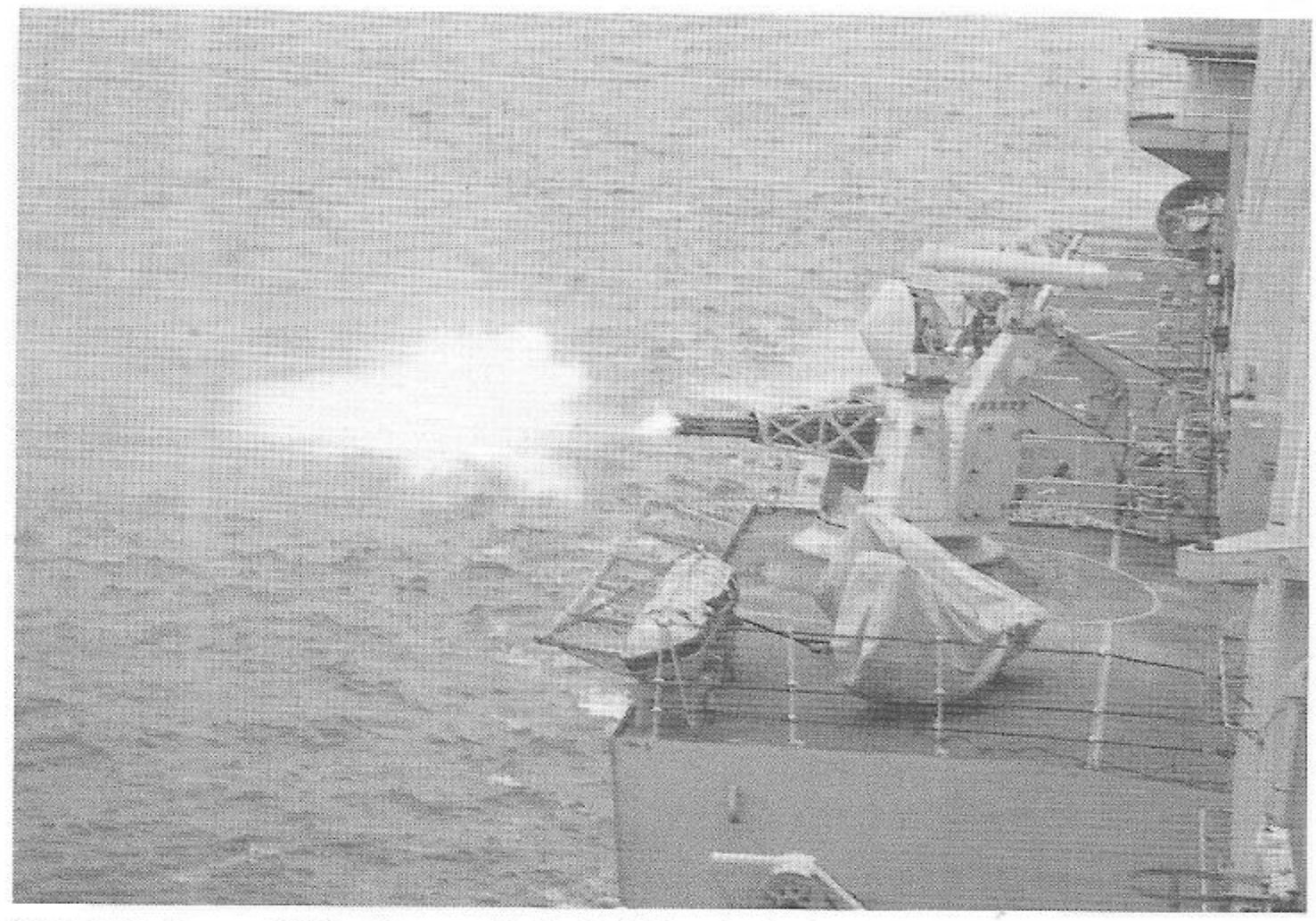


Diagram of the OTOBREDA 127 mm/54 Compatto to be installed in the KDX-2000 (OTOBREDA)


Signaal Goalkeeper CIWS will be used by the RoK Navy for the first time in the KDX-2000 (Signaal)

Mounting weight: 6,800 kg (14,994 lb)
Crew: 0
Range: 200 m to 3 km (1.61 n miles)
Rate of fire: 4,200 rds/min
Ammunition: 369 g (TP, HEI, HEISD, API, MPDS)

Manufacturers/Contractors
Hollandse Signaalapparaten BV, Hengelo, Netherlands (system/radar).
General Electric Company, Armament Systems Department (gun).

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

ARGOSystems AR 700 APECS II radar detection and jamming system
AR 700 APECS II is an advanced modular ESM/ECM system covering frequencies from 0.5 to 18 GHz, which is designed to counter most known radar threats. It is a fully automatic system, identifying and jamming threat emitters using a mixture of IFM receivers and microprocessor-controlled jammers, with high-speed switching enabling up to 16 threats to be jammed simultaneously. The antenna array consists of a mast-mounted ESM antenna assembly with two DF arrays, one omnidirectional unit and two monopulse units; system processing equipment; operator's console and two ECM transmitters (port and starboard) with their antenna systems located inside the transmitter units.

Specifications
ESM frequency coverage: 0.5-18 GHz
High sensitivity: up to −67 dBm
Detection range: 200 n miles ships; 50 n miles aircraft
DF accuracy: 4° RMS; 2° RMS fine DF
Automatic tracking: 500 active signals in dense signal environment
Signal identification speed: <1s
ECM azimuth coverage: 360° using a 60-beam jammer (one beam per 6° azimuth sector)
Radiated power: 180 kW nominal mid-band
ECM frequency coverage: 7.5-18 GHz

Manufacturer/Contractor
ARGOSystems Inc, Sunnyvale, California, USA.

DECOYS

CSEE DAGAIE Mk 2 countermeasures system
There will be four CSEE DAGAIE Mk 2 ten-barrelled, trainable launchers mounted immediately abaft the mast. These can be loaded with either IR or chaff rockets. The firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, windspeed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate between them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either 3-5 μm and 8-14 μm IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised glass fibre chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 μm bands.

Specifications
Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)

Manufacturer/Contractor
CSEE Défense, Paris, France.

AN/SLQ-25 Nixie noisemaker
An AN/SLQ-25 Nixie solid-state, modular design electroacoustic countermeasures decoy system will be used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom or in a partially or totally enclosed location on the main deck. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor

controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm (3.10 ft) long, 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Samsung/BAeSEMA/Signaal SSCS Mk 7

In May 1994 BAeSEMA announced it had won a contract to supply three SSCS Mk 7 systems to the Republic of Korea for the 'KDX-2000' class frigates. This system will:

- Prepare and co-ordinate a tactical database from all available sensor data and collate it into an accurately defined tactical situation
- Present the information comprising the agreed tactical picture in the appropriate manner to suit the current requirement of each member of the command team.
- Perform track management and link data co-ordination functions
- Carry out and present threat evaluation
- Provide the means to execute and monitor weapons and sensor management policies in accordance with mission plans, rules of engagement, tactical doctrine and current tactical situation.
- Prepare and present weapon and situation status reports, including the identification of any conflicts in weapon/sensor assignment or the engagement process.
- Provide automatic assistance with combat system or data management tasks, including special-to-task functions.
- Provide the facilities for planning, data recording, post-action analysis and training.

The nodal architecture will make the overall system highly reliable and involves Racal-made software-driven Multifunction Consoles (MFC) linked by a fibre optic local area network (LAN). The LAN will be to the IEE 802.5 standard and gateways will be provided between the combat system and the other weapons and sensors because it is neither practical nor desirable for all the consoles to interface with the data highway. These gateways, which will be duplicated to provide redundancy, will perform the functions of interface conversion, preprocessing and filtering of data before it is passed to the command system.

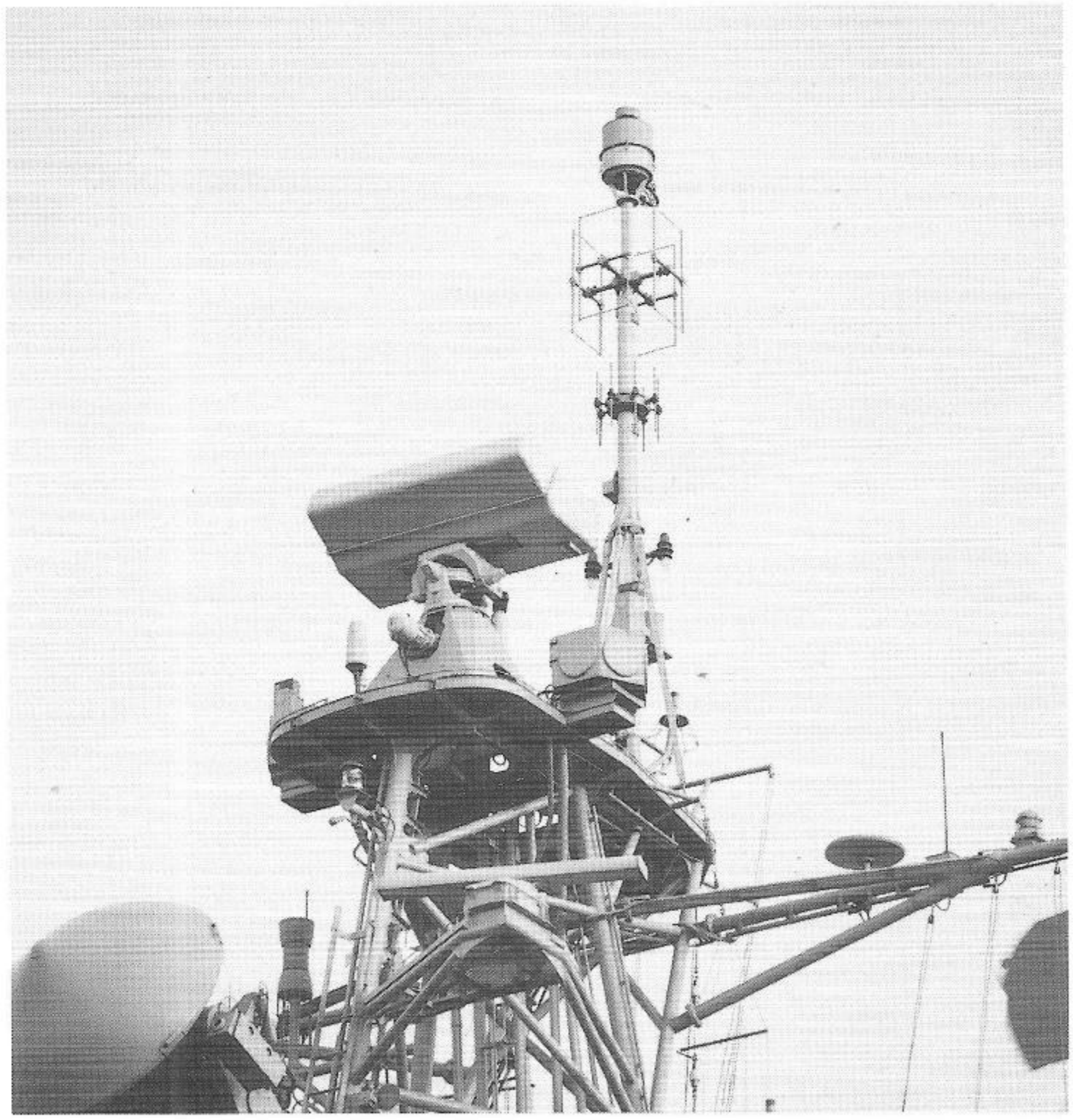
The Racal Multifunction Consoles (MFCs) will have a 32-bit databus, with databus input/output, general purpose and node service cards, two display generator cards and a 60 Mbyte hard disk drive. The applications processors will be based upon Intel 80286 32-bit microprocessors. In consoles requiring mathematical facilities for tasks such as TMA, the processor will be supplemented by Inmos T800 high-speed (10 Mips) transputer arrays. The display processors will be based upon the Motorola 68030 microprocessor, with as many operations as possible taking place in parallel to provide higher performance, increase redundancy and reduce bottlenecks. The MFCs will be two-man displays incorporating common service nodes.

The Korean SSCS Mk 7 will have eight MFCs with two Signaal fire-control system consoles of the MOC type from the SIGHT family, with the two systems linked by a Signaal Data Highway. The input/output nodes are the same as in the RN system but are linked not only to the MFCs but also to peripherals including maintenance facilities, the contact evaluation plot and a bridge display. In the applications processor 13 of the 17 cards are common with the RN system, and the two systems will both involve some 280 processors and 1.5 million lines of code.

The software architecture for the Korean system will use the Outfit DNA core system infrastructure software including the Ada-language run-time manager. The application software is added and the distributed database management systems ensure the data is handled quickly and reliably. The majority of the software has been provided by BAeSEMA Group Systems' Scientific Division and there will be 60 per cent commonality between the Royal Navy and Korean Navy software. From System 02 onwards there will be an increasing Korean hardware element provided under licence by Samsung Electronics.

RADARS

Type	MW 08	SPS-55M	STIR 180
Maker	Signaal	ISC Cardion	Signaal
Role	Air/surface search (3D)	Navigation	Fire control
Band	G	I/J	I/J/K
Beam	2 × 9°	1.5 × 20°	1.4°
Peak power	150 kW	130 kW	220 kW
Gain	23 dB	31 dB	–
Pulsewidth	0.6 µs	0.12/1.0 µs	0.29 µs
PRF	3,800 pps	2,250/750 pps	1,800/3,600 pps
Scan rate	27 rpm	16 rpm	–



Signaal's MW-08 will be the 3D air and surface search radar in the KDX-3000 (Signaal)

Manufacturers/Contractors
BAeSEMA Combat Systems Division.
Samsung Electronics, Korea.

Korean Naval Tactical Data System (KNTDS)

It is reported that all three of the KDX-2000 frigates will also be outfitted for the Korean Naval Tactical Data System (KNTDS). This is a national, joint-service system for seaward defence against infiltration operations, particularly from North Korea and is designed to improve naval and coastal defence through the real-time exchange of tactical information among various land-based and shipboard sensors. A shore-based command centre co-ordinates the system, providing the co-ordination necessary to bring the most effective response to bear on the enemy. To achieve this, the system collects, analyses, evaluates and displays tactical information from radar sites, warships, patrol aircraft and the national Air Defence Ground Environment (ADGE) system to assist the commander in making decisions. The KNTDS also exchanges evaluated track

information with participating naval units and provides a medium for ordering or commanding naval forces and tactical air and weapon systems in accomplishing the mission. The current seaborne element of KNTDS are three 'Ulsan' class frigates, each of which has one KNTDS console and is linked via Link 11 to the Fleet Command Centre (FCC) ashore, and these will be joined by the three KDX-2000 frigates. The frigates lead groups of smaller craft in carrying out their mission to detect and intercept small coastal craft trying to penetrate South Korean coastal waters. Five shore-based radars, the main air control centre and the South Korean Marines also feed the FCC over two systems: Link 11 and the high-frequency Inter-Site DataLink (ISDL).

Manufacturers/Contractors

Litton Data Systems, Agoura Hills, California, USA.
Samsung Electronics, Seoul, South Korea.

COMMUNICATIONS AND DATALINKS

Datalink: Litton Link 11
IFF: UPX-27.

SONAR

STN Atlas DSQS-23 (ASO 96)

The KDX-2000 frigates will be fitted with the DSQS-23 hull-mounted, low-frequency sonar, which has the STN Atlas designation ASO 96. DSQS-23 is designed for computer-aided detection, localisation and classification over an entire 360° azimuth. It is modular in design, enabling it to provide: underwater telephone; automatic target tracking; classification; ray trace; intercept; torpedo warning; vertical stabilisation; simulation; interface to 'own ship's' fire-control system; underwater survey display and torpedo command functions and, if one is fitted, interface to towed array sonar. The hull-mounted transducer is 2.5 m (8.2 ft) in diameter and 1 m (3.28 ft) high. The system is designed to transfer data on up to 10 targets automatically into the command system.

Manufacturer/Contractor

STN Atlas Elektronik GmbH, Bremen, Germany.

AVIATION

AVIATION FACILITIES

Flight deck: 21 × 14.2 m (70 × 46 ft) (estimated)

HELICOPTER

The KDX-2000 will embark one Westland Super Lynx Mk 99, some of which are already in operation with the Korean Navy.

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 General Electric LM-2500 gas turbines; 43.42 MW (58,200 hp) sustained; 2 MTU or SEMT-Pielstick diesels; 5.88 MW (8,000 hp(m))
Shafts: 2

FURTHER INFORMATION

PROGRAMME

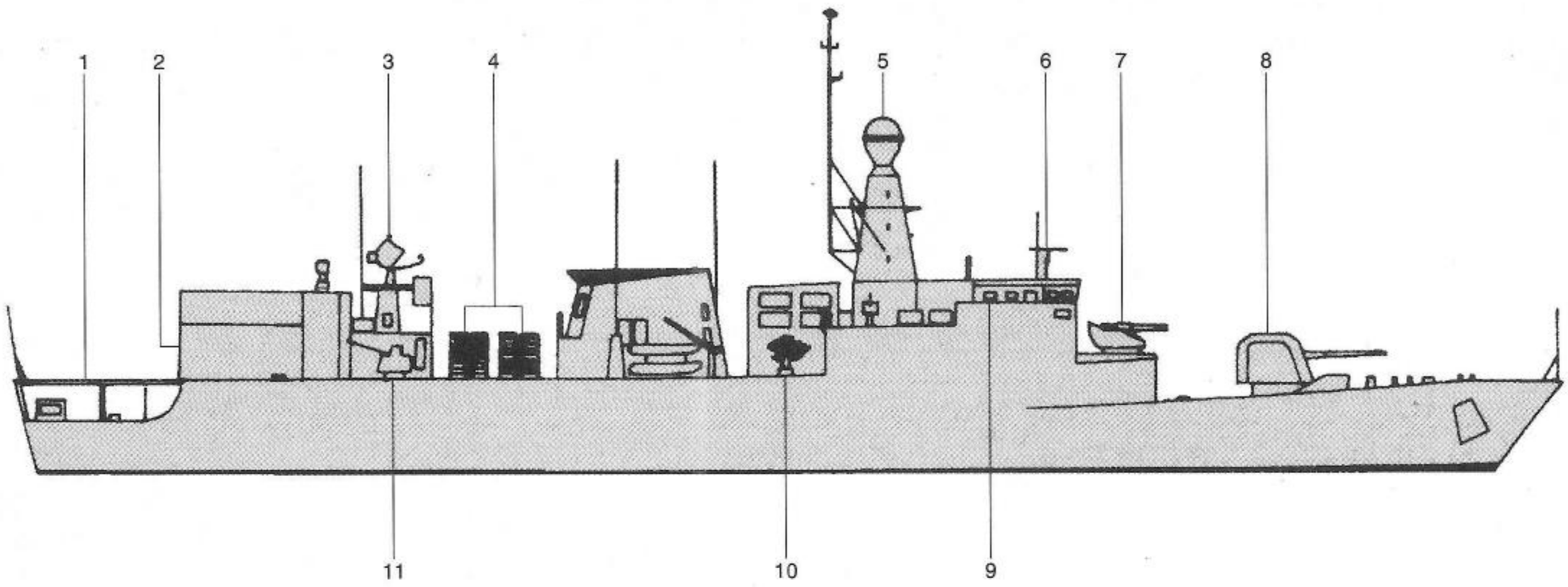
This programme has suffered from a number of delays. It was originally planned that the first keel would be laid down at Daewoo in late 1992, with a planned completion date of 1996, but the definition studies extended to late 1993. At that point some contracts for the weapon systems were signed.

The first batch of three ships is now under construction, with the first of class launched by Daewoo in September 1996 and due to be completed in 1998. This will be followed by the second and third of class, both of which are also being built by Daewoo.

It was announced in April 1996 that the KDX-1 programme would involve only the three ships currently under construction. These will, however, be followed by six KDX-2 ships, which will essentially be stretched KDX-1s with an increased displacement of some 5,000 tonnes. These new ships will have a Mk 41 vertical launch system in 'B' position launching Standard SM-2MR Block III missiles and it is also reported that they will have the SSCS-7 command system. They will probably also have a towed sonar array.

There are also unconfirmed reports of a possible KDX-3 design, displacing some 7,000 tonnes and equipped with an AEGIS system. Such a vessel would appear to have much in common with the JMSDF's 'Kongo' class.

FATAHILLA



Nala (Ian Sturton)

1 *Flight deck (for Westland Wasp helicopter)* **2** *Hangar* **3** *Signaal DA 05 air/surface search radar* **4** *Aerospatiale MM38 Exocet anti-ship missiles* **5** *Signaal WM 28 fire-control radar* **6** *Racal-Decca AC 1229 navigation radar* **7** *Bofors 375 mm twin barrel ASW mortar* **8** *Bofors 120 mm (4.7 in)/46 gun* **9** *Rheinmetall Rh-202 20 mm cannon* **10** *Knebworth Corvus 8-barrel chaff launcher* **11** *Bofors 40 mm/70*

GENERAL SPECIFICATIONS

Country of origin: Netherlands
Operator: Indonesia

Class: FATAHILLAH

Built: 3
Active: 3

Displacement:
standard: 1,200 t
full load: 1,450 t

Dimensions
Length: 84 m (276 ft)
Beam: 11.1 m (36.4 ft)
Draught: 3.3 m (10.7 ft)

Speed: 30 kts
Range: 4,250 n miles at 16 kts

Complement: 89 (11 officers)

SHIPS

FATAHILLAH (361)

Builder	Wilton Fijenoord, Schiedam, Netherlands
Laid down	31 Jan 1977
Launched	22 Dec 1977
Commissioned	16 Jul 1979

MALAHAYATI (362)

Builder	Wilton Fijenoord, Schiedam, Netherlands
Laid down	28 Jul 1977
Launched	19 Jun 1978
Commissioned	21 Mar 1980

NALA (363)

Builder	Wilton Fijenoord, Schiedam, Netherlands
Laid down	27 Jan 1978
Launched	11 Jan 1979
Commissioned	4 Aug 1980

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 38 medium-range anti-ship missile

Ship-launched MM 38 Exocets are carried in two twin launcher-containers sited immediately abaft the stack, pointing across the ship at an angle of 90°. In addition to the launcher installations there is a control console and there is a co-ordinate converter to interface the missile with the ship's sensors.

Targets are acquired by the ship's search radar and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence. This involves turning on the thermal battery, releasing the mechanical safety locks, igniting the booster and, finally, breaking the umbilical cord; the total process takes some 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change of course during its flight.

The attack consists of three phases:

Cruise phase. The cruise phase starts as the missile clears the container and the missile, powered by the sustainer motor, flies towards the general location of the target at a height of about 100 m (328 ft) which is low enough to reduce the chance of detection but adequate for target acquisition. This phase can be as long as 22 km and ends when the seeker acquires the target. This seeker is a Dassault Electronique ADAC (Auto Directeur Anti-Clutter) active monopulse radar, working in the I-band (8-10 GHz), which has a typical range of 13 n miles (24 km) against FACs.

Approach phase. On detecting the target the missile descends to 9-15 m (30-50 ft) in the approach phase.

Terminal phase. During this final phase the missile descends to 8 m (26 ft) (2-5 m (6.5-16 ft) in a calm sea) for a sea-skimming run in to the target.

A salvo may be fired in 12-20 seconds.

Specifications

MM 38
Length: 5.21 m (17 ft)
Diameter: 35 cm (14 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,621 ft)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s
Booster: 100 kg SNPE Epervier boost motor, weight 100 kg, burn time of 2.4 s
Warhead: Luchaire 165 kg fragmentation warhead
Fuzes: Delayed impact fuze and autopilot-controlled proximity fuze

Manufacturer/Contractor

Aerospatiale Missiles. France.

TUBES

Fatahillah (361) and *Malahayati* (362) both have six 324 mm US Mk 32 torpedo tubes sited in two triple mounts either side of the after deckhouse. Twelve torpedoes are carried. (There are no tubes in *Nala*, as they have been displaced by the two Bofors 40 mm mounts).

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Specifications

Mk 46 Mod 5 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Malahayati *(362). These 1,450 t ships carry a heavy armament for their size. On the foredeck is a Bofors 120 mm gun and a twin-barrelled Bofors 375 mm ASW mortar. There are four MM 38 Exocet launchers amidship, while aft are two triple torpedo tubes and a Bofors 40 mm gun. Virtually all electronics in this Dutch-built ship are by Signaal.*

Manufacturer/Contractor
Loral Defense Systems, Akron, Ohio, USA.

GUNS

BOFORS TAK 120/46 dual-purpose gun
There is a single 120 mm (4.7 in) mounting in 'A' position. The barrel of the TAK 120 L/46 barrel is water-cooled and has an exchangeable liner. There is an automatic loader. This gun is only to be found in the Indonesian 'Fatahillah' class and Finnish 'Turunmaa' class corvettes.

Specifications
TAK 120 L/46
Calibre: 120 mm
Length of barrel: 46 calibres
Muzzle velocity: 800 m/s (2,625 ft/s)
Traverse: 360° at 40°/s
Elevation: −10 to +80° at 32°/s
Crew: 3-4
Range: 10 n miles (18.5 km)
Rate of fire: 80 rds/min/barrel
Shell weight: 21 kg (46 lb)

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Bofors 40 mm/70
Fatahillah (361) and *Malahayati* (362) have one Bofors 40 mm mount each, located at the after end of the main deck. *Nala* (363) has two 40 mm mounts, one either side of the hangar.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −3 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Rheinmetall Rh-202 20 mm cannon
All three ships mount two Rheinmetall Rh-202 20 mm cannon, which are mounted in the bridge wings. They are mounted on a simple pedestal and are manually operated.

Specifications
S20
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,250 m/s (3,297-4,101 ft/s)
Traverse: 360°
Elevation: −10 to +55°
Crew: 1-2
Range: 1 n mile (1.85 km)
Rate of fire: 80 rds/min/barrel
Shell weight: 21 kg (46 lb)

Manufacturer/Contractor
Bofors Ordnance, Sweden.

ANTI-SUBMARINE MORTARS

Bofors 375 mm ASW rocket system
There is a single, Bofors twin-tube, 375 mm ASW rocket launcher located in the 'B' gun position. The system consists of a rocket launcher, a handling system, the ship sonar and a fire-control system. The two launch tubes are mounted on trunnions with an automatic contact device to connect the rockets with the fire-control system. The hydraulic laying machinery is in the front of the mounting and a flame deflector in the rear; there is also an automatic electrohydraulic handling system. The rounds are stored vertically beneath the mounting and selected by an operator. The rate of fire is one round a second and rockets may be fired singly or in a salvo. There are two types of rocket, both with Hexotonal filling. The Type E (Erika) rocket has Stidar time and impact fuzes, while the Type N (Nelli) uses the Zambo proximity and impact fuzes. A total of 54 rounds is carried.

Specifications
Launcher
Tubes: 4
Traverse: 260° at 18°/s
Elevation: −15 to +90° at 18°/s
Crew: 4

Rockets

	Type E	Type N
Weight	250 kg (551 lb)	230 kg (507 lb)
Muzzle velocity	130 m/s (427 ft/s)	205 m/s (673 ft/s)
Explosive weight	107 kg (236 lb)	80 kg (176 lb)
Range	0.35-0.87 n miles (0.65-1.63 km)	0.85-2.11 n miles (1.58-3.62 km)
Sinking speed	10.7 m/s (35.1 ft/s)	9.2 m/s (30.2 ft/s)

Manufacturer/Contractor
Bofors, Sweden.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

MEL Susie-1

Susie-1 is a solid-state ESM equipment covering the range 2-18 GHz and is used to trigger the Corvus chaff launchers. It is capable of auto-tracking seven signals.

DECOYS

CORVUS chaff decoy launching system

Corvus is a simple, lightweight, quick reaction system for the self-defence of surface vessels against surface-to-surface and air-to-surface missiles. Window (chaff) dispensing rockets are fired to form a radar decoy screen around the vessel. Two modes of operation are available for the system. The two modes — distraction decoy and centroid decoy — differ in the azimuth angle at firing and the range at which window is released. A cylindrical rotating structure carries eight launching tubes mounted in two sets of three, one above the other, and crossed at 90° in azimuth with two further tubes set above, and aligned midway between the other tubes, all at a fixed elevation of 30°. A deck-mounted pedestal supports the rotating structure on its training bearing and also houses a self-contained electrical power conversion unit for the control circuits and the associated electrical equipment.

Specifications

Training
Bearing arc (normal) that is, launcher axis: 60-120°
Bearing arc (max) that is, tube axis: 15-165°
Launcher weight: 585 kg (1,290 lb)
Off-launcher equipment weight: 42 kg (92.6 lb)
Tube diameter: 195 mm
Tube length: 1.6 m (5.24 ft)
Weight (empty): 25 kg (55 lb)
No of guides: 4, RH spiral

Manufacturer/Contractor

Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

T-Mk 6 Fanfare

The T-Mk 6 torpedo decoy consists of two winches each with a cable and a 'fish' containing a mechanical acoustic device.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SEWACO-RI action data automation/ Daisy data processing

SEWACO-RI (RI = Republik Indonesia) was specifically assembled for Indonesian use and is based on an expansion of the WM28 weapons control system.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

WEAPONS CONTROL

Signaal WM28/61

The three Indonesian ships are fitted with the Signaal WM28/61 fire-control system. Like other members of the WM20 family, WM28 radar has two antennas sharing a common, stabilised mounting and housed in a distinctive, egg-shaped radome — the famous 'Signaal egg' — which is located on top of the prominent plated mast. The stabilisation system permits operation at roll angles of ±30° and pitch angles of ±10°. The upper antenna, which is of the cassegrain type, is used for searching as well as for automatic tracking of surface targets for weapon control. The lower antenna is of the paraboloid segment type with horn feed and is used for tracking air targets and for controlling air defence weapons. The antennas are fed from a common I/J-band transmitter but during surveillance all the transmitter output is channelled to the search antenna.

Peak pulse power is 180 kW and output power is shared by waveguide switching. The search radar has a range of between 30 and 32 km against surface targets and 7,600 m (24,936 ft) against air targets, while the tracker has a range of about 29 km. With the larger search antenna the search radar is increased to about 46 km. The tracker is capable of monitoring the movement of aircraft with a 1 m² cross-section at velocities up to 900 m/s (2,953 ft/s)and similar size objects moving at or near the surface at maximum velocities of between 34 and 55 m/s (111 and 180 ft/s).

The computer, controls and displays are in a two- or three-man console which includes firing pedals. The consoles feature a small PPI display, an A-scope to present data on the tracking radar and shell splashes and a B-scope for presenting search radar video and the predicted hitting point. The PPI display has range scales of 10, 30 and 60 km. The console also has an alphanumeric display capable of presenting 16 lines, each of 32 characters.

WM28/61 (the suffix '61' denotes that it uses the SMR-MU computer) is a weapon control system for ships up to destroyer size to control light or medium calibre guns and an ASV missile using semi-active guidance. It can engage either an air or a surface target with the gun and a surface target with the missile system.

The radar can automatically track one air and one surface target simultaneously. For use with the missile the air target tracking antenna is slaved to the surface target tracking programme and linked with a CW transmitter in order to illuminate the target. It can control a second light or medium calibre gun for engaging an air and/or surface target. The system can track automatically an air and/or two surface targets.

Manufacturer/contractor

Hollandse Signaalapparaten, Hengelo, Netherlands.

Signaal LIROD 8 electro-optic director

LIROD (Lightweight Radar Optronic Director) is a lightweight fire-control system based upon a K-band tracking radar and a TV camera, and is designed for simultaneous control of two dual-purpose guns while tracking one air and one surface target. The system reaction time from detection to the beginning of the engagement is about 4.5 seconds. It is based upon a 0.6 m (1.97 ft) diameter parabolic antenna with monopulse cluster. It has a very narrow pencil beam and is resistant to clutter through the application of pulse Doppler tracking combined with FFT techniques. There are also sophisticated ECCM facilities. The radar can track fighter-size targets up to 18 km away and is capable of tracking targets with a maximum speed of 1,000 m/s (3,280 ft/s). In addition to the radar there is a militarised TV camera with CCIR standard video format, which can detect fighter-size targets at about 5.44 n miles (10 km) and large surface ships at about 10.9 n miles (20 km).

Specifications

Director
Traverse: 360° at 120°/s
Elevation: −25 to +150° at 80°/s
Radar: K-band
Field of view:
TV camera: 3-30° (2-20°)
IR camera: 3°
Laser rangefinder
Pulse length: 20 ns
Max repetition frequency: 10 Hz
Beam divergency: 1.2-1.5 mrad

Laser tracker
Max repetition frequency: 25 Hz
Beam divergency: 1.5 and 6 mrad

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

Set	DA 05	WM 28	AC 1229*
Company	Signaal	Signaal	Racal-Decca
Role	Air/surface search/ target indication	Fire control (SSM/127 mm gun)	Navigation
Band	E/F	I/J	I/J
Beam	1.5 × 8°	1.5 × 4/7° (search) 2.4° (track)	1.3 × 30°
Peak power	1,200 kW	200 kW	25 kW
Gain	32.2 dB	33.5 dB	30 dB
Pulsewidth	1.3/2.6 µs	0.22/4.5 µs	0.05/0.25/1.0 µs
PRF	1,000/500 pps	3,600/1,800 pps	1,300/650 pps
Scan rate	10/20 rpm	60 rpm	25 rpm
Range	75 n miles (137 km) for 2 m² target	25 n miles (46 km)	—

Notes: * AC = Anti-Collision

SONAR

PHS-32 hull-mounted search and attack sonar system

PHS-32 is a medium-range, high-performance search and attack sonar which includes signal processing facilities for fast Fourier transformation processing of all preformed beam receiving channels. All data are presented on a single TV-type display, while operation has been much simplified by the use of light pen control. The system can track up to four targets automatically. A circular transducer permits all-round coverage in various modes of transmission such as: Omni, TRDT, MCC (wide vertical beam), LISTEN (passive with time/bearing recorder presentation). An audio beam is also available.

Specifications

Frequencies: 3
Pulse lengths: 12.5, 25, 50, 100 ms and 400 ms long pulse (CW or FM)

Detection range: >10,000 yd
Vertical beamwidth: 12 or 20°
Bearing accuracy: 1° RMS
Range accuracy: ±0.5-2%
Notch filtering: Selectable rejection bandwidth

Own Doppler correction: On all 60 channels
Roll and pitch performance: Automatic co-ordination of transmitting pulse and vertical beamwidth in rough weather

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

AVIATION

AVIATION FACILITIES

Nala (363) is the only ship in the class with aviation facilities. The hangar closes over the helicopter.

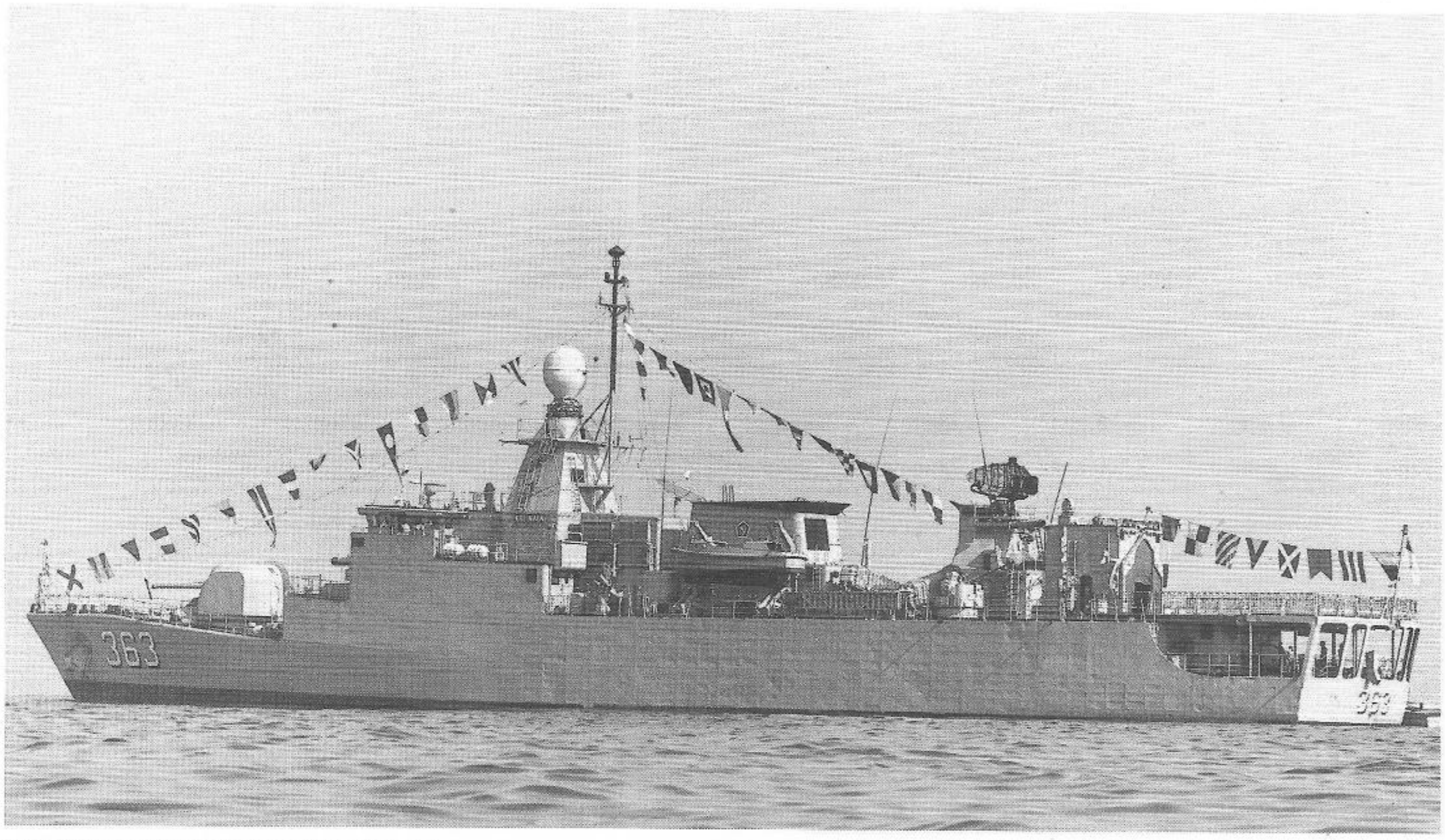
HELICOPTERS

One Westland Wasp
(*Nala* only).

Specifications

Wasp HAS Mk 1
Dimensions
Main rotor
diameter: 9.83 m (32.25 ft)
Tail rotor
diameter: 2.29 m (7.5 ft)
Fuselage length: 9.24 m (30.33 ft)
Height to top of rotor hub: 2.72 m (8.92 ft)
Weights:
empty: 1,566 kg (3,452 lb)
max take-off: 2,495 kg (5,500 lb)

Performance:
max level speed (sea level): 104 kts (193 km/h)
economic cruising speed: 96 kts (177 km/h)
max range: 263 n miles (488 km)
Power plant: 1 — 710 ehp (derated) Rolls-Royce/Bristol Nimbus 503 turboshaft
Avionics: PTR 170 and PV 141 UHF and UHF homing radio, and standby UHF
Weapons: 2 Mk 44 or 1 Mk 46 torpedoes, or 2 AS.12 anti-ship missiles



Nala *(363) showing the flight deck and hangar.*

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 Rolls-Royce Olympus TM3B gas turbine; 19 MW (25,440 hp) sustained; 2 MTU 20V 956 TB92 diesels; 8.14 MW (11,070 hp(m)) sustained
Shafts: 2
Propellers: 2 LIPS cp

FURTHER INFORMATION

PROGRAMME

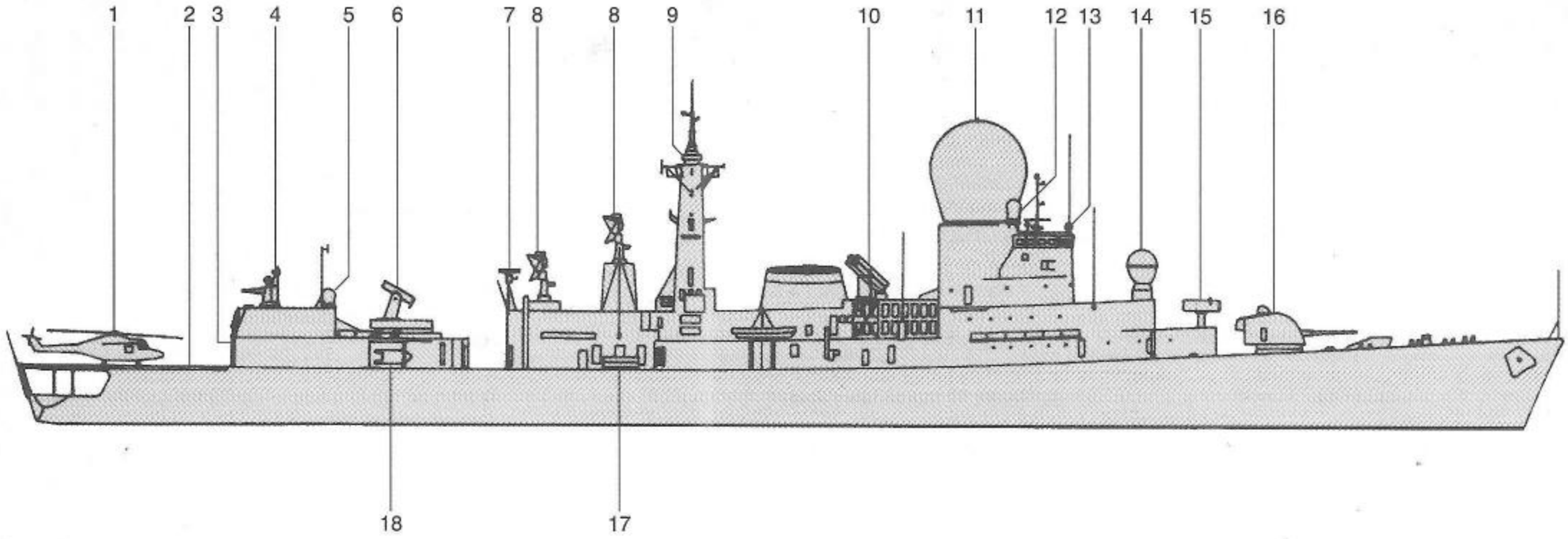
These are the only major warships ever to have been built specifically for the Indonesian Navy. They are very compact ships and are officially rated by the Indonesian Navy as corvettes, although they are generally considered to be frigates. They were ordered in August 1975 from NEVESBU, the Dutch design and construction consortium and were delivered between 1978 and 1980.

DESIGN

These ships manage to pack considerable capability into a small hull with the automatic 120 mm gun, in particular, appearing to be particularly heavy.

The first two ships do not have the facilities for a helicopter, but the last ship, *Nala* (363), has a full flight deck with an unusual hangar which closes across the top of the helicopter. Initially, *Nala* embarked an MBB BO-105 helicopter, but more recently it has embarked one of the navy's Westland Wasps.

TROMP



De Ruyter (Ian Sturton)
1 *Westland SH-14B Lynx helicopter* **2** *Flight deck* **3** *Hangar* **4** *Signaal SGE-30 Goalkeeper 30 mm CIWS* **5** *Inmarsat Satcom* **6** *Mk 13 Mod 4 launcher for Standard SM-1MR SAM* **7** *Racal-Decca 1226 helicopter control radar* **8** *Raytheon AN/SPG-51C fire control (for Standard SAM)* **9** *Signaal RAMSES ESM/ECM system* **10** *McDonnell Douglas Harpoon anti-ship missiles* **11** *Signaal MTTR/SPS-01 3D radar* **12** *SCOT 1D Satcom* **13** *Racal-Decca 1226 navigation radar* **14** *Signaal WM25 fire control* **15** *Mk 29 launcher for Raytheon Sea Sparrow SAM* **16** *Twin Bofors 120 mm (4.7 in)/50 mounting* **17** *US Mk 32 324 mm torpedo tubes* **18** *Loral Hycor Mk 36 SRBOC chaff/IR launcher*

GENERAL SPECIFICATIONS

Operator: Netherlands

Class: TROMP (FFG)

Built: 2
Active: 2

Displacement:
standard: 3,665 t
full load: 4,308

Dimensions
Length: 138.2 m (453.4 ft) (oa); 131.00 m (429.8 ft)
Beam: 14.8 m (48.6 ft)
Draught: 4.6 m (15.1 ft)

Speed: 30 kts
Range: 5,000 n miles at 18 kts

Complement: 306 (34 officers)

SHIPS

TROMP (F 801)

Builder	Koninklijke Maatschappij De Schelde, Flushing, Netherlands
Laid down	4 Aug 1971
Launched	2 Jun 1973
Commissioned	3 Oct 1975

DE RUYTER (F 806)

Builder	Koninklijke Maatschappij De Schelde, Flushing, Netherlands
Laid down	22 Dec 1971
Launched	9 Mar 1974
Commissioned	3 Jun 1976

De Ruyter *(F 806). The two ships of this class are due to be replaced by two LCFs in 2001-2002*
(Royal Netherlands Navy)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84A/C Block 1C Harpoon

Eight Harpoon anti-ship missile canisters are mounted immediately before the stack; there are two groups of four launchers each, with the groups pointing across the ship to the opposite beam. The missiles are the Block 1C version, which flies at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns and, for the terminal phase, have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 kg)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

Tromp *(F 801). The most characteristic feature of these ships is the large radome for the Signaal 3D MTTR/SPS-01. The MTTR (Multi Target Tracking Radar) is an integral part of the SEWACO-I command system* (Royal Netherlands Navy)

SURFACE-TO-AIR MISSILES

Mk 13 Mod 4 launcher
There is a single Mk 13 Mod 4 launcher located aft, just forward of the hangar. There are 40 missiles stored vertically in a below-decks magazine in two concentric rings. Launching rate is one missile every 10 seconds.

Standard Missile-1 Medium Range (SM-1MR)
Main air defence armament is the SM-1MR. SM-1MR Block IV missiles have a Naval Weapon Center Mk 51 expanding rod warhead, while Block V missiles have a Naval Weapon Center Mk 90 blast fragmentation warhead.

Specifications
Length: 4.48 m (14.7 ft)
Diameter: 34.3 cm (13.5 in)
Wing span: 1.06 m (3.48 ft)
Weight: 642.3 kg (1,416 lb)
Speed: Mach 2
Range: 20.5 n miles (38 km)
Altitude: 19,800 m (65,000 ft)

Manufacturers/Contractors
Hughes Missile Systems, Tucson, Arizona, USA.
Raytheon, Missile Systems Division, Bedford, Maryland, USA.

Raytheon Sea Sparrow point-defence missile system
Both ships are fitted with a Mk 29 octuple launcher for the Sea Sparrow system, which is located on the foredeck in 'B' position. Sixteen RIM-7 Sea Sparrow missiles are carried and the system uses the WM-25 fire-control system. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg blast fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications
RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Aircraft Company, Missile Systems Group (second missile source).
Naval Weapons Center, Crane, USA (warhead).

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited amidships, below the forward SPG-51C director.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

Manufacturer/Contractor
GEC-Marconi Naval Systems, UK.

TORPEDOES

Alliant Techsystems 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

Bofors TAK 120 medium-calibre dual-purpose guns
The twin 120 mm mounting is in 'A' position. The two mountings required for the 'Tromp' class were taken from the Dutch destroyer *Gelderland* (D 811) when it was stricken in 1973, completey refurbished and then installed in the 'Tromp' class ships. The TAK 120 L/50 barrels are of monobloc construction with exchangeable liners and are water-cooled. They have a vertical, sliding wedge breech block and automatic rammer, each barrel being fed by a separate ammunition hoist. The turret is made of steel with the captain's position on the right. Although the weapon is fully automatic the turret includes one manned position on each side for local control.

Specifications
TAK 120 L/50
Calibre: 120 mm
Length of barrel: 50 calibres
Muzzle velocity: 850 m/s
Traverse: 360° at 22°/s
Elevation: −9 to +85° at 25°/s
Crew: n/k
Range: 11 n miles (20.5 km)
Rate of fire: 40 rds/min/barrel
Weight of shell: 24 kg

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Signaal/General Electric SGE-30 30 mm Goalkeeper close in weapons system
One Signaal/General Electric 30 mm 7-barrelled Gatling Goalkeeper close in weapons system is mounted in the hangar roof. Goalkeeper is an autonomous, fully automatic system, consisting of a General Electric Sea Vulcan 30 gun, I-band search radar, I/K-band tracking radar, TV camera, and ancillaries. The Sea Vulcan 30 is based upon the electrohydraulically powered GAU-8/A 30 mm seven-barrel, Gatling gun, with each barrel firing once during each revolution of the barrel cluster. The gun is very reliable, with 33,000 mean rounds between stoppages. The mounting has an ammunition capacity of 1,190 rounds carried in a linkless system using a feed and storage drum, which is claimed to be sufficient for several target engagements before reloading is necessary. The warhead kill capability of Goalkeeper against anti-ship missiles is achieved by use of MPDS rounds which have high-density, tungsten-alloy penetrators. For 'soft' targets, HEI and TP types of ammunition can be used.

The I-band search radar uses a 2,050 × 280 mm linear array antenna with an integrated sidelobe suppression antenna. The antenna rotates at 60 rpm and has a horizontal beamwidth of 1.7° and a vertical beamwidth of 60°. The radar is powered by a water-cooled, synthesiser-driven, TWT transmitter with high output power for greater frequency and PRF flexibility in the face of ECM threats.

Specifications
Calibre: 30 mm
Muzzle velocity: 1,020 m/s (TP, HEI); 1,150 m/s (APDS)
Traverse: 360°
Elevation: −25 to +85°
Mounting weight: 6,800 kg (14,991 lb)
Crew: 0
Range: 200 m to 3 km (1.61 n miles)
Rate of fire: 4,200 rds/min
Ammunition: 369 g (TP, HEI, HEISD, API, MPDS)

Manufacturers/Contractors
Hollandse Signaalapparaten BV, Hengelo, Netherlands (system/radar).
General Electric Company, Armament Systems Department (gun).

Oerlikon 20 mm
Two Oerlikon 20 mm cannon may be mounted, if tactically necessary.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC COUNTERMEASURES (ECM)

AN/SLQ-503 (RAMSES) ECM SYSTEM

The AN/SLQ-503 Reprogrammable Advanced Multimode Shipborne ECM System (RAMSES) countermeasures system provides protection against I/J-band radar threats. It is an integrated responsive jammer capable of long-range jamming of search radars and the deception of missiles once launched. In its normal mode of operation, RAMSES is interconnected to and controlled from the ship's ESM systems and a dedicated ECM operator is not required, but in the back-up mode RAMSES can be manually controlled (target designation and jamming) from a remote-control panel located conveniently near the EW operator. RAMSES is capable of high pulse and CW Effective Radiated Power (ERP). Multimode jamming operation is possible with multitarget handling capability. The system is reprogrammable and power management is provided. The antennas are fully trainable (port and starboard, each through 180°) and are stabilised for roll and pitch.

Manufacturer/Contractor
Lockheed Canada Inc, Kanata, Ontario, Canada.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units located at the forward end of the hangar.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Signaal SEWACO-I

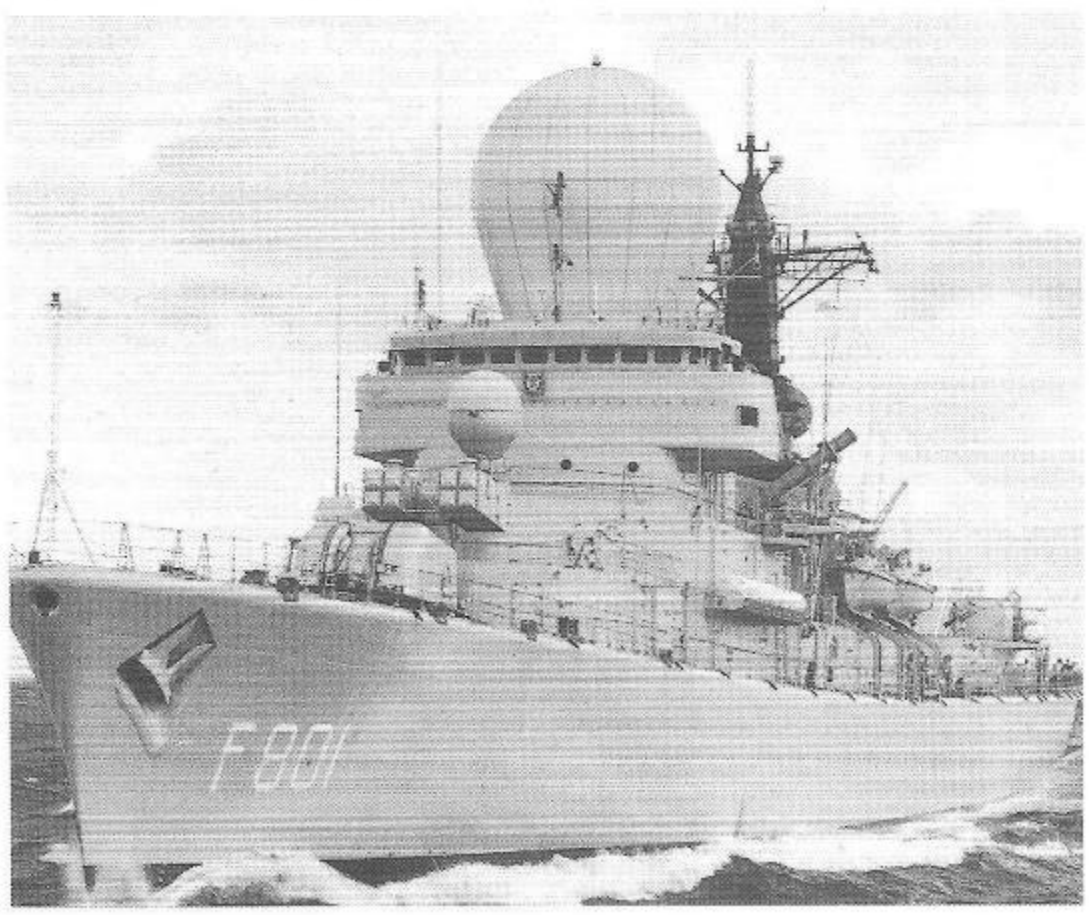
SEWACO-I comprises four major elements. The sensors include the SPS-01 3D radar system; secondary radar sensors such as IFF and helicopter transponders; the CWE-610 hull-mounted sonar system; and passive sensors, such as the ESM suite and IR sensors. The second element is the DAISY action information system, which including consoles, plotting table, conference display and the command and control software package. Third element is the weapon control system, comprising active and passive target tracking and illumination systems, weapon interface systems for interfacing with hard-kill and soft-kill weapons and close in weapon control systems. Finally, there is the communications system, with internal and external communication equipment and automatic datalink systems.

SEWACO-I's functions include:
air, surface and subsurface warning
compilation and display of tactical air, surface and subsurface situations
threat evaluation and target engagement in AAW, EW, ASuW, ASW and NGS
navigation including ASW helicopter direction
communication including tactical datalink operation
onboard scenario-driven training
organisation and system management.

The principal sensors of the SEWACO-I system in the Royal Netherlands Navy's guided missile frigates are

RADARS

Type	MTTR/SPS-01	Type 1226 (two)	AN/SPG-51C (two)	WM-25
Maker	Signaal	Decca	Raytheon	Signaal
Role	Air/surface search (3D)	Navigation	Fire control	Fire control
Band	F	I	G/I	I/J
Beam	Search: 1.5 × 2 to 30° Track:1.5 × 1.5°	1.2°	Track: 1.6° Illum: 0.9°	Search: 1.5 × 4/7° Track: 2.4°
Peak power	750 kW	25 kW	Track: 81 kW Illum: 5 kW	200 kW
Gain	39 dB	30 dB	Track: 39.5 dB Illum: 45 dB	33.5 dB
Pulsewidth	40 µs	0.05/0.25/1.0 µs	Track: 2.1-3.2 µs	0.22/4.5 µs
PRF	460/550 pps	n/a	Surface: 4.1 kHz Air: 9.5-16.7 kHz	3,600/1,800 pps
Scan rate	20 rpm	28 rpm	—	60 rpm
Typical range	—	48 n miles	—	25 n miles (46 km)



Tromp *(F 801), nameship of a class of two, built in the 1970s for the RNethN. The twin 120 mm mounting on the foredeck was 'recycled' having been used previously in the destroyed* Gelderland *(D 811)* (Royal Netherlands Navy)

Pilot's view of De Ruyter *(F 806). Note the Mk 13 launcher on the hangar roof, with the two related SPG-51C directors behind it. There are two SCOT1D Satcom antennas either side of the MTTR/SPS-01 radome with an Inmarsat antenna beside the Goalkeeper CIWS on the hangar roof* (Royal Netherlands Navy)

the Signaal 3D MTTR/SPS-01 (MTTR = MultiTarget Tracking Radar) and the combined search and tracking radars of the WM25 fire-control system which is integrated into SEWACO-I and the Signaal ESM system. The 3D radar also incorporates a slotted waveguide antenna for IFF/SIF facilities. Among the weapons associated with SEWACO-I are Standard SM1-MR, Harpoon SSM, the NATO Sea Sparrow, the twin 119 mm (4.7 in) gun turret, and the two triple-tube 324 mm torpedo launchers.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 10; Link 11; JMCIS
Satcom: SCOT 1D

WEAPONS CONTROL

Signaal WM25 fire-control system

The WM25 is the fire-control system for Sea Sparrow and is housed in the egg-shaped radome on the platform before the bridge. The radar operates in the I and J bands and has a range of some 25 n miles (46 km). Inside the 'egg' the search and tracking antennas are mounted one above and one below a common stabilised platform within a spherical radome, which eliminates most of the time-consuming acquisition search pattern of the tracking antenna after designation, and provides direct acquisition. WM25 has a short reaction time against medium- and short-range air and surface targets, and is able to engage both air and surface targets simultaneously, using an SMR computer (SMR = Signaal Micromin Rekenaar). In addition, WM25 is linked to DAISY-1 via an intercomputer interface, which results in the joint availability of relevant DAISY data, transfer of target designation data and commands and tell-backs of weapons status.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

SONAR

CWE-610 hull-mounted active sonar system

The Model CWE-610 low-frequency (LF) sonar is designed for the long-range detection of submarines in deep and shallow water. There is a 36 stave transducer in a dome under the hull and two active consoles, enabling it to perform a search-while-track function. Facilities offered include a search capability in three 120° sectors, passive correlation, and reverberation processing. Transmissions are at 6, 7 and 8 kHz and use 10° preformed reveiver beams. Range of the active system is approximately 30,000 m (98,425 ft) and there is a passive display for greater ranges. The sonar system outputs data automatically into SEWACO-1. All mode changes and range scale changes are controlled by console push-buttons, and displays include a Doppler display on each of the active consoles and a passive sonar bearing time recorder display. CWE-610 was designed specifically to meet Dutch requirements for the 'Tromp' class, although there have been subsequent sales to other navies.

Manufacturer/Contractor

EDO Corporation, Government Systems Division, College Point, New York.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 19.39 m (63.6 ft) × 14.8 m (48.6 ft)
Hangar: 1 hangar, 9.7 m (32 ft) × 14.8 m (48.6 ft)

HELICOPTER

One Westland SH-14D Lynx

(Note: all RNethN SH-14B/C Lynxes have now been converted to SH-14D standard.)

Specifications

SH-14D
Dimensions:
main rotor diameter: 12.80 m (42.00 ft)
tail rotor diameter: 2.21 m (7.25 ft)
length overall (rotors turning): 15.165 m (49.75 ft)
Weights
empty: 2,740 kg (6,040 lb)
empty, equipped (ASW): 3,343 kg (7,370 lb)
Performance:
cruising speed: 125 kts (232 km/h)
speed for max endurance: 70 kts (130 km/h)
max rate of climb: 661 m (2,170 ft)/min
time on station (ASW) 50 n miles (93 km) radius: 2 h
max range: 320 n miles (593 km)
max endurance: 2 h 50 min
Power plant: 2 Rolls-Royce Gem 42-1 with max contingency rating of 835 kW (1,120 shp)
Crew: 2 (pilot and co-pilot/observer)
Radar: Ferranti Sea Spray Mk 1 lightweight search and tracking radar
Mission: Alcatel DUAV-4 dipping sonar; FLIR systems 2000HP FLIR
Navigation: Trimble Type 2200; Doppler 91
ESM: Ferranti AWARE-3 ESM
ASW armament: 2 Mk 46 homing torpedoes; depth charges

PROPULSION

Specifications

System: Combined gas turbine or gas turbine (COGOG)
Main machinery: 2 Rolls-Royce Olympus TM3B gas turbines; 37.9 MW (50,880 hp) sustained; 2 Rolls-Royce Tyne RM 1C gas turbines; 7.4 MW (9,900 hp) sustained
Shafts: 2
Auxiliary machinery: 4 Smit-Slikerveer/Paxman Valenta RP-200, 12-cylinder diesels; each 1,000 kW

FURTHER INFORMATION

PROGRAMME

Tromp and *De Ruyter* were built as replacements for the two gun-armed cruisers *De Ruyter* (C 801) and *De Zeven Provincien* (C 802), which had joined the fleet in 1953, and which are both still in service as the Peruvian *Almirante Grau* (81) and *Aguirre* (82), respectively. The two new ships were required to combine the roles of ASW task group flagship with that of area air defence ship. Their principal air defence system is Standard SM-1MR, with a single Mk 13 launcher aft and close in protection provided by NATO Sea Sparrow, with a single launcher forward of the bridge. Surface warfare weapons include eight Harpoon SSMs and a single twin 120 mm mount, the guns for which came from a scrapped 'Holland' class destroyer.

The first design allowance was voted for in 1967 estimates. Final design began in January 1968 and was ready by September 1969 when invitations to tender were issued. The ships were laid down in 1971 and were commissioned in 1975/76.

DESIGN

The preliminary design was for a ship with a conventional steam-turbine propulsion system driving fixed-blade propellers, but it was eventually decided to use the (then) novel gas turbines with controllable-pitch propellers. Apart from the technical reasons for this choice, it enabled significant reductions in manpower to be achieved, while, by using the Olympus/Tyne combination, commonality with the contemporary Royal Navy Types 21 and 42 could be achieved.

One pair of roll dampers is fitted, positioned low on the hull, immediately under the main mast. There are two spade rudders, positioned perpendicularly to the hull, each with its own electrohydraulic steering gear; the two systems are electrically synchronised, but can operate independently should this be required.

Because the two ships were destined to spend most of their operational lives in the North Atlantic, considerable emphasis was placed on seaworthiness. One of the key factors in this is the large freeboard, raising the centre of gravity, which, in its turn, required a greater beam to maintain stability, although fortunately, this created the extra space needed to house the many new electronic equipments being fitted in the ship. The hull shape is conventional, with V-formed frames, and both weather and main decks run the full length of the hull. The hull is constructed of steel plate on long-stem T-bars, and the tower supporting the air defence radar is also made of steel. The remainder of the superstructure is, however, made of seawater-resistant aluminium alloy.

MODERNISATION

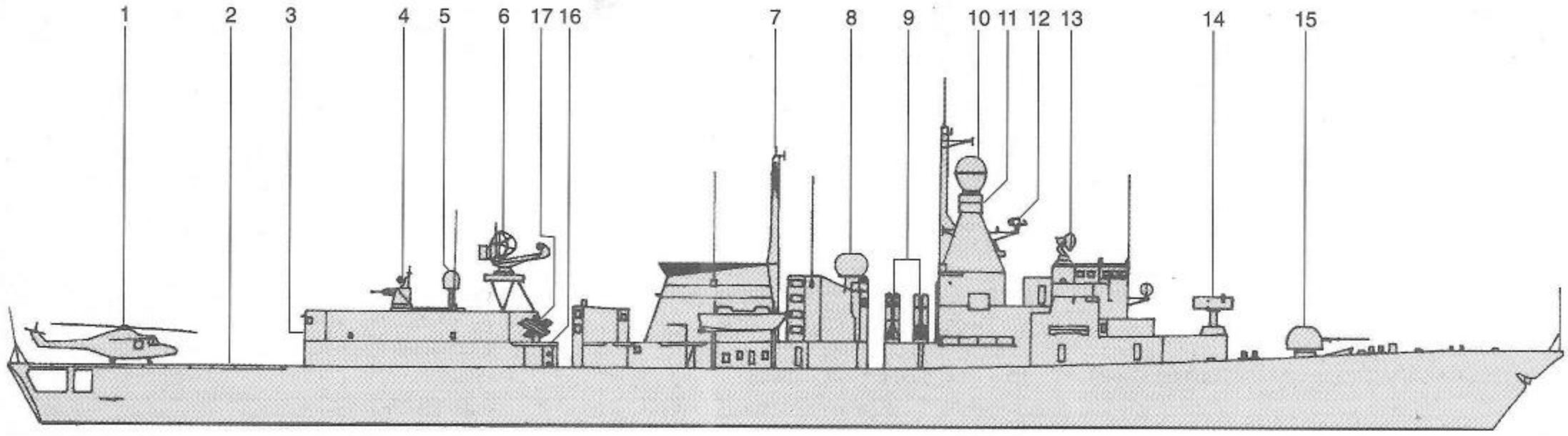
A complete modernisation had been planned for the early 1990s, although this was cancelled in 1988 as an economy measure. Despite this, new equipment has been repeatedly added to these two ships, including new radomes for the SPS-01 3D radar in 1980; a new EW suite and Link 11 in 1984; and SCOT satellite terminals in 1988-90. Weapons additions have included Harpoon in 1977/78 and Goalkeeper, which was fitted first to *De Ruyter* (F 806) and later to *Tromp* (F 801).

It had been intended from very early in the ships' lives to replace the Tynes with a more fuel-efficient engine, but this has never happened, probably due to the cancellation of the mid-life update.

THE FUTURE

The intention is to replace both ships by the two LCF air defence frigates. Two of these are planned, the first of which is due to commission in July 2001.

KORTENAER



Pieter Florisz (Ian Sturton)

1 Westland SH-14D Super Lynx 2 Flight deck 3 Hangar 4 Signaal SGE-30 Goalkeeper (Hughes 30 mm Vulcan seven-barrel gun) 5 Satcom (Inmarsat) 6 Signaal LW08 air search radar 7 Signaal RAMSES ESM/ECM (part) 8 Satcom antennas 9 McDonnell Douglas Harpoon anti-ship missiles (eight) 10 Signaal WM25 fire director radar 11 Signaal RAMSES ESM/ECM (part) 12 Signaal ZW06 surface search radar 13 Signaal STIR target indication radar 14 Mk 29 eight-cell launcher for Raytheon Sea Sparrow SAM 15 OTOBREDA 76 mm (3 in)/62 Compact 16 US Mk 32 324 mm torpedo launcher (triple) 17 Loral Hycor SRBOC Mk 36 chaff/IR launcher

GENERAL SPECIFICATIONS

Operator: Netherlands

Class: KORTENAER

Built: 10
Active: 4

Displacement:
standard: 3,050 t
full load: 3,630 t

Dimensions
Length: 130.5 m (428 ft)
Beam: 14.6 m (47.9 ft)

Draught: 4.3 m (14.1 ft) (hull); 6.2 m (20.3 ft) (screws)

Speed: 30 kts
Range: 4,700 n miles at 16 kts on Tynes

Complement: 176 (18 officers) plus 24 spare berths

SHIPS

PHILIPS VAN ALMONDE (F 823)
Builder Dok en Werfmaatschappij Wilton-Fijenoord, Rotterdam, Netherlands
Laid down 3 Oct 1977
Launched 11 Aug 1979
Commissioned 2 Dec 1981

BLOYS VAN TRESLONG (F 824)
Builder Dok en Werfmaatschappij Wilton-Fijenoord, Rotterdam, Netherlands
Laid down 27 Apr 1978
Launched 15 Nov 1980
Commissioned 25 Nov 1982

JAN VAN BRAKEL (F 825)
Builder Koninklijke Maatschappij De Schelde, Flushing, Netherlands
Laid down 16 Nov 1979
Launched 16 May 1981
Commissioned 14 Apr 1983

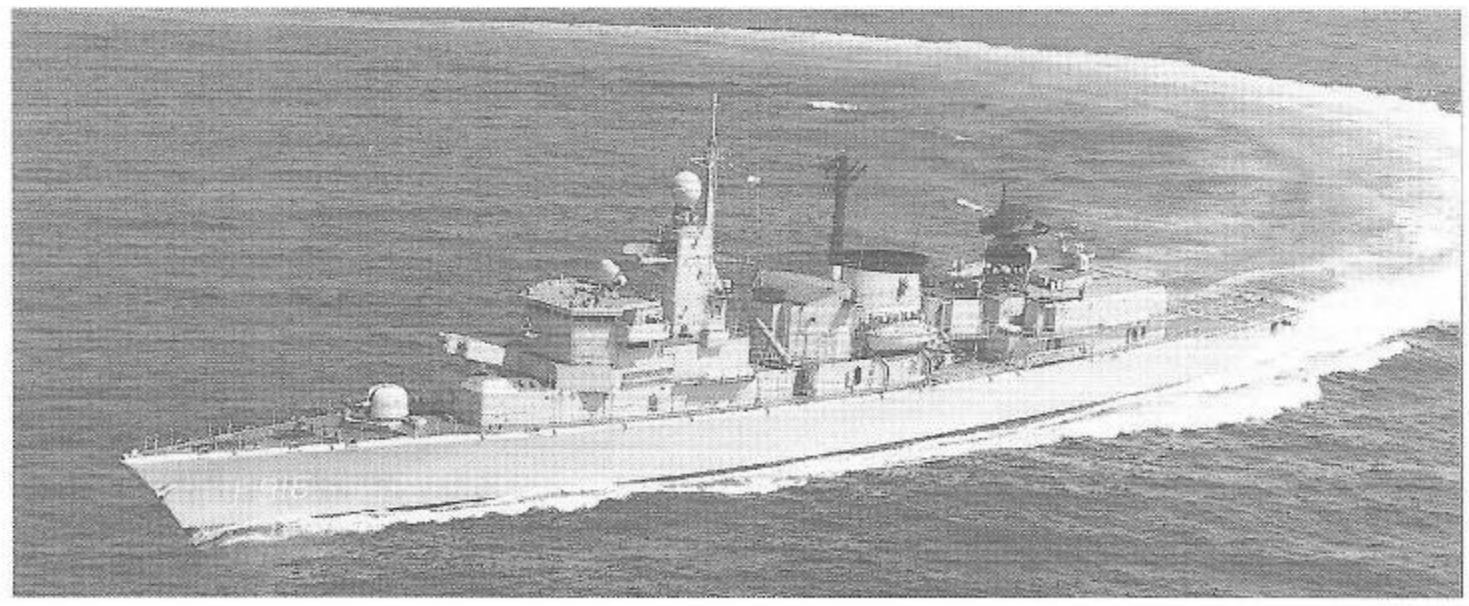
PIETER FLORISZ (F 826)
Builder Koninklijke Maatschappij De Schelde, Flushing, Netherlands
Laid down 21 Jan 1981
Launched 8 May 1982
Commissioned 1 Oct 1983

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84A/C Block 1C Harpoon

Eight Harpoon anti-ship missile canisters are mounted immediately abaft the foremast; there are two groups of four launchers, with each group pointing across the ship to the opposite beam. The missiles are the Block 1C version, which has additional options, compared to previous blocks, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.



Abraham Crijnsen *(F 816), one of ten 'Kortenaer' class frigates built for the RNethN, of which only four remain in Dutch service. Three were sold to Greece in 1993-95 and in 1996 two were sold to the UAE, including* Abraham Crijnsen (RNethN)

Specifications

Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s.
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

Raytheon Sea Sparrow point-defence missile system

The Mk 29 octuple launcher for the Sea Sparrow system is located on the foredeck in 'B' position. Twenty-four RIM-7 Sea Sparrow missiles are carried and the system uses the STIR fire-control system. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-

to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg blast fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications
RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

TUBES

Two twin 324 mm US Mk 32 torpedo tubes are mounted at the forward end of the after superstructure.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Compact
There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications
Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/sec
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy

Signaal/General Electric SGE-30 30mm Goalkeeper close in weapons system
One Signaal/General Electric 30 mm 7-barrelled Gatling Goalkeeper close in weapons system is mounted in the hangar roof. Goalkeeper is an autonomous, fully automatic system, consisting of a General Electric Sea Vulcan 30 gun, I-band search radar, I/K-band tracking radar, TV camera, and ancillaries. The Sea Vulcan 30 is based upon the electrohydraulically powered GAU-8/A 30 mm seven-barrel, Gatling gun, with each barrel firing once during each revolution of the barrel cluster. The gun is very reliable, with 33,000 mean rounds between stoppages. The mounting has an ammunition capacity of 1,190 rounds carried in a linkless system using a feed and storage drum, which is claimed to be sufficient for several target engagements before reloading is necessary. The warhead kill capability of Goalkeeper against anti-ship missiles is achieved by use of MPDS rounds which have high-density, tungsten-alloy penetrators. For 'soft' targets, HEI and TP types of ammunition can be used.

The I-band search radar uses a 2,050 × 280 mm linear array antenna with an integrated sidelobe suppression antenna. The antenna rotates at 60 rpm and has a horizontal beamwidth of 1.7° and a vertical beamwidth of 60°. The radar is powered by a water-cooled, synthesiser-driven, TWT transmitter with high output power for greater frequency and PRF flexibility in the face of ECM threats.

Specifications
Calibre: 30 mm
Muzzle velocity: 1,020 m/s (TP, HEI); 1,150 m/s (APDS)
Traverse: 360°
Elevation: −25 to +85°
Mounting weight: 6,800 kg (14,994 lb)
Crew: 0
Range: 200 m to 3 km (1.61 n miles)
Rate of fire: 4,200 rds/min
Ammunition: 369 g (TP, HEI, HEISD, API, MPDS)

Manufacturers/Contractors
Hollandse Signaalapparaten BV, Netherlands (system/radar).
General Electric Company, Armament Systems Department (gun).

Oerlikon 20 mm
Two single Oerlikon 20 mm guns are mounted either side of the bridge superstructure abreast the foremast.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Signaal Sphinx ESM system
Sphinx (System for Passive Handling of INtercepted Xmissions) is a radar warning system covering the frequencies 1-18 GHz.

Signaal RAMSES ECM system
The Signaal Reprogrammable Advanced Multimode Shipborne ECM System (RAMSES) countermeasures system provides protection against I/J-band radar threats. It is an integrated responsive jammer capable of long-range jamming of search radars and the deception of missiles once launched. In its normal mode of operation, RAMSES is interconnected to and controlled from the ship's ESM systems and a dedicated ECM operator is not required, but in the back-up mode RAMSES can be manually controlled (target designation and jamming) from a remote-control panel located conveniently near the EW operator. RAMSES is capable of high pulse and CW Effective Radiated Power (ERP). Multimode jamming operation is possible with multitarget handling capability. The system is reprogrammable and power management is provided. The antennas are fully trainable (port and starboard, each through 180°) and are stabilised for roll and pitch.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

DECOYS

Loral Hycor SRBOC Mk 6-barrelled Chaff Launcher
There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units mounted at the forward end of the hangar.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SEWACO II sensor, weapon control and command system
SEWACO II is installed in all Dutch-built 'Kortenaer' class frigates, including those supplied to Greece. Sensors include the Signaal LW-08, and ZW-06 radars, the combined search and tracking radar of the WM25 weapon control system and ESM system, two optical target designation sights and an automatic datalink. Non-Signaal sensors include IFF, a helicopter transponder system and the AN/SQS-505 sonar set. The SEWACO system consists of Signaal's Digital Action Information SYstem (DAISY), WM25 weapon control system, including a Separate Tracking and Illumination Radar (STIR) on which a TV camera is mounted, while the weapons fit comprises the OTO Melara 76/62 dual-purpose gun, Harpoon SSM, NATO Sea Sparrow, ASW torpedoes and a Lynx ASW helicopter. SEWACO II's functions include:

air, surface and subsurface warning
compilation and display of tactical air, surface and subsurface situations
threat evaluation and target engagement in AAW, EW, ASuW, ASW and NGS
navigation including ASW helicopter direction
communication including tactical datalink operation
onboard scenario-driven training
organisation and system management.

A 'Kortenaer' class frigate exposes its Westinghouse AN/SPS-509 bow-mounted sonar dome in typical North Atlantic weather (Royal Netherlands Navy)

RADARS

Type	LW-08	ZW-06	STIR	WM25
Maker	Signaal	Signaal	Signaal	Signaal
Role	Air/surface search	Surface search/ navigation	Fire control	
Band	D	I	I/J/K	I/J
Beam	2.2 × csc² to 40°	0.9 × 19°	1.4°	Search: 1.5 × 4/7° Track: 2.4°
Peak Power	150 kW	60 kW	220 kW	200 kW
Gain	30 dB	32 dB	—	33.5 dB
Pulsewidth	35/69 µs	0.06/0.6 µs	0.29 µs	0.22/4.5 µs
PRF	1,000/500 pps	4,000/2,000 pps	1,800/3,600 pps	3,600/1,800 pps
Scan rate	7.5/15 rpm	24 rpm	—	60 rpm
Typical range	145 n miles at 26,000 ft for 2 m² target	14 n miles (26 km)	76 n miles (140 km) for 1 m² target	25 n miles (46 km)

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11

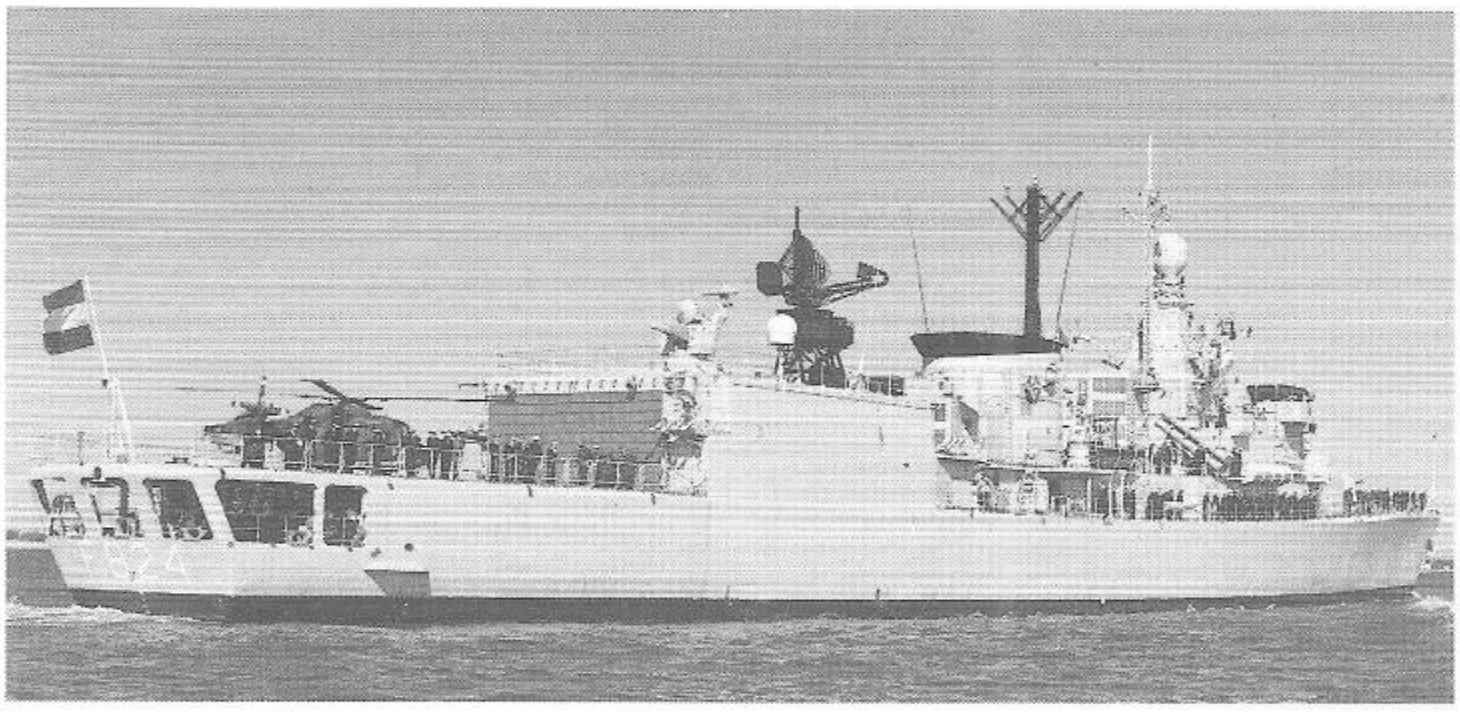
Satcom: F 823 to F 826 only. Electrospace SHF. This recently installed SHF system is based on the US Navy's AN/WSC-6, with twin antennas under the pan-cake-shaped domes providing 360° coverage, even at high latitudes.

SONARS

Westinghouse AN/SQS-505 hull-mounted search and attack sonar

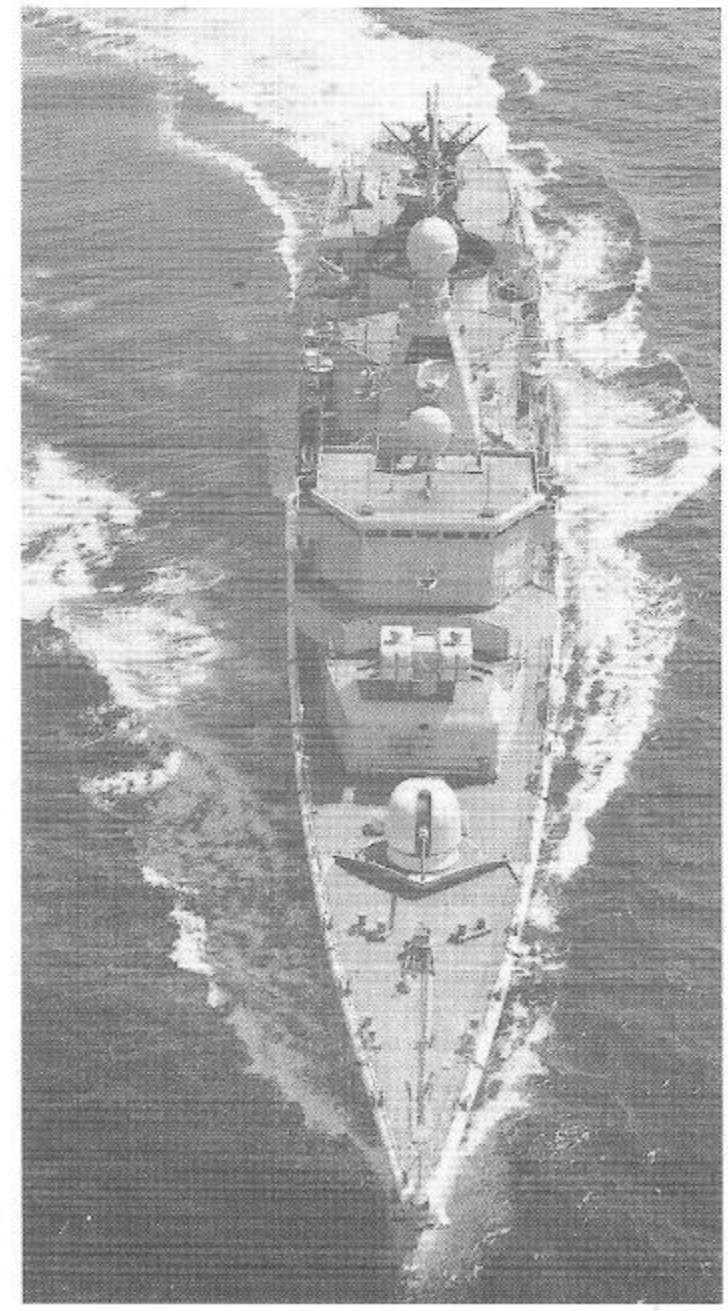
AN/SQS-505 was installed in F 807, 811 and 816, as built. The Canadian Westinghouse AN/SQS-505 sonar

Signaal LW08 2D L-band long-range air and surface search (Signaal)



Bloys van Treslong *(F 824) with its Westland SH-14D Super Lynx on the flight deck. Note the Satcom dome on the hangar roof* (H & L van Ginderen Collection)

Bloys van Treslong *(F 824) is one of the four 'Kortenaer' class ships still in service with the Royal Netherlands Navy. The radar on the bridge roof is the Signaal STIR, with behind it the ZW06 surface search antenna. At the top of the tower is the Signaal 'egg' housing the WM25 fire-control radar while below is a 'collar' of small radomes which are part of the RAMSES ESM/ECM system* (Jane's/H M Steele)



A 'Kortenaer' class frigate. Ten of these ships were built for the RNethN: eight by de Schelde and two by Wilton-Fijenoord

Pieter Florisz *(F 826). This ship has the same 'mushroom-shaped' radomes for satellite communications as fitted in the 'Karel Doorman' class* (H & L van Ginderen Collection)

is a hull-mounted 7 kHz, search and attack sonar. It is a deep water, omnidirectional, surveillance system, but is also able to operate in a directional mode that can maintain search ability while tracking defined targets. Three selectable frequencies are available so that several ships can survey an area in close proximity without cross-talk. In high sea states leading to excessive roll and pitch of the ship, the AN/SQS-505 utilises transmit beam stabilisation, which delays transmission until near optimum roll and submergence conditions prevail, thereby minimising chances of the target being missed altogether.

Specifications

Coverage: 360° (azimuth)
Range: 183-3,000 m (200-3,200 yd)
Doppler range: ± 40 kts (7.2 kHz)
Displays: Range (A Scan); Bearing (B Scan)
Doppler frequencies: 6.4, 7.2 and 8.0 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT
Power level: High and low (10 dB reduction)

Manufacturer/Contractor

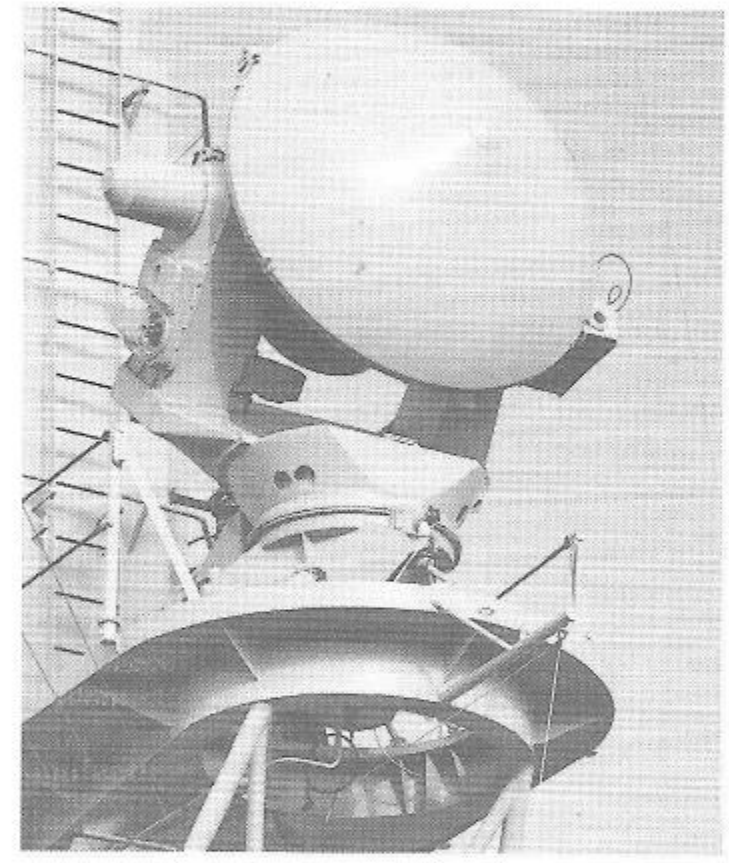
Westinghouse Canada Inc, Burlington, Ontario, Canada.

AN/SQS-509 hull-mounted search and attack sonar

AN/SQS-509 was installed in the last four ships to be built: F 823 to F 826. This is an improved version of AN/SQS-505.

Specifications

Coverage: 360° (azimuth)
Range: 183-3,000 m (200-3,200 yd)
Doppler range: ± 40 kts (7.2 kHz)
Displays: Range (A Scan); Bearing (B Scan)
Doppler frequencies: 4.8, 5.4 and 6.0 kHz
Doppler limits: ±40 kts
Passive frequency: 3.125 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT
Power level: High and low (12 dB reduction)



STIR, I- and K-band tracking and illumination radar (Signaal)

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 24.5 m (80 ft) × 14.6 m (47.9 ft)
Hangar: The hangar is large enough to accommodate two Lynx helicopters, but only one is normally carried.
Helicopter: 2 Westland SH-14D Lynx (note: all RNethN SH-14B/C Lynxes have now been converted to SH-14D standard)

Westland SH-14D Lynx

Specifications

Dimensions:
main rotor diameter: 12.80 m (42.00 ft)
tail rotor diameter: 2.21 m (7.25 ft)
length overall (rotors turning): 15.165 m (49.75 ft)
Weights:
empty: 2,740 kg (6,040 lb)
empty, equipped (ASW): 3,343 kg (7,370 lb)
Performance:
cruising speed: 125 kts (232 km/h)
speed for max endurance: 70 kts (130 km/h)
max rate of climb: 661 m (2,170 ft)/min
time on station (ASW) 50 n miles (93 km) radius: 2 h
max range: 20 n miles (593 km)
max endurance: 2 h 50 min
Power plant: 2 Rolls-Royce Gem 42-1 with maximum contingency rating of 835 kW (1,120 shp).
Crew: 2 (pilot and co-pilot/observer)
Radar: Ferranti Sea Spray Mk 1 lightweight search and tracking radar.
Mission: Alcatel DUAV-4 dipping sonar; FLIR systems 2000HP FLIR.
Navigation: Trimble Type 2200; Doppler 91
ESM: Ferranti AWARE-3 ESM
ASW armament: 2 Mk 46 homing torpedoes; depth charges

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 Rolls-Royce Olympus TM3B gas turbines; 37.9 MW (50,880 hp) sustained; 2 Rolls-Royce Tyne RM1C gas turbines; 7.4 MW (9,900 hp) sustained
Shafts: 2
Propellers: cp
Auxiliary power: 4 SEMT-Pielstick generators driving Smit-Slikkerveer generators.

FURTHER INFORMATION

PROGRAMME

The 'Kortenaer' class was designed to replace the four 'Holland' and eight 'Friesland' class destroyers, which had been built between 1950 and 1958. The requirement was for a ship which would:

- operate in the North Atlantic in any weather and under threat from air, surface and submerged attack
- have a maximum speed of about 30 knots, a cruising speed of 20 knots and a range of about 4,000 n miles
- have the latest weapons and sensors, including a helicopter capable of autonomous ASW operations
- have the greatest degree of automation to reduce manning to a minimum
- achieve maximum standardisation with NATO
- have a reserve of space and weight for future modifications and updating

Approaches were made to other NATO navies, many of whom were then also working on new frigate designs. Initial discussions were held with the UK Navy, with a view to developing a common hull form, but all efforts to reach agreement failed. Then the US Navy tried to interest the Dutch in the Patrol Frigate design ('Oliver Hazard Perry' class), but the Dutch did not like its single screw design, excessive draught and high cost. The French C70ASW design ('Georges Leygues' class) was also examined, but was found unsuitable. All these discussions meant that by 1972 the RNethN still did not have a design and work then went ahead on a national design.

An initial order for four was placed on 10 October 1974, followed by an order for a further four on 28 November 1974, and for the final four in 1976. The Greek Navy then indicated an intention to purchase two ships and, in order to ensure the sale, two ships already fitting out were selected for the sale: the original *Pieter Florisz* (F 812) and the original *Witte de With* (F 813), respectively. In the moves to resolve the situation for the RNethN it was decided to:

- order two new ships, but as anti-air warfare (AAW) ships, rather than as ASW, which became the 'Jacob van Heemskerk' class
- nameship of the class was *Jacob van Heemskerk* (F 312), which took the pennant number of the first ship sold to Greece, but with a new name.
- second ship in the class took the name and pennant number of the second ship sold to Greece: *Witte de With* (F 813).
- rename the final ship ordered as part of the Kortenaer ASW programme, but without changing its pennant number. Thus, the ship ordered as *Willem van der Zaan* (F 826) became *Pieter Florisz* (F 826).

In summary, the RNethN originally ordered twelve ASW versions, but ended up with ten ASW versions ('Kortenaer' class) and two AAW versions ('Jacob van Heemskerk' class).

DESIGN

The flush-deck hull has upper (weather) and main decks running the full length of the ship, giving considerable strength, with high freeboard and negative sheer. Fin stabilisers are fitted and there is a single rudder and a single anchor, the latter being positioned high on the stem of the clipper bow to keep the chain clear of the bow-mounted sonar. There are three deckhouses, the forward one accommodating the bridge, ship's offices and officers' living quarters, and supporting the mast, radars and two weapons systems. The central deckhouse accommodates the inlets and uptakes for the main and auxiliary engines, while the after deckhouse accommodates the hangar and torpedo room. The whole of the after end of the weather deck is devoted to the flight deck, which meant that openings had to be made in the after end of the main deck to provide berthing facilities.

The same COGAG system was adopted as in the 'Tromp' class, with the two Olympus main engines in the forward engine room and the two Tynes in the after engine room, together with the synchro-self-shifting couplings, the main gearboxes and the thrust blocks. There are four auxiliary diesel-generator sets, of which two are always in use, one is on standby and one is assumed to be undergoing maintenance. Two boilers are used to raise steam for evaporators and for domestic use.

MODERNISATION

As built, the first two ships (F 807 and F 808) mounted a second 76 mm gun on the hangar roof, but the third ship onwards mounted a single 40 mm Bofors instead. The first two were then modified to the same standard. Subsequently all have had the 40 mm replaced by a single Goalkeeper mount.

During refit in 1985-86 *Pieter Florisz* (F 826) was adapted for a limited number of female crew (about 25) and the others have since been similarly converted.

At one stage it was planned to fit SMART fire-control radars but this plan has since been cancelled, although SMART radars have been installed in the two 'Jacob van Heemskerck' class ships. It was also planned to fit towed arrays, and F 825 and F 826 were fitted with such a system for a short period, but this has now been shelved.

It is currently planned to fit the four remaining Dutch ships with the new 100 rds/min version of the OTO-BREDA 76 mm gun.

TRIALS

The SMART radar was given sea trials in *Jan Van Brakel* (825) in 1990. The radar was installed on the hangar roof, with the control room in the hangar.

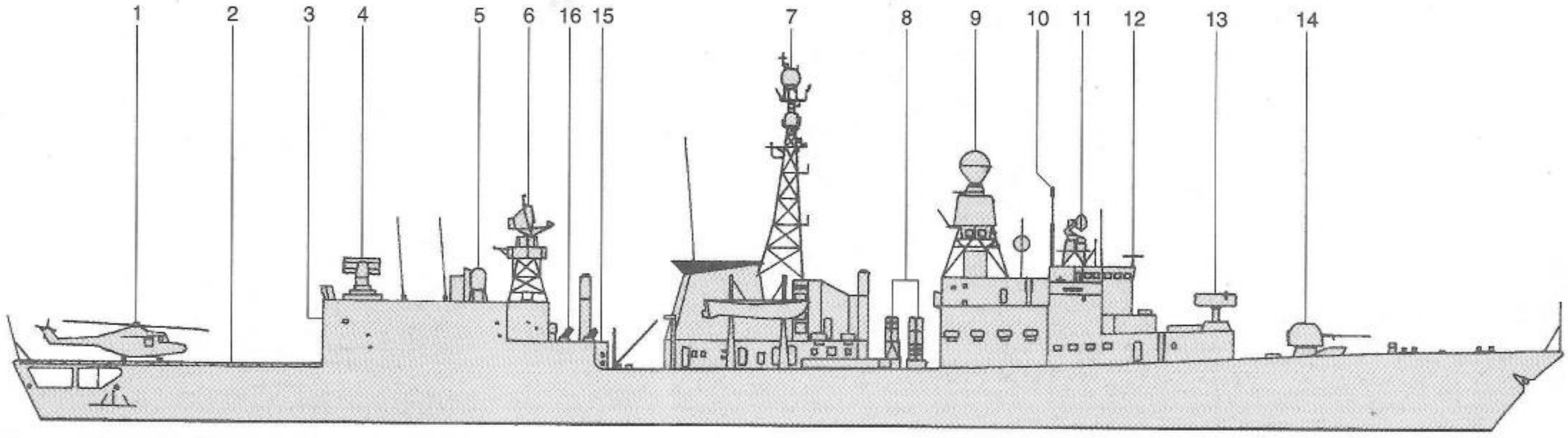
SALES

Two were sold to Greece while fitting out (see 'Elli' class below) and were transferred in mid-1980 and mid-1981, respectively.

Of the ten Kortenaer ships then completed for the RNethN three more were later sold to Greece, under an agreement signed on 11 November 1992. This agreement included refits by De Schelde, Flushing, Netherlands, the removal of Goalkeeper CIWS and the extension of the hangar by 2 m (6.56 ft) to accommodate the AB 212ASW. The ships were then transferred to the Greek Navy: *Banckert* on 14 May 1993 (*Aegeon* (F460)); *Callenburg* on 30 March 1994 (*Adrias* (F 459)); and *Van Kinsbergen* on 1 February 1995 (*Navarinon* (F 462)). *Kortenaer* is also due for sale and may also go to Greece.

A $360 million contract was signed on 2 April 1996 for the sale of Dutch naval equipment to the UAE, which includes two 'Kortenaer' class frigates. The two ships concerned are *Piet Hein* (F 811), and *Abraham Crijnsen* (F 816), which were commissioned into the RNethN in 1980 and 1983, respectively. Both ships are being refitted and modified to make them more suitable for continuous operations in the Gulf environment. Among the modifications so far announced are new Goalkeeper CIWS and fitting Scout LPI radar.

BREMEN (TYPE 122)



Niedersachsen (Ian Sturton)
1 *Westland Lynx Mk 88* **2** *Flight deck* **3** *Hangar* **4** *Mk 49 launcher for RAM missiles* **5** *SCOT 1A satellite communications antennas* **6** *Signaal DA 08 air/surface search radar* **7** *FL1800S ESM/ECM system* **8** *McDonnell Douglas Harpoon anti-ship missiles* **9** *Signaal WM25 fire-control radar* **10** *FL1800S ESM/ECM system* **11** *Signaal STIR* **12** *SMA 3RM20 navigation radar* **13** *Mk 29 eight-cell launcher for NATO Sea Sparrow SAM* **14** *OTOBREDA 76 mm (3 in)/62 Mk 75 gun* **15** *Twin Mk 32 324 mm torpedo tubes* **16** *Two Loral Hycor Mk 36 chaff/IR launchers*

GENERAL SPECIFICATIONS

Country of origin: Netherlands
Operator: Germany
Type: Type 122

Class: BREMEN

Built: 8
Active: 8

Displacement:
standard: 2,900 t
full load: 3,800 t

Dimensions
Length: 128 m (420.0 ft)
Beam: 14.4 m (47.2 ft)
Draught: 6.0 m (19.7 ft)

Speed: 30 kts; 20 kts on diesels
Range: 4,000 n miles at 18 kts

Complement: 207 (aircrew 18)

SHIPS

BREMEN (F 207)
Builder Bremer Vulkan, Bremen, Germany
Laid down 9 Jul 1979
Launched 27 Sep 1979
Commissioned 7 May 1982

NIEDERSACHSEN (F 208)
Builder AG Weser/Bremer Vulkan, Bremen, Germany
Laid down 9 Nov 1979
Launched 9 Jun 1980
Commissioned 15 Oct 1982

RHEINLAND-PFALZ (F 209)
Builder Blohm + Voss/Bremer Vulkan, Bremen, Germany
Laid down 29 Sep 1979
Launched 3 Sep 1980
Commissioned 9 May 1983

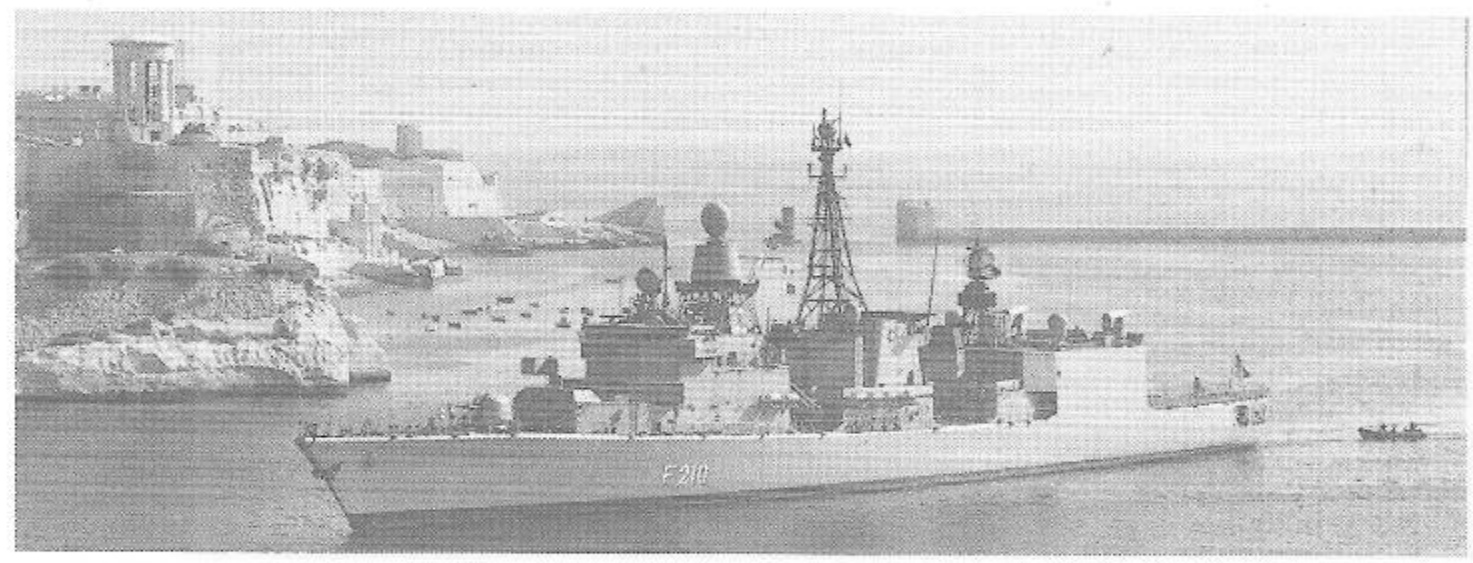
EMDEN (F 210)
Builder Thyssen Nordseewerke, Emden/ Bremer Vulkan, Bremen, Germany
Laid down 23 Jun 1980
Launched 17 Dec 1980
Commissioned 7 Oct 1983

KÖLN (F 211)
Builder Blohm + Voss, Hamburg/Bremer Vulkan, Bremen, Germany
Laid down 16 Jun 1980
Launched 29 May 1981
Commissioned 19 Oct 1984

KARLSRUHE (F 212)
Builder Howaldtswerke, Kiel/Bremer Vulkan, Bremen, Germany
Laid down 10 Mar 1981
Launched 8 Jan 1982
Commissioned 19 Apr 1984

AUGSBURG (F 213)
Builder Bremer Vulkan, Bremen, Germany
Laid down 4 Apr 1987
Launched 17 Sep 1987
Commissioned 3 Oct 1989

LÜBECK (F 214)
Builder Thyssen Nordseewerke, Emden/ Bremer Vulkan, Bremen, Germany
Laid down 1 Jun 1987
Launched 15 Oct 1987
Commissioned 19 Mar 1990



Rheinland-Pfalz *(F 210) entering Grand Harbour Malta on a NATO deployment*

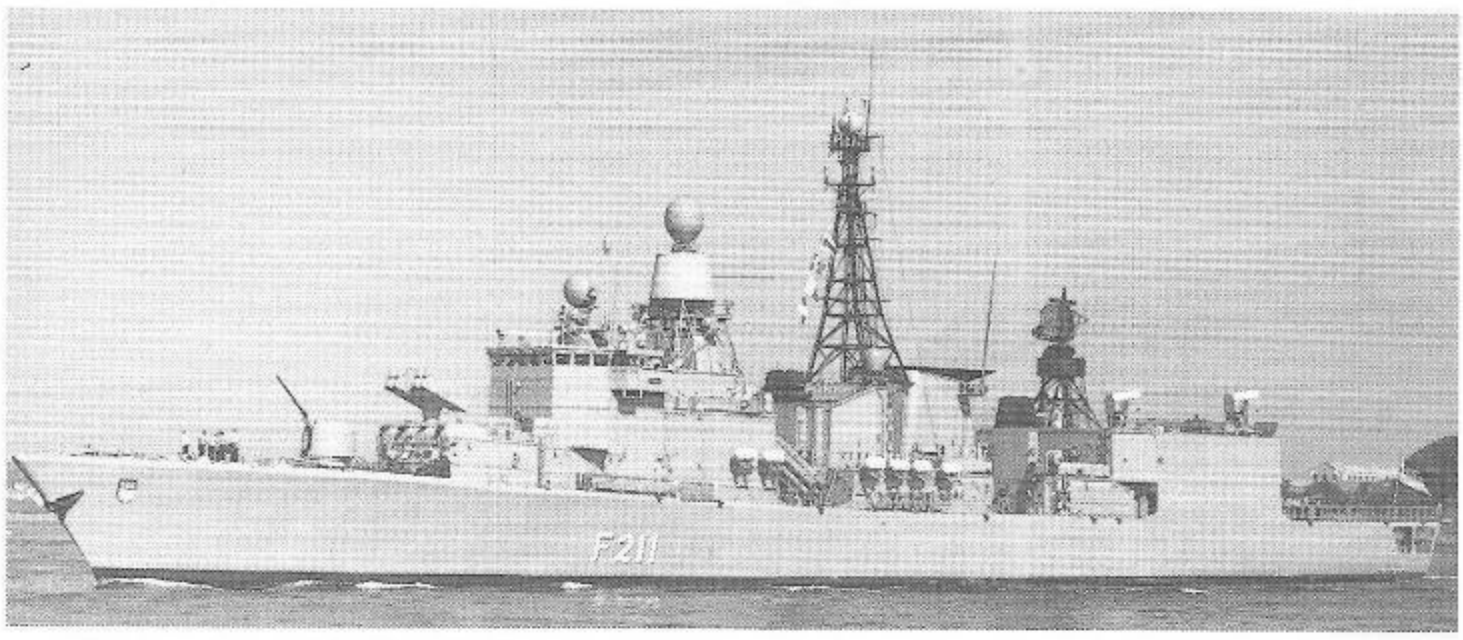
WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84C Block 1C Harpoon

Eight Harpoon anti-ship missile canisters are mounted immediately abaft the forward deckhouse; there are two groups of four launchers, with each group pointing across the ship to the opposite beam. The missiles are the Block 1C version, which has additional options, compared to previous blocks, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)



Köln *(F 211) with two Mk 49 RAM launchers* (Jane's/H M Steele)

Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

Raytheon Sea Sparrow point-defence missile system

The Mk 29 octuple launcher for the Sea Sparrow system is located on the foredeck in 'B' position. Sixteen RIM-7 Sea Sparrow missiles are carried and the system uses the WM25/STIR fire-control system. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications

RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors

Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (Prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

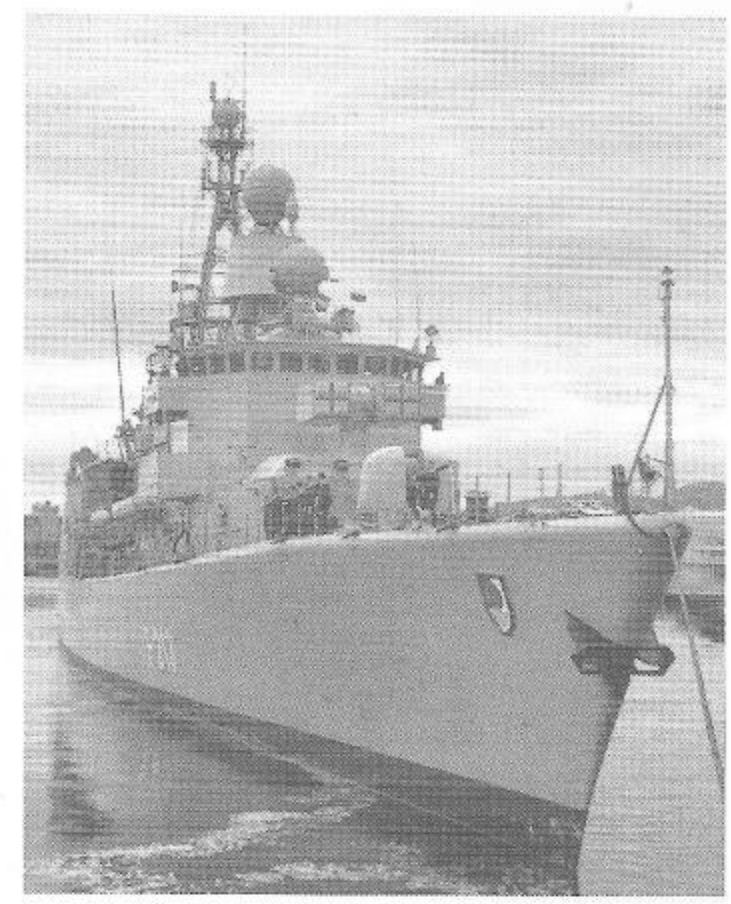
RIM-116A RAM close in system

There are two 21-cell Mk 49 launchers for the Rolling-Airframe Missile (RAM): one on the foredeck, the other aft on the roof of the twin hangars. RAM is a lightweight, close in, quick reaction, anti-missile defence system, the RIM-116 missile being based on the Sidewinder air-to-air missile, but with significant modifications, enabling it to be used as a fire-and-forget system. There is an infra-red, terminal guidance seeker in the nose (taken from the Stinger man-portable surface-to-air missile), behind which is a new dual-mode passive radio frequency seeker for mid-course guidance. Most of the rear of the missile is based upon Sidewinder components. Missiles are stored in sealed launcher-containers which are manually loaded into the 21-cell Mk 49 RAM Standard Launchers.

Radar and electro-optical sensors provide details of target location, distance and speed, while the ship's ESM system inputs data on the target's radar frequency, as well as correlating radar data on location. On launch, the missile is spun-up by a rifling band as it is driven down the launch tube, and then as it leaves the launcher the four tail fins deploy which maintain the spin. Aerodynamic control is provided by the two canard surfaces, which also deploy after launch. The autopilot and control system maintain the initial line of sight course towards the target and then the RF seeker is activated and once this acquires the target it takes control of the guidance system and makes the appropriate course alterations. The IR seeker is also activated and when a sufficient signal-to-noise ratio is achieved this takes over guidance control for the terminal phase. The missile is capable of manoeuvres up to 20 *g* in any direction. The system can only be fired automatically at the moment, but manual control will become possible with Block 2 missiles.

Specifications

Mk 49 RAM Standard launcher
Traverse: 360°
Elevation: −25 to +80°
Turning circle: 3.27 m (10.72 ft)



Augsberg *(F 213). On the foredeck are an OTOBREDA 76 mm/62 Mk 75 and a Mk 29 eight-cell launcher for NATO Sea Sparrow missiles. On the bridge roof are STIR target indication radar and the Signaal WM25 'egg', with between them (with the conical tip) is the omnidirectional antenna of the ESM part of the FL1800S EW suite. The sphere at the masthead is also part of the FL1800S system* (Jane's/H M Steele)

RIM-116 missile
Length: 2.79 m (9.15 ft)
Diameter: 12.7 cm (5 in)
Wing span: 43.4 cm (17.0 in)
Weight: 73.6 kg (162.3 lb)
Speed: Mach 2
Range: 5.17 n miles (9.6 km)
Warhead: 9.09 kg (20.0 lb) fragmentation blast WDU-17B
Motor: Hercules/Aerojet Mk 36 solid propellant rocket.

Manufacturer/Contractor

RAM Systems GmbH, D-85521 Riemerling, Germany.

TUBES

Two twin 324 mm US Mk 32 torpedo tubes are mounted internally at the forward end of the after superstructure. Eight Mk 46 Mod 1 torpedoes are carried.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 1 324 mm torpedoes

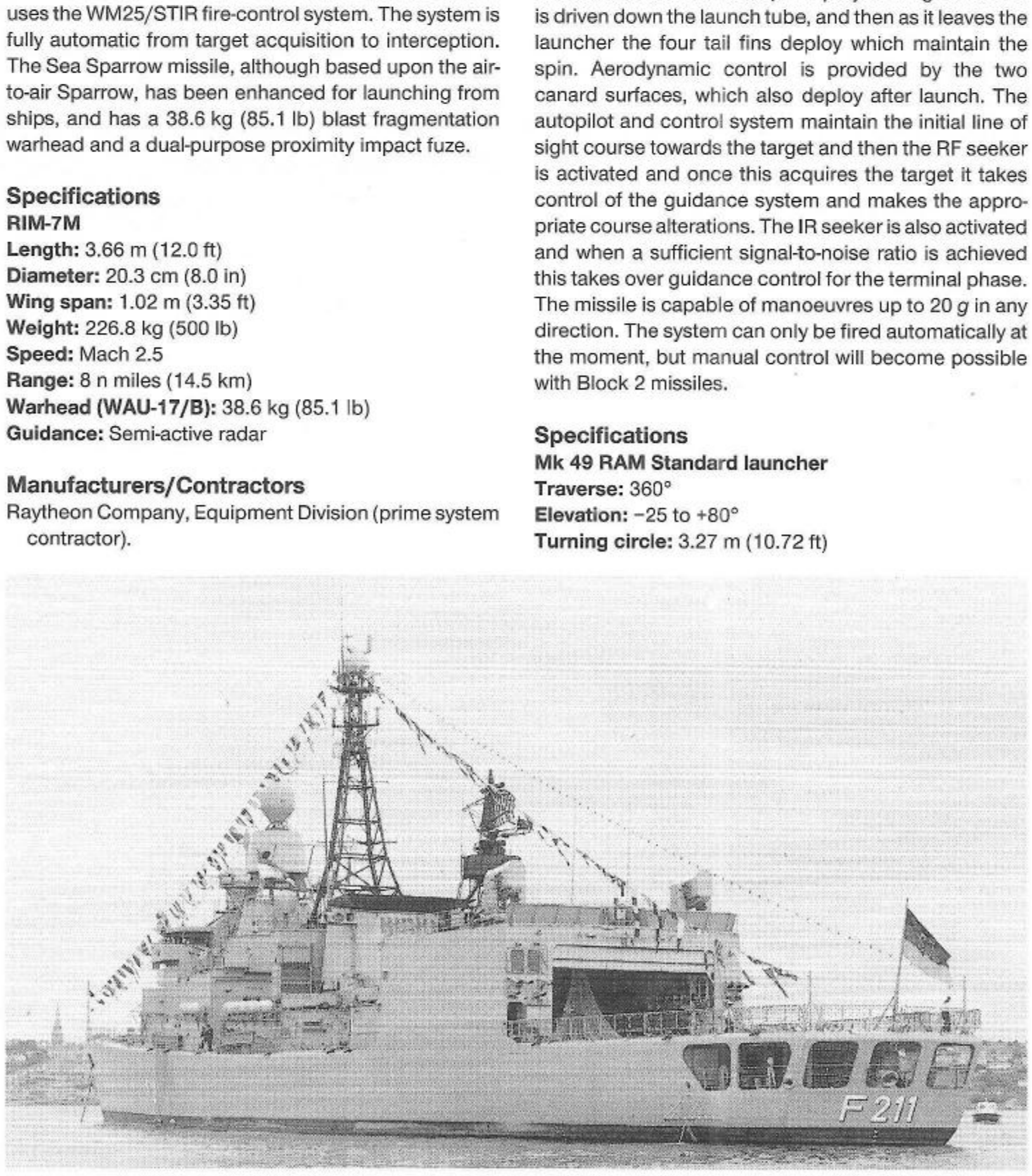
Specifications

Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

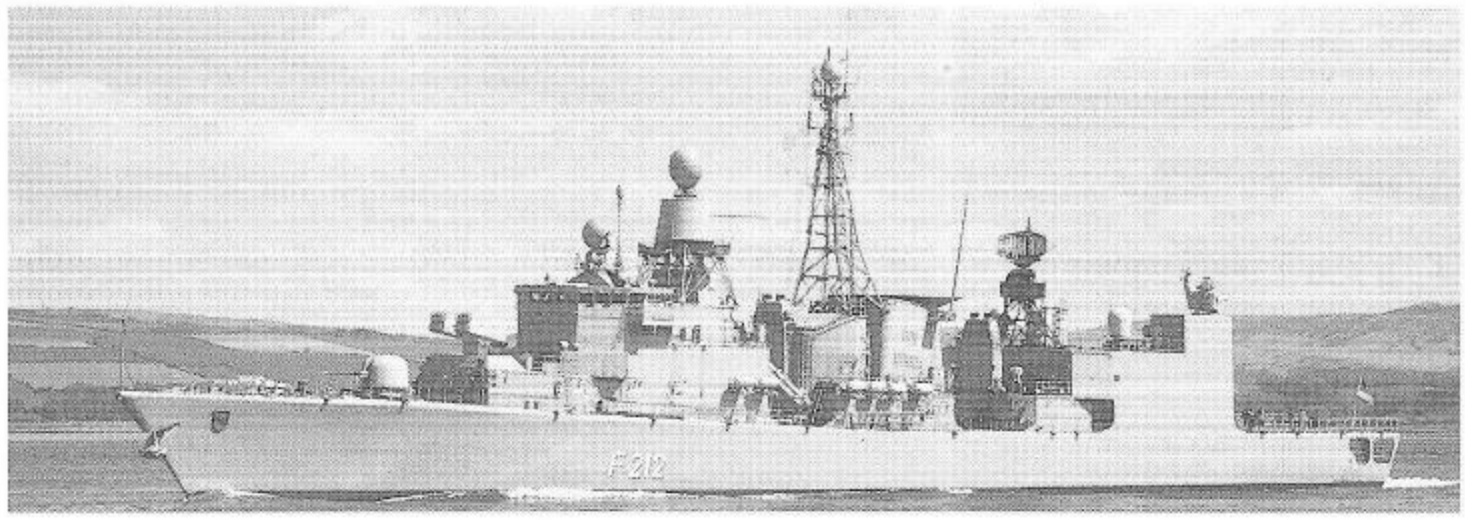
GUNS

OTOBREDA 76 mm (3 in)/62 Compact

There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.



Köln *(F 211) with two RAM launchers on the hangar roof* (H & L van Ginderen Collection)



Karlsruhe *(F 212) is one of eight Type 212 frigates built for the German Navy between 1979 and 1990. The German design is based on that of the Dutch* Kortenaer, *but there are differences as the ships had to meet different operational requirements. Note that in this shot, the ship has a Signaal Goalkeeper CIWS on the hangar roof, which was installed for a 1992-93 overseas deployment; it has since been replaced by two RAM launchers* (Jane's/H M Steele)

Specifications
Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)

Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Oerlikon 20 mm
Two single Oerlikon 20 mm guns can be mounted in the bridge wings, if required.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

DASA FL 1800S Stage II
The FL 1800S Stage II ESM/ECM suite is based on the earlier FL 1800S, but with considerable improvements in the areas of signal processing, analysis, MMIC and ECM. A new channelised receiver with nine sub-bands provides extremely accurate frequency measurement and CW resistance. Two fully integrated superheterodyne receivers have been incorporated for special analysis of pulses and for later upgrade to fit in a 'fingerprinting' system. Expanded capacity threat libraries are provided, which include onboard reprogrammable modules for use in out-of-area missions. The system handles several threats simultaneously, regardless of frequency or direction of arrival.

The ECM system consists of a tracking processor for tracking ECM emitters and to control the timing of both synchronous and asynchronous ECM, modulators for generating ECM modes (ECM-RF), and multibeam array ECM antennas for simultaneous generation of countermeasures, even against multiple threats. A different collection of ECM modes is used to counter each threat, with a look-through mode employed to verify the effectiveness of jamming, and to update the ESM situation in general. The effective radiated power of the jamming is such that it is sufficient to cover the ship's radar cross-section.

Specifications
(ESM)
Frequency range: 2-18 GHz
Azimuth coverage: 360°
Elevation coverage: −10 to +60°
Polarisation: 45° linear for receiving channel; circular for DF
DF accuracy: 5° typical RMS

Manufacturer/Contractor
Daimler-Benz Aerospace AG, Sensor Systems Division, Ulm, Germany

DECOYS

Loral Hycor SRBOC Mk 6-barrelled Chaff Launcher
There are four six-barrelled Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units mounted at the forward end of the hangar.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

AN/SLQ-25 Nixie noisemaker
One AN/SLQ-25 Nixie (Phase 1), solid-state, modular design electroacoustic countermeasures decoy system is mounted on the port side of the quarterdeck. It protects the ship from acoustic homing torpedoes and consists of a remote-control unit; a countermeasures transmitter which generates and amplifies the signals; a power-operated double-drum winch for streaming/recovering the towed bodies; and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them, while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located on the quarterdeck, with the towed bodies deployed through the transom. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm long (3.10 ft), 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.

Prairie noise suppression systems
The ships are fitted with the Prairie radiated noise suppression system, in which high-pressure air is bled off from the ship's gas turbine and ejected from a pipe placed laterally across the ship's hull just forward of the machinery spaces. The forward motion of the ship causes the air to form a layer separating the hull from the water and thus masking the machinery noises which would otherwise be radiated directly into the water. Such a system is less effective at slow speeds where the air bubbles tend to rise to the surface rather than remain attached to the hull.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SATIR F 122 tactical data handling system
SATIR *(System zur Auswertung Taktischer Informationen auf Raketenzerstoerren)* is a command and weapon control system *(Führungs und Waffeneinsatzsystem FüWes)* with the hardware and software integrated by the Bundesamt für Wehrtechnik und Beschaffung (BWB) and the Kommando Marine Führungssystems (KdoMFüSys) and then interfaced with sensor and weapon systems.

SATIR F 122 was designed for the F 122 frigates and has a mainframe architecture running on BWB software written in the CMS-2Y language. The mainframe itself is a dual-bay UniSys 32-bit AN/UYK-7.

SATIR acquires data from a variety of sensors, processes them and then displays them to ensure effective engagement of airborne, surface and subsurface targets. The CIC has been designed to be operated efficiently by the minimum number of personnel while the high processing speed and large storage capacity of the computers, together with very fast peripheral equipment and considerable redundancy, permits maintenance and repairs to be carried out without interfering with the primary operational functions. A modular software structure was adopted and four packages were produced, one each for operations, maintenance, support and administration.

Radar video data is transmitted both directly to the display consoles and, via the video extractor, to the central computer and there is partial integration of the IFF system.

The SATIR F 122 system uses the Hughes AN/UYA-4 display system family and has nine OJ-194 consoles with the commanding officer sharing those of the tactical action and anti-air warfare officers. There are consoles for the WM25 gun fire control and the Mk 91 surface-to-air missile systems and two for electronic warfare. The anti-submarine warfare officer has a console together with the track co-ordinator/supervisor and the helicopter controller. There is also a dedicated console for the DSQS-21 sonar system.

Principal air/sea search sensor is the Signaal DA 08 high-power (145 kW peak), coherent F-band search radar with synthesiser-driven TWT transmitter. The horn-fed parabolic reflector antenna rotates at 10/20 rpm and the beamwidth is 1.55 × 40°. The PRF is 500-1,000 and the maximum range is 104 n miles (193 km). The other prime sensor is the Atlas Elektronik DSQS 21BZ hull-mounted, medium-frequency, active search and attack sonar. This has a 1 m (3.3 ft) diameter, hull-mounted transducer array which produces 32 preformed beams.

Manufacturers/Contractors

BWB (prime contractor).
Unisys
STN Atlas Elektronik } (prime subcontractors)

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11
Satcom: Matra Marconi SCOT 1A Satcom (three sets are held in a pool and allocated to ships according to operational requirements)

WEAPONS CONTROL

See SATIR F 122 (above).

SONAR

DSQS-21 hull-mounted sonar systems

DSQS-21 was designed for the Type 122 frigate. It is an active search and attack sonar, operating at medium frequencies. Computer-aided detection techniques are used for classification and tracking and the information is presented on colour CRT displays to permit Doppler coding and the discrimination of data on the integrated displays. The 'Z' in the nomenclature indicates variants equipped with electronic stabilisation to minimise the effects of ship's motion. The transducer array is 1 m (3.3 ft) in diameter and consists of 32 staves.

RADARS

Type	DA-08	3 RM 30	STIR	WM25
Maker	Signaal	SMA	Signaal	Signaal
Role	Air/surface search	Navigation	Fire control	
Band	F	I (9,375 MHz)	I/J/K	I/J
Beam	1.5 × csc² to 40°	1.2 × 25°	1.4°	Search: 1.5 × 4/7° Track: 2.4°
Peak power	145 kW	20 kW	220 kW	200 kW
Gain	33 dB	—	—	33.5 dB
Pulsewidth	35/69 µs	0.05/0.15/0.5/1.5 µs	0.29 µs	0.22/4.5 µs
PRF	1,000/500 pps	5,200/2,600/1,300/ 650 pps	1,800/3,600 pps	3,600/1,800 pps
Scan rate	10/20 rpm	25 rpm	—	60 rpm
Typical range	110 n miles (204 km) for 2 m² target	—	76 n miles (140 km) for 1 m² target	25 n miles (46 km)

Manufacturer/Contractor

STN Atlas Elektronik GmbH, Bremen, Germany.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 24.5 × 14.6 m (80 × 47.9 ft)
Helicopters: 2 Westland Mk 88 Lynx ASW helicopters are carried, which, under current plans, will be replaced by the Eurocopter NH-90s sometime after 2000.

Westland Mk 88 Lynx

Specifications

Dimensions:
main rotor diameter: 12.80 m (42.00 ft)
tail rotor diameter: 2.21 m (7.25 ft)
length overall (rotors turning): 15.165 m (49.75 ft)
Weights:
empty: 2,740 kg (6,040 lb)
empty, equipped (ASW): 3,343 kg (7,370 lb)
Performance:
cruising speed: 125 kts (232 km/h)
speed for max endurance: 70 kts (130 km/h)
max rate of climb: 661 m (2,170 ft)/min
time on station (ASW) 50 n miles (93 km) radius: 2 h
max range: 320 n miles (593 km)
max endurance: 2 h 50 min

Power plant: 2 Rolls-Royce Gem 42-1 with maximum contingency rating of 835 kW (1,120 shp)
Crew: 2 (pilot and co-pilot/observer)
Radar: Ferranti Sea Spray Mk 1 lightweight search and tracking radar
Mission: Bendix AN/AQS-18 dipping sonar
Navigation: Racal RNS 252 GPS-aided INS; Doppler 91
ASW armament: 2 Mk 46 homing torpedoes; depth charges; (possibly DM 4A1 torpedoes and/or anti-ship missiles in future)

Augsberg *(F 213) with a German Navy Westland Lynx aboard. In this 1995 shot neither Goalkeeper nor RAM is installed* (Jane's/H M Steele)

PROPULSION

Specifications
System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 General Electric LM 2500 gas turbines; 38 MW (51,000 hp) sustained; 2 MTU 20V 956 TB92 diesels; 8.14 MW (11,070 hp(m)) sustained
Shafts: 2 Escher-Wyss, five-bladed
Propellers: cp

FURTHER INFORMATION

PROGRAMME

The German Navy's Type 122 had its genesis in the early 1970s. at the height of the Cold War, when the need arose to replace the 'Fletcher' class destroyers and 'Köln' class frigates. The new ships were required to meet the German Navy's NATO obligations to counter the Soviet Northern Fleet and the Red Banner Baltic Fleet in the North Sea. The North Sea was of great importance at that time as the final stage of the sea route for reinforcements from the USA to Europe which were due to disembark in the north German ports, while a very considerable amount of sea traffic would have taken British reinforcements from the UK to Denmark and Norway. In addition, the North Sea was seen as an operational area for up to ten Soviet SSBNs armed with shorter-range SLBMs targeted against Western European targets.

Considerable discussions took place before the placing of the order. The Germans first considered whether their needs would be met by a small frigate without a flight deck, which would operate in concert with either land-based helicopters or helicopters based on a specialised helicopter carrier. They also examined the possibilities of a force of corvettes operating in conjunction with submarines. The eventual choice, however, was a frigate with its own aviation facilities. Next, seven frigate designs, all foreign, were examined: Wielingen (E-71) (Belgium); C 70ASW (France); Lupo (Italy): Kortenaer (Netherlands); Types 21 and 22 (UK); and Patrol Frigate ('Oliver Hazard Perry') (USA). Of these, the Dutch Kortenaer was judged to be the closest to the German requirements.

The national operational requirement was endorsed in 1974 and, in 1975, a co-operation agreement was signed between the German MoD and the RNethN. Approval was given in early 1976 for the first six of the class. There was a dearth of orders in German shipyards at the time, so the German Cabinet decided that, while Bremer Vulkan should be appointed prime contractor, the order for the first six was to be shared between five yards: AG Weser, Kiel (1); Blohm + Voss, Hamburg (2); Bremer Vulkan, Bremen (1); Howaldtswerke, Kiel (1); and Thyssen-Nordseewerke, Emden (1). The subcontractors were responsible for constructing and partially fitting out the hull, but it was then towed to the Bremer Vulkan yard where weapon systems and electronics were fitted and trials conducted. At the time, this complicated construction programme was estimated to have added some DM150 million (at 1976 prices) to the overall cost.

Some considerable time later an order for a further two was placed (6 December 1985), which were built by Bremer Vulkan and Thyssen Nordseewerke.

DESIGN

The German operational requirement was considerably different from that which the Dutch Kortenaer was designed to meet. The Dutch ship was required to operate as part of a task group in the North Atlantic, and to have a balanced weapon and sensor fit to counter air, surface and underwater threats. The German ship, however, was required to hunt and destroy submarines in the shallow waters of the North Sea, under a somewhat greater air threat. The German operational requirement also specified: area anti-submarine screening; point-defence capability against submarines, aircraft and missiles; and an ability to engage surface targets, particularly amphibious forces.

The result was a ship which differed in many details from the Dutch prototype. Like the Dutch ship, the German ship has two decks running the full length of the ship, but the Germans decided on a double bottom and a full load displacement some 300 tonnes greater. The German requirement for two helicopters also resulted in a rather wider hangar, which is flush with the gunwale.

	Kortenaer	Type 122
Displacement		
standard	3,050 t	2,900 t
full load	3,630 t	3,800 t
Length overall	130.5 m (428 ft)	128 m (420.0 ft)
Beam	14.6 m (47.9 ft)	14.4 m (47.2 ft)
Draught	6.2 m (20.3 ft)	6.0 m (19.7 m)
Helicopters	1	2

The Germans originally intended to install the same COGOG propulsion system as the Dutch, but this was changed before construction. First, the dash engines were changed to General Electric LM-2500s, which had a similar power output to the Rolls-Royce Olympus, but had a higher compression ratio and higher combustion temperatures, which were believed to result in greater efficiency and lower fuel consumption. Thus, the LM-2500s lower operating costs were calculated to more than offset the higher initial cost. Similarly, it was decided to use MTU diesels rather than Tyne gas turbines for cruising, as the diesels had both lower procurement and operating costs.

MODERNISATION

All have been fitted between 1992 and 1996 with the RAM missile system, and a new EW fit is currently being installed.

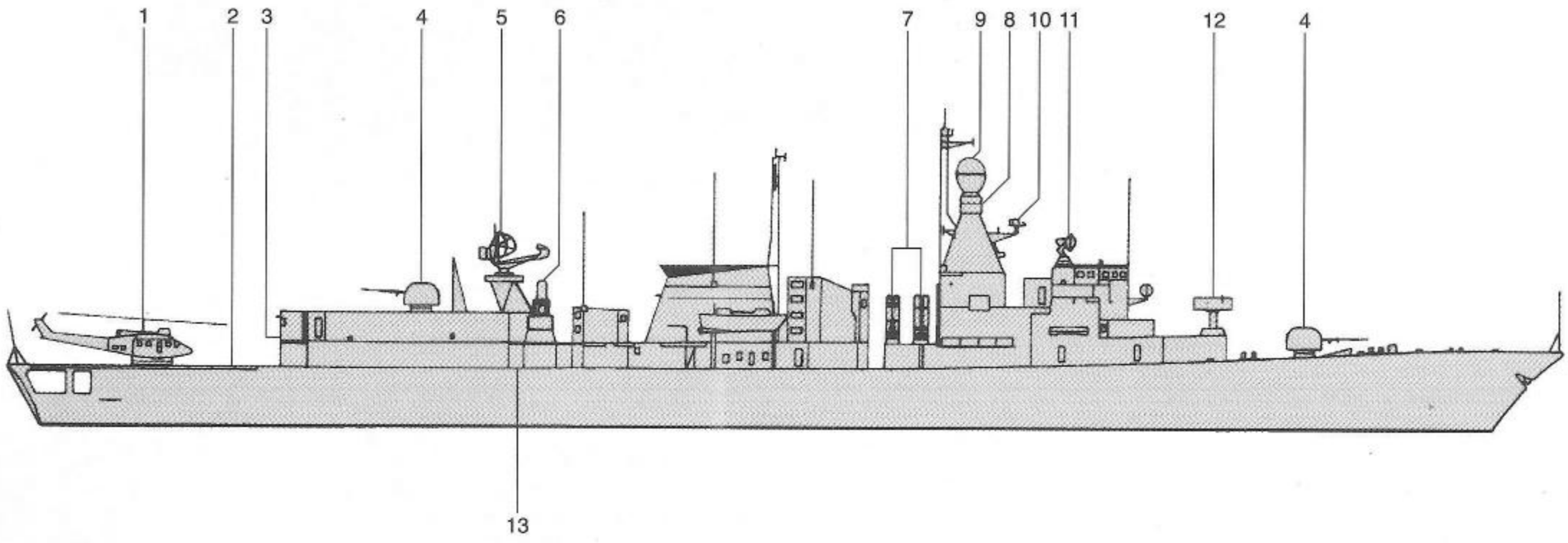
Consideration is being given to mounting two Rheinmetall Rh-202 20 mm cannon. These would be taken from decommissioned Klasse 520 landing craft, refurbished, and then mounted in the bridge wings, in a similar manner to that in the Type 123 frigates.

An improved search radar is also being considered.

OPERATIONAL

These eight ships form the 2nd and 4th Frigate Squadrons and are based at Wilhelmshaven, which will become the single base for all Bundesmarine frigates in due course. Three containerised SCOT 1A satellite terminals were acquired in 1988 and when fitted are mounted on the hangar roof. Dutch Goalkeeper CIWS was installed on the port side of the hangar roof in F 207, 208 and 212 as a short-term contingency in 1991.

ELLI (KORTENAER)



13

Elli (Ian Sturton)
1 *AB 212ASW helicopter* **2** *Flight deck* **3** *Hangar* **4** *OTOBREDA 76 mm (3 in)/62 Compact* **5** *Signaal LW08 air search radar* **6** *Hughes Vulcan Mk 15 20 mm CIWS* **7** *McDonnell Douglas Harpoon anti-ship missiles (eight)* **8** *Sphinx ESM array* **9** *Signaal WM25 fire-control radar* **10** *Signaal ZW06 surface search radar* **11** *Signaal STIR target indication radar* **12** *Mk 29 launcher for NATO Sea Sparrow SAM* **13** *Twin 324 mm torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Netherlands
Operator: Greece
Type: Kortenaer

Class: ELLI

Purchased: 5
Active: 5
Possible purchase: 1

Displacement:
standard: 3,050 t
full load: 3,630 full load

Dimensions
Length: 103.5 m (428 ft)
Beam: 14.6 m (47.9 ft)
Draught: 6.2 m (20.3 ft) (screws)

Speed: 30 kts
Range: 4,700 n miles at 16 kts

Complement: 176 (17 officers)

SHIPS

ELLI (F 450)

Builder	Koninklijke Maatschappij de Schelde, Flushing, Netherlands
Laid down	1 Jul 1977 (*Pieter Florisz* (F 812))
Launched	15 Dec 1979
Acquired by Greece	26 Jun 1981
Commissioned	10 Oct 1981 (Elli F 450)

LIMNOS (F 451)

Builder	Koninklijke Maatschappij de Schelde, Flushing, Netherlands
Laid down	13 Jun 1978 (*Witte de With* (F 813))
Launched	27 Oct 1979
Acquired by Greece	26 Jun 1981
Commissioned (RNIN)	18 Sep 1982 (*Limnos* (F 451))

AEGEON (F 460)

Builder	Koninklijke Maatschappij de Schelde, Flushing, Netherlands
Laid down	25 Feb 1976
Launched	13 Jul 1978
Commissioned (RNIN)	29 Oct 1980 (*Banckert* (F 810))
Acquired by Greece	14 May 1993 (*Aegeon* (F 460))

Aegeon *(F460), the former Dutch ship,* Banckert *(F 810) which was sold to Greece in 1993* (H & L van Ginderen Collection)

ADRIAS (F 459)

Builder	Koninklijke Maatschappij de Schelde, Flushing, Netherlands
Laid down	30 Jun 1975
Launched	12 Mar 1977
Commissioned (RNIN)	26 July 1979 (*Callenburgh* (F 808))
Acquired by Greece	30 Mar 1994 (*Adrias* (F 459))

NAVARINON (F 461)

Builder	Koninklijke Maatschappij de Schelde, Flushing, Netherlands
Laid down	2 Sep 1975
Launched	16 Apr 1977
Commissioned (RNIN)	24 Apr 1980 (*Van Kinsbergen* (F 809))
Acquired by Greece	1 Feb 1995 (*Navarinon* (F 461))

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84A/C Block 1C Harpoon

Eight Harpoon anti-ship missile canisters are mounted immediately abaft the forward deckhouse; there are two groups of four launchers, with each group pointing across the ship to the opposite beam. The missiles are the Block 1C version, which has additional options, compared to previous blocks, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)

Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s.
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

Raytheon Sea Sparrow point-defence missile system

The Mk 29 octuple launcher for the Sea Sparrow system is located on the foredeck in 'B' position. Twenty-four RIM-7 Sea Sparrow missiles are carried and the system uses the WM25/STIR fire-control system. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications

RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturer/Contractors

Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

FIM-43 Redeye close in system

The FIM-43 Redeye system is a man-portable close-range SAM, which although originally developed for army use, is also used by a number of navies. A number of launchers is deployed in the 'Elli' class frigates.

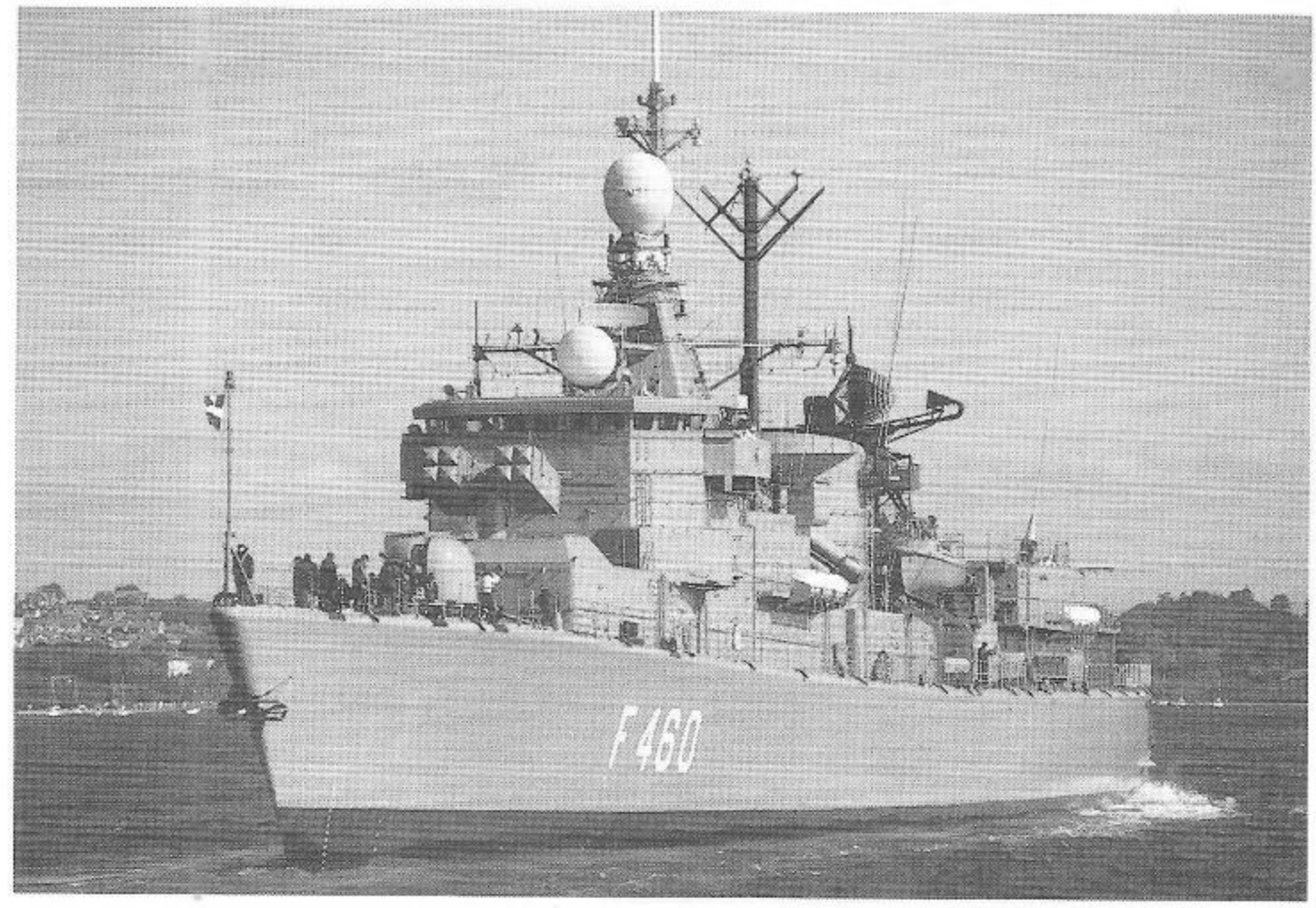
The system consists of an M46A2 launcher assembly with grip-stock, sighting system, an M41 missile in its launcher-container, and a battery coolant device which is fitted to the M46A2. On acquiring a target the operator activates the battery coolant unit and uses the optical sighting system (×7.5 magnification; 25° field of view) to track the target until the missile seeker 'locks on', which generates both audio and visual signals, and the missile is launched. The first stage rocket carries the missile out of the tube and the aerodynamic surfaces deploy, and then, after 1.6 seconds, by which time the missile is 6-7 m (19.6-23 ft) ahead of the operator, the sustainer motor ignites, the warhead is armed, and the seeker constantly measures the difference between the gyro line of sight and the IR source. Throughout the engagement the seeker is continuously repositioned to remain aimed at the target.

Specifications

FIM-43
Length: 1.28 m (4.2 ft)
Diameter: 70 cm (27.5 in)
Weight: 8.2 kg (18.0 lb)
Speed: Mach 1.6
Range: 3,300 m (10,827 ft)
Altitude: 3,000 m (9,843 ft)
Guidance: IR passive homing

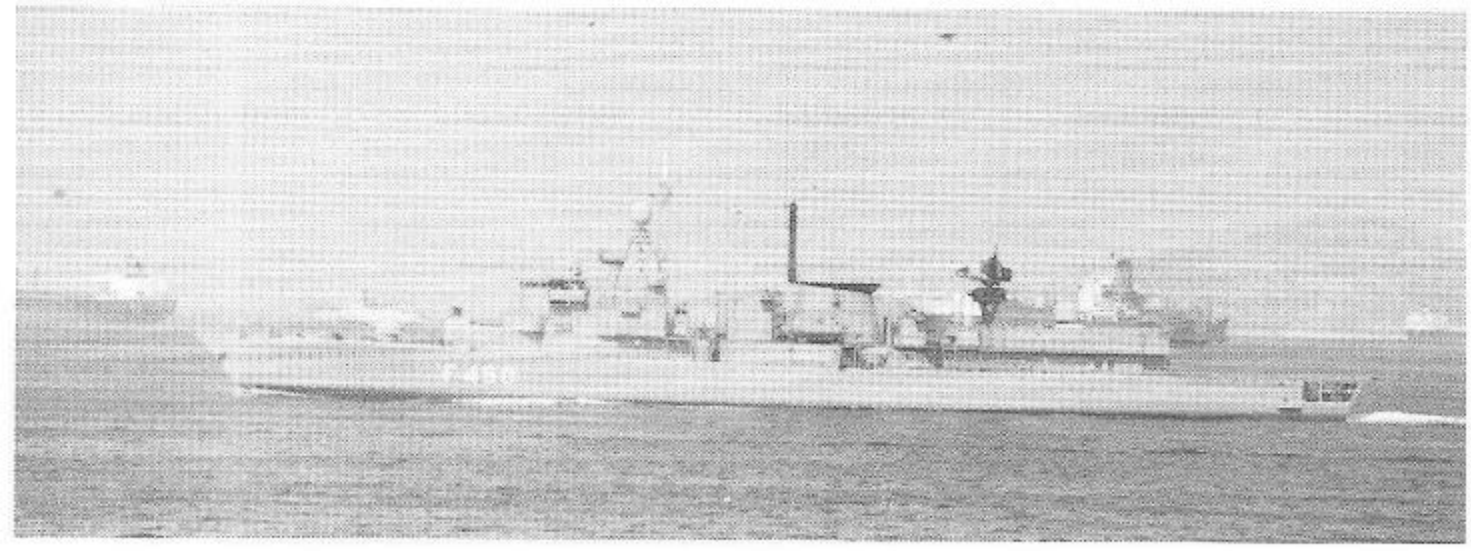
Manufacturers/Contractors

Hughes Missile Systems (prime).
Raytheon Company, Missile Systems Division (second source).
Dornier GmbH (prime European).



Aegeon *(F 460). Weapons include 76 mm gun ('A' position), Mk 29 eight-cell launcher for NATO Sea Sparrow SAM ('B' position) and eight Harpoons (tail end of port-side quad launcher is visible to the left of ship's boat). The 'collar' of DF arrays for the Signaal Sphinx can also be seen below the WM25 Signaal 'egg'* (Jane's/H M Steele)

Navarinon *(F 461) with one 76 mm and two Mk 15 CIWS* (H & L van Ginderen Collection)



Elli *(F 450) the original ship in the Greek Kortenaer class and one of two purchased as new-builds. Note the extended hangar, necessary to accommodate the Greek Navy's AB 212ASW helicopters and the gun armament of two 76 mm and two Mk 15 CIWS* (H & L van Ginderen Collection)

TUBES

Two twin 324 mm US Mk 32 torpedo tubes are mounted at the forward end of the after superstructure. Sixteen Mk 46 Mod 1 torpedoes are carried.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 1/2, 324 mm torpedoes

Specifications

Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts

Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Compact

The two original Greek ships (*Elli* (F 450) and *Limnos* (F 451)) both have two OTOBREDA 76 mm (3 in) guns. One is sited, as with all other 'Kortenaer' class and Type 122 ships, in the 'A' position on the foredeck. The second gun is sited on the hangar roof. The ex-RNethN ships were transferred with the normal Dutch fit of one 76 mm gun in 'A' position. For future plans see 'Further Information' below.

Specifications

Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/sec
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy

Hughes Mk 15 CIWS Phalanx

There are two Hughes Mk 15 CIWS Phalanx close in weapons systems (CIWS), which are mounted either side of the forward end of the hangar roof. The mounts consist of a 20 mm M61A1, six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n miles (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min (Block 0, Block 1 Baseline 0), 4,500 rds/min (Block 1 Baseline 1)
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA (system).

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Signaal SPHINX

SPHINX (System for Passive Handling of INtercepted Xmissions) is a radar warning system covering the frequencies 1-18 GHz.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

ELECTRONIC COUNTERMEASURES (ECM)

Signaal RAMSES ECM SYSTEM

The Signaal Reprogrammable Advanced Multimode Shipborne ECM System (RAMSES) countermeasures system provides protection against I/J-band radar threats. It is an integrated responsive jammer capable of long-range jamming of search radars and the deception of missiles once launched. In its normal mode of operation, RAMSES is interconnected to and controlled from the ship's ESM systems and a dedicated ECM operator is not required, but in the back-up mode RAMSES can be manually controlled (target designation and jamming) from a remote-control panel located conveniently near the EW operator. RAMSES is capable of high pulse and CW Effective Radiated Power (ERP). Multimode jamming operation is possible with multitarget handling capability. The system is reprogrammable and power management is provided. The antennas are fully trainable (port and starboard, each through 180°) and are stabilised for roll and pitch.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

DECOYS

Loral Hycor SRBOC Mk 6-barrelled Chaff Launcher

The two original Greek ships have two six-barrelled Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units abreast the bridge. (They originally had two British Corvus mounted at the forward end of the hangar, but these were removed when the Mk 15 Phalanx CIWS were installed.) The ex-RNethN ships still have four SRBOC pending installation of the CIWS.

Specifications

Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SEWACO II sensor, weapon control and command system

Both the original two ships and the later ships bought from the RNethN are fitted with SEWACO II. Sensors include the Signaal LW-08, and ZW-06 radars, the combined search and tracking radar of the WM25 weapon control system and ESM system, two optical target designation sights and an automatic datalink. Non-Signaal sensors include IFF, a helicopter transponder system and the AN/SQS-505 sonar set. The SEWACO system consists of Signaal's Digital Action Information SYstem (DAISY), WM25 weapon control system, including a Separate Tracking and Illumination Radar (STIR) on which a TV camera is mounted, while the weapons fit comprises the OTO Melara 76/62 dual-purpose gun, Harpoon SSM, NATO Sea Sparrow, ASW torpedoes and a Lynx ASW helicopter. SEWACO II's functions include:

- air, surface and subsurface warning
- compilation and display of tactical air, surface and subsurface situations
- threat evaluation and target engagement in AAW, EW, ASuW, ASW and NGS
- navigation including ASW helicopter direction
- communication including tactical datalink operation
- onboard scenario-driven training
- organisation and system management.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

Type	LW-08	ZW-06	STIR	WM25
Maker	Signaal	Signaal	Signaal	Signaal
Role	Air/surface search	Surface search/ navigation	Fire control	
Band	D	I	I/J/K	I/J
Beam	2.2 × csc² to 40°	0.9 × 19°	1.4°	Search: 1.5 × 4/7° Track: 2.4°
Peak power	150 kW	60 kW	220 kW	200 kW
Gain	30 dB	32 dB	—	33.5 dB
Pulsewidth	35/69 µs	0.06/0.6 µs	0.29 µs	0.22/4.5 µs
PRF	1,000/500 pps	4,000/2,000 pps	1,800/3,600 pps	3,600/1,800 pps
Scan rate	7.5/15 rpm	24 rpm	—	60 rpm
Typical range	145 n miles at 26,000 ft for 2 m² target	14 n miles (26 km)	76 n miles (140 km) for 1 m² target	25 n miles (46 km)

COMMUNICATIONS AND DATALINKS

Datalink: Link 10; Link 11

SONAR

Westinghouse AN/SQS-505 hull-mounted search and attack sonar

AN/SQS-505 is installed in all these ships. The Canadian Westinghouse AN/SQS-505 sonar is a hull-mounted 7 kHz, search and attack sonar. It is a deep water, omnidirectional, surveillance system, but is also able to operate in a directional mode that can maintain search ability while tracking defined targets. Three selectable frequencies are available so that several ships can survey an area in close proximity without cross-talk.

In high sea states leading to excessive roll and pitch of the ship, the AN/SQS-505 utilises transmit beam stabilisation, which delays transmission until near optimum roll and submergence conditions prevail, thereby minimising chances of the target being missed altogether.

Specifications

Coverage: 360° (azimuth)
Range: 183-3,000 m (200-3,200 yd)
Doppler range: ±40 kts (7.2 kHz)
Displays: Range (A Scan); Bearing (B Scan)
Doppler frequencies: 6.4, 7.2 and 8.0 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT
Power level: High and low (10 dB reduction)

Manufacturers/Contractors

Westinghouse Canada Inc, Burlington, Ontario, Canada

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 24.5 m × 14.6 m (80 × 47.9 ft)
Hangar: Because the AB-212ASW is larger than the Lynx, the hangar in the original two Greek ships was lengthened by 2.2 m (7.22 ft) during construction. This does not apply, as yet, to the ex-RNethN ships
Helicopters: 2 Agusta-Bell AB 212ASW helicopters

Agusta-Bell AB 212ASW

Specifications

Main rotor diameter: 14.63 m (48.0 ft)
Length overall (both rotors turning): 22.15 m (57.08 ft)
Fuselage length: 12.92 m (42.39 ft)
Height to rotor head: 3.91 m (12.82 ft)
Rotor disc area: 168.1 m² (1,809 sq ft)
Max take-off weight: 5,070 kg (11,177 lb)
Max speed (never exceed): 130 kts (240 km/h)
Typical cruising speed: 100 kts (185 km/h)
Hovering ceiling (out of ground effect): 396 m (1,300 ft)
Range with max standard fuel: 332 n miles (615 km)
Engine: 1 Pratt & Whitney Canada PT6T-6 Turbo Twin-Pac rated at 1,398 kW (1,875 shp)
Role equipment: Torpedoes

PROPULSION

Specifications

System: Combined gas turbine or gas turbine (COGOG)
Main machinery: 2 Rolls-Royce Olympus TM3B gas turbines; 39.7 MW (50,880 hp) sustained; 2 Rolls-Royce Tyne RM1C gas-turbines; 7.4 MW (9,900 hp) sustained
Propellers: cp

FURTHER INFORMATION

PROGRAMME

The original contract for the purchase of one of the 'Kortenaer' class then building for the Netherlands' Navy was signed with the Netherlands on 15 September 1980, and included an option on a second ship. This option was taken up on 7 June 1981, but a plan to construct a third ship in Greece was dropped, due to financial problems.

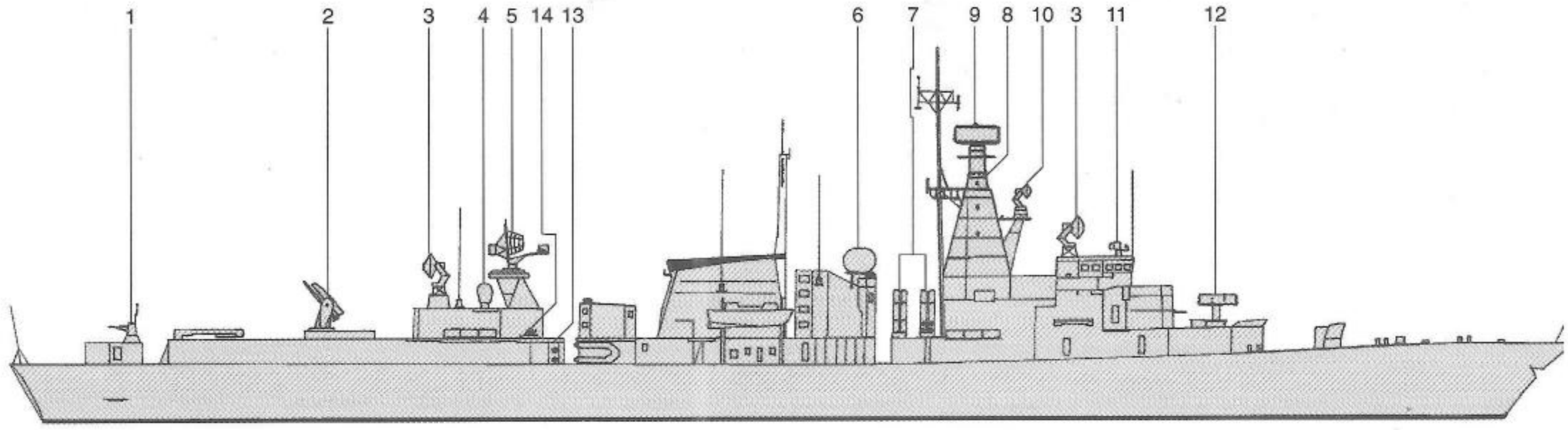
After a gap of some ten years, a second contract was signed on 9 November 1992, under which three ex-RNethN ships were transferred. It is expected that the Greek Navy will also purchase a sixth hull (probably *Kortenaer* (F 807) from the RNethN when it becomes available.

MODERNISATION

In the late 1980s it was planned to replace the after 76 mm gun with a single Mk 15 Phalanx CIWS. When Gulf deployments were undertaken in 1990-91, however, the 76 mm gun was retained and two Mk 15 Phalanx fitted on modified platforms at the forward end of the hangar, which had been previously occupied by Corvus launchers. Two new SRBOC launchers were fitted either side of the bridge.

It had been planned that the three ex-Netherlands ships would be modified to the same standard. This would have involved installing a second 76 mm gun on the hangar roof and two Mk 15 Phalanx to replace the Goalkeeper which was removed before transfer. However, as there is a shortage of funds it is now intended to mount a single Mk 15 Phalanx in the hangar roof, although the hangar will still be lengthened to accommodate the two AB 212ASW.

JACOB VAN HEEMSKERCK (KORTENAER)



Jacob van Heemskerck (Ian Sturton)

***1** Signaal/Hughes SGE-30 Goalkeeper CIWS **2** Mk 13 Mod 1 launcher for Standard SM-1MR **3** Signaal STIR 240 **4** Satcom **5** Signaal LW 08 air search radar **6** Satcom **7** McDonnell Douglas Harpoon anti-ship missiles **8** RAMSES DF array **9** Signaal SMART air-surface search radar **10** Signaal STIR 180 **11** Signaal ZW 06 **12** Mk 29 eight-cell launcher for NATO Sea Sparrow **13** Twin 324 mm torpedo tubes **14** Loral Hycor Mk 36 SRBOC six-tube chaff/IR launchers*

GENERAL SPECIFICATIONS

Operator: Netherlands
Type: Kortenaer

Class: JACOB VAN HEEMSKERCK (FFG)

Built: 2
Active: 2

Displacement:
standard: 3,000 t
full load: 3,750 t

Dimensions
Length: 130.5 m (428 ft)
Beam: 14.6 m (47.9 ft)

Draught: 4.3 m (14.1 ft) (hull); 6.2 m (20.3 ft) (screws)

Speed: 30 kts
Range: 4,700 n miles at 16 kts on Tynes

Complement: 197 (23 officers)

SHIPS

JACOB VAN HEEMSKERCK (F 812)

Builder	Koninklijke Maatschappij de Schelde, Flushing, Netherlands
Laid down	21 Jan 1981
Launched	5 Nov 1983
Commissioned	15 Jan 1986

WITTE DE WITH (F 813)

Builder	Koninklijke Maatschappij de Schelde, Flushing, Netherlands
Laid down	15 Dec 1981
Launched	25 Aug 1984
Commissioned	17 Sep 1986

Witte de With *(F 813), one of two air defence variants of the 'Kortenaer' class design*
(H & L van Ginderen Collection)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84C Block 1C Harpoon

Eight Harpoon anti-ship missile canisters are mounted immediately abaft the forward deckhouse; there are two groups of four launchers, with each group pointing across the ship to the opposite beam. The missiles are the Block 1C version, which has additional options, compared to previous blocks, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

Standard Missile-1 Medium Range (SM-1MR)

Main air defence weapon is the Standard SM-1MR surface-to-air missile. The Standard SM-1MR is the original version of the missile with a combined booster-sustainer rocket motor. The missile has a Raytheon conical scan, solid-state, semi-active radar seeker with

Jacob van Heemskerck *(F 812) with a US Navy Kaman SH-2 Seasprite. The Goalkeeper CIWS is on the quarterdeck, with the Mk 13 SAM launcher turned to one side. Forward of the launcher are a STIR 140 and an LW 08 air search radar, both by Signaal, and two SCOT 1D satellite terminals* (Royal Netherlands Navy)

Dutch task group at sea, with a 'Tromp' class frigate (left), Witte de With *(F 813) (right) and astern a 'Karel Doorman' class frigate and a replenishment oiler* (Royal Netherlands Navy)

scan receiver, speed gate and analogue guidance computer, and an expanding rod warhead in the ordnance section. The fire-control system uses the Dutch STIR.

Specifications
(SM-1MR)
Length: 4.46 m (14.66 ft)
Diameter: 34.3 cm (13.5 in)
Wing span: 1.57 m (5.15 ft)
Weight: 1,343.6 kg (2,962 lb)
Speed: Mach 2.5
Range: 34.5 n miles (64 km)
Altitude: 24,400 m (80,000 ft)

Manufacturers/Contractors
Hughes Missile Systems
Raytheon Missile Systems Division.

Raytheon Sea Sparrow point-defence missile system
The magazine contains 24 NATO Sea Sparrow missiles and the system uses the WM25/STIR fire-control system. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications
RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturer/Contractors
Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

MISSILE LAUNCHERS

Mk 13 Mod 4 launcher
There is one Mk 13 Mod 4 single-arm launcher located aft, which is used to launch Standard SM-1MR SAMs. There are 40 missiles stored vertically in a below-decks magazine in two concentric rings. Launching rate is one missile every 10 seconds. Mod 4 introduced solid-state technology, replacing the electromechanical relays in Mods 1-3.

Mk 29 launcher
One Mk 29 octuple launcher is located atop a platform deck on the foredeck. The Mk 29 can launch one missile every ten seconds.

TUBES

Two twin 324 mm US Mk 32 torpedo tubes are mounted at the forward end of the after superstructure.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

Signaal/Hughes SGE-30 30mm Goalkeeper close in weapons system
One Signaal/Hughes 30 mm 7-barrelled Gatling Goalkeeper close in weapons system is mounted on the quarterdeck. Goalkeeper is an autonomous, fully automatic system, consisting of a Hughes Sea Vulcan 30 gun, I-band search radar, I/K-band tracking radar, TV camera, and ancillaries. The Sea Vulcan 30 is based upon the electrohydraulically powered GAU-8/A 30 mm seven-barrel, Gatling gun, with each barrel firing once during each revolution of the barrel cluster. The gun is very reliable, with 33,000 mean rounds between stoppages. The mounting has an ammunition capacity of 1,190 rounds carried in a linkless system using a feed and storage drum, which is claimed to be sufficient for several target engagements before reloading is necessary. The warhead kill capability of Goalkeeper against anti-ship missiles is achieved by use of MPDS rounds which have high-density, tungsten-alloy penetrators. For 'soft' targets, HEI and TP types of ammunition can be used.

The I-band search radar uses a 2,050 × 280 mm linear array antenna with an integrated sidelobe suppression antenna. The antenna rotates at 60 rpm and has a horizontal beamwidth of 1.7° and a vertical beamwidth of 60°. The radar is powered by a water-cooled, synthesiser-driven, TWT transmitter with high output power for greater frequency and PRF flexibility in the face of ECM threats.

Specifications
Calibre: 30 mm
Muzzle velocity: 1,020 m/s (TP, HEI); 1,150 m/s (APDS)
Traverse: 360°
Elevation: −25 to +85°
Mounting weight: 6,800 kg (14,994 lb)
Crew: 0
Range: 200 m to 3 km (1.61 n miles)
Rate of fire: 4,200 rds/min
Ammunition: 369 g (TP, HEI, HEISD, API, MPDS)

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands (system/radar).

Oerlikon 20 mm
Two single Oerlikon 20 mm guns are mounted either side of the bridge superstructure abreast the foremast.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2.740 ft/s)
Range:
anti-surface: 0.93 n miles (1.5 km)
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Signaal SPHINX

SPHINX (System for Passive Handling of INtercepted Xmissions) is a radar warning system covering the frequencies 1-18 GHz.

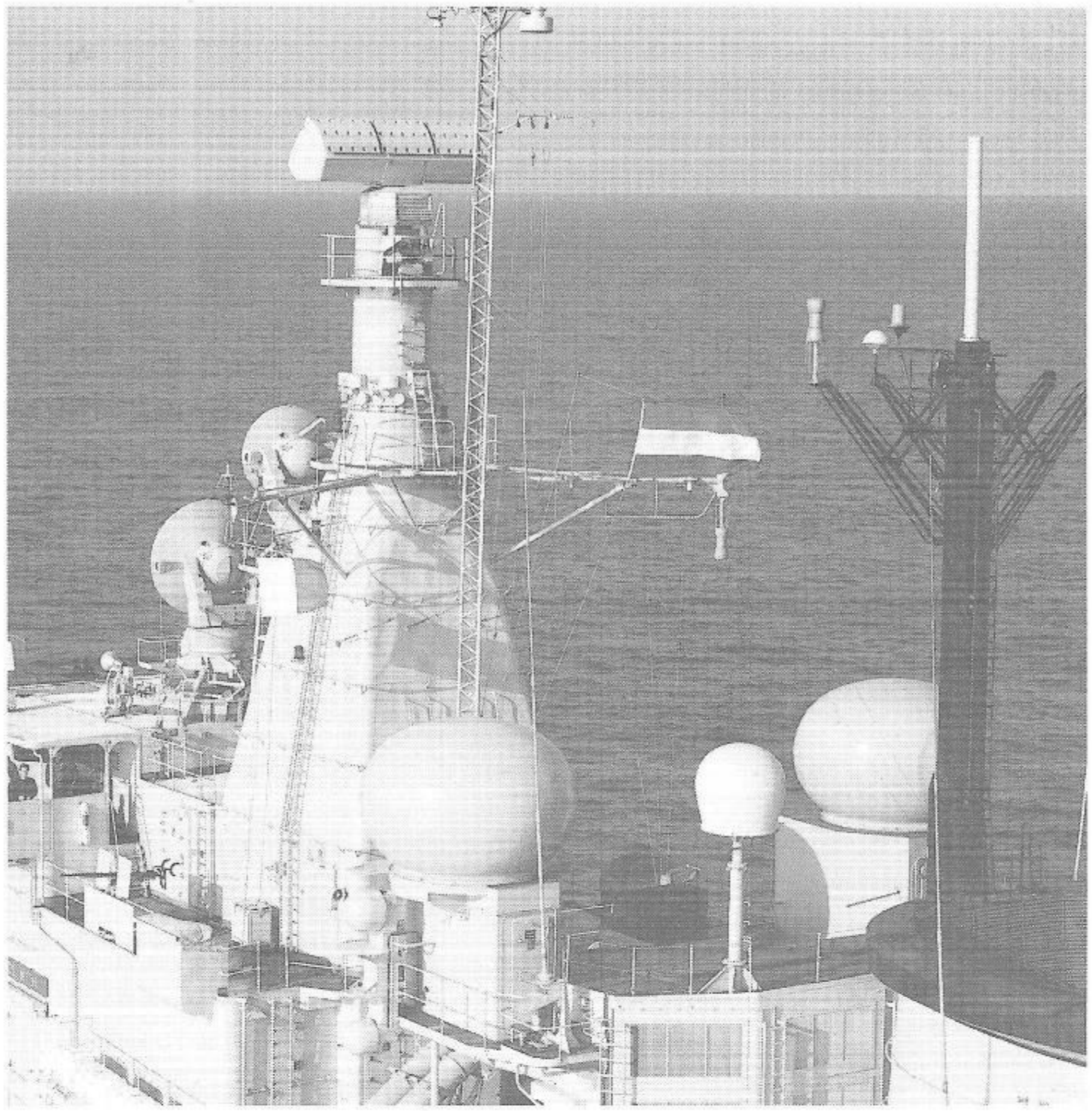
RAMSES jammer system

Signaal's Reprogrammable Advanced Multimode Shipborne ECM System (RAMSES) is a modular naval electronic countermeasures system designed principally to provide protection for ships against radar threats. It is an integrated responsive jammer capable of long-range jamming of search radars and the deception of missiles once launched. In its normal mode of operation, RAMSES is controlled by the Signaal SPHINX, so a dedicated ECM operator is not therefore required. In the back-up mode, RAMSES can be manually controlled (target designation and jamming) from the remote-control panel located conveniently near the EW operator.

RAMSES operates in I/J-band and is capable of high pulse and CW Effective Radiated Power (ERP). Multimode jamming operation is possible with multitarget handling capability. There are two antennas in small 'egg-shaped' radomes on each side of the ship, abaft the foremast and immediately below the Satcom antennas. The two RAMSES antennas are vertically separated with the receive antenna uppermost and a radiation-reflecting plate between them. On receiving orders from SPHINX, the RAMSES receiver trains towards the designated threat, searches for it and then locks onto it, whereupon the system automatically triggers a programmed response. With two separate systems, two targets can be handled simultaneously, but, in addition to this, jamming sequences for the next targets can be set up, so that as soon as one target has been dealt with the next can be tackled.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.



Close-up of Witte de With *(F 813). At the masthead is the Signaal SMART air surface search radar and below it the RAMSES DF array encircles the tower. On the front of the tower is a Signaal STIR 180 and below it on the bridge roof a STIR 240. In the foreground are two 'mushroom' radomes for satellite antennas and below the left one is a RAMSES jammer installation with two small radomes separated by two radiation-reflecting plates. Note also the Oerlikon 20 mm cannon on the bridge wing* (Royal Netherlands Navy via Signaal)

DECOYS

Loral Hycor SRBOC Mk 6-barrelled Chaff Launcher

There are two six-barrelled, fixed, Mk 36 SRBOC launchers immediately below the mainmast.

Specifications

Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEM

Signaal SEWACO VI action data automation

The four elements in the SEWACO VI system are:

- sensors consisting of primary 2/3D radar systems for long-, medium- and short-range air and surface warning, secondary radar sensors such as IFF and helicopter transponders, hull-mounted sonar systems, and passive sensors such as ESM and IR sensors. Automatic initiation and tracking of air and surface targets is released by built-in track capability or additional primary and secondary video extractors
- the DAISY system comprising operator consoles, plotting table, conference display and the command and control software package
- weapon control system comprising active and/or passive target tracking and/or illumination systems, weapon interface systems for interfacing with hard-kill and soft-kill weapons and close in weapon control systems
- a communications system with internal and external communication equipment and automatic datalink systems.

Functions performed include:

- air, surface and subsurface warning
- compilation and display of tactical air, surface and subsurface situations
- threat evaluation and target engagement in AAW, EW, ASuW, ASW and NGS
- navigation including ASW helicopter direction
- communication including tactical datalink operation
- onboard scenario-driven training
- organisation and system management.

SEWACO VI was specially designed for the RNethN's 'Jacob van Heemskerck' class air defence frigates and comprises: Signaal LW-08 extended range/elevation version, a stabilised DA-05, ZW-06 and Goalkeeper search radar sensors; multiple video extractor systems; a SPHINX ESM system; RAMSES ECM system; two optical target designation sights; the GMCS guided missile control system, consisting of three STIRs (one 1.8 m (5.9 ft) and two 2.4 m (7.9 ft) scanners) with high-power coherent transmitter chains. CW illumination for Standard SM1 MR and for Sea Sparrow missiles is provided by each STIR. The system provides a high level of autonomy by means of automatic threat evaluation and STIR and weapon selection for automatic target engagement.

The DAISY system includes six vertical consoles, two horizontal consoles and a sonar display console, primary and secondary video extractors. In addition to the normal DAISY functions it has extensive air defence software facilities. IFF, VESTA and datalink are also integrated in the SEWACO system. The weapons are the SM1-MR to be launched by a Mk 13 Mod 4 launcher, Sea Sparrow from eight-cell launcher, Harpoon surface-to-surface missiles, RBOC countermeasures, Mk 46 torpedoes and the EX 83 30 mm gun portion of the Goalkeeper CIWS.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11; JMCIS (may be fitted)
Satcom: The SHF Satcom system is based on the US Navy AN/WSC-6, with twin aerials providing 360° coverage, even at high latitudes

Jacob van Heemskerck *(F 812) (left) and* Witte de With *(F 813) (right). Note that F 812 has a DA 08 at the masthead while F 813 has a SMART radar* (RNethN)

SONAR

AN/SQS-509 hull-mounted search and attack sonar

AN/SQS-509, an improved version of AN/SQS-505, is installed in both these ships.

Specifications

Coverage: 360° (azimuth)
Range: 183-3,000 m (200-3,200 yd)
Doppler range: ±40 kts (7.2 kHz)
Displays: Range (A Scan); Bearing (B Scan)
Doppler frequencies: 4.8, 5.4 and 6.0 kHz
Doppler limits: ±40 kts
Passive frequency: 3.125 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT
Power level: High and low (12 dB reduction)

RADARS

Type	LW-08	SMART	Scout	STIR 240 (two)	STIR 180
Maker	Signaal	Signaal	Signaal	Signaal	Signaal
Role	Air/surface search	3D air search	Surface search	Fire control	Fire control
Band	D	F	I	I/J/K	I/J/K
Beam	2.2× csc² to 40°	2 × 9°	—	1.4° or 1.0°	1.4° or 1.0°
Peak Power	150 kW	150 kW	1 mW – 1 W	5 kW (average)	5 kW (average)
Gain	30 dB	23 dB	30 dB		
Pulsewidth	35/69 µs	0.6 µs	—	0.3 µs	0.3 µs
PRF	1,000/500 pps	3,800 pps	—	3,200/6,400 pps	3,200/6,400 pps
Scan rate	7.5/15 rpm	27 rpm	24 rpm	—	—
Typical range	145 n miles at 26,000 m for 2 m²	0.1 m² target at Mach 3	FPB at 15 n miles	76 n miles (140 km) for 0.5 m² air target	54.68 n miles (100 km) for 0.5 m² air target

PROPULSION

Specifications

System: Combined gas turbine or gas turbine (COGOG)
Main machinery: 2 Rolls-Royce Olympus TM3B gas turbines; 37.9 MW (50,880 hp) sustained; 2 Rolls-Royce Tyne RM1C gas-turbines; 7.4 MW (9,900 hp) sustained
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

In the 1970s the RNethN undertook a commitment to NATO to provide four ASW task groups in the North Atlantic in war. Each of those task groups required a flagship/air defence ship and the two 'Tromp' class frigates were already available for this role.

Thus, there was a requirement for two further flagship/air defence ships for the remaining two task groups and the sale of two ASW Kortenaers to Greece provided the opportunity to construct the two required ships on a Kortenaer hull.

DESIGN

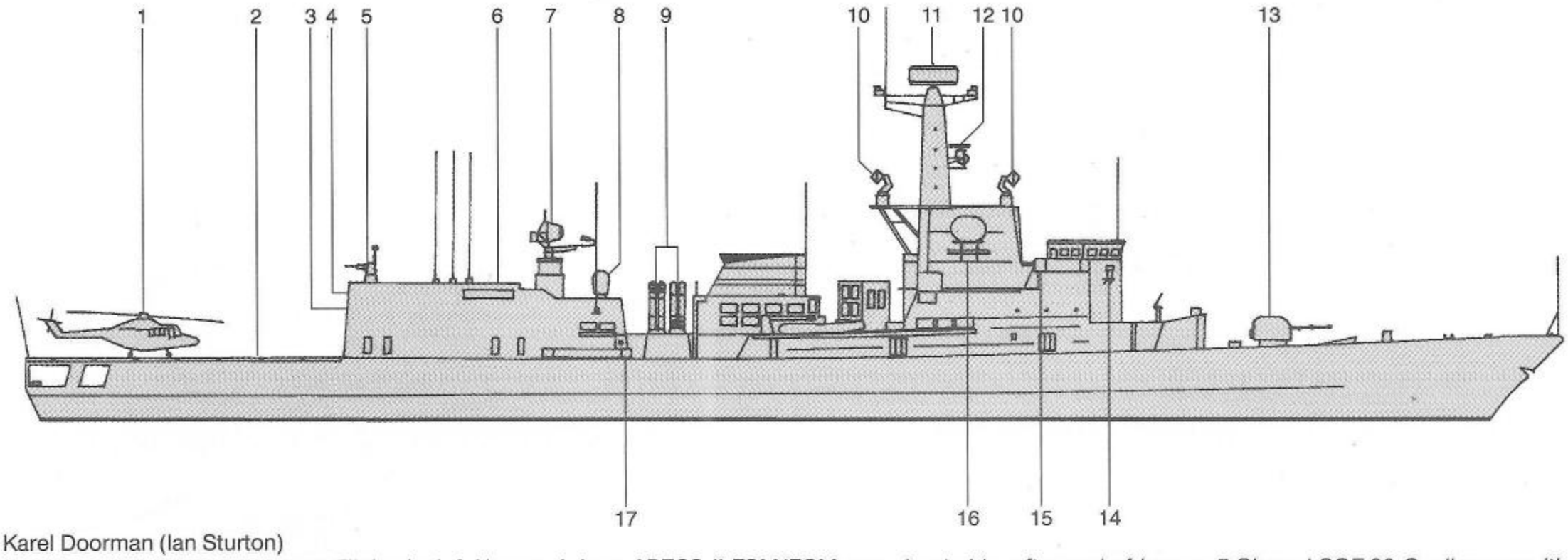
The 'Jacob van Heemskerck' class is identical in dimensions and propulsion to the ASW Kortenaer, and has a number of the same weapons systems, such as Harpoon, NATO Sea Sparrow, Goalkeeper and Mk 32 torpedo tubes. The major differences lie in the deletion of the 76 mm gun, and the replacement of the hangar and flight deck by a large magazine and launcher for Standard SM-1MR SAMs.

MODERNISATION

In-service upgrading has included fitting twin Satcom terminals: to F 812 in 1993, and to F 813 in 1994/95. Signaal SMART radar replaced DA 05 in F 813 in 1994 and in F 812 in 1995/96.

A 'Capability Upkeep Programme' (CUP) had been planned to take place between 1999 and 2002, but it is now intended to cancel this in order to free the funds to purchase two additional LF frigates (see 'LCF' entry).

KAREL DOORMAN



Karel Doorman (Ian Sturton)

1 *Westland SH-14 Super Lynx* **2** *Flight deck* **3** *Hangar* **4** *Argo APECS II ESM/ECM array (port side, after end of hangar* **5** *Signaal SGE-30 Goalkeeper with Hughes 30 mm Vulcan 7-barrel gun* **6** *Mk 48 vertical launchers for Raytheon Sea Sparrow SAM (16 missiles; port side of hangar)* **7** *Signaal LW 08 air/surface search radar* **8** *Marisat satellite antenna* **9** *McDonnell Douglas Harpoon anti-ship missiles (eight)* **10** *Signaal STIR target indication and tracking radar* **11** *Signaal SMART air/surface search radar* **12** *Racal-Decca 1226 navigation radar* **13** *OTOBREDA 76 mm (3 in)/62 automatic gun* **14** *Argo APECS II ESM/ECM array* **15** *Oerlikon 20 mm cannon* **16** *Signaal SATCOM antenna* **17** *Two 324 mm torpedo tubes*

GENERAL SPECIFICATIONS

Operator: Netherlands

Class: KAREL DOORMAN

Built: 8
Active: 8

Displacement:
full load: 3,320 t

Dimensions
Length: 122.25 m (401.08 ft)
Beam: 14.37 m (47.15 ft)
Draught: 4.30 m (14.11 ft)

Speed: 30 kts (Speys); 21 kts (diesels)
Range: 5,000 n miles at 18 kts

Complement: 156 (16 officers) (accommodation for 163)

SHIPS

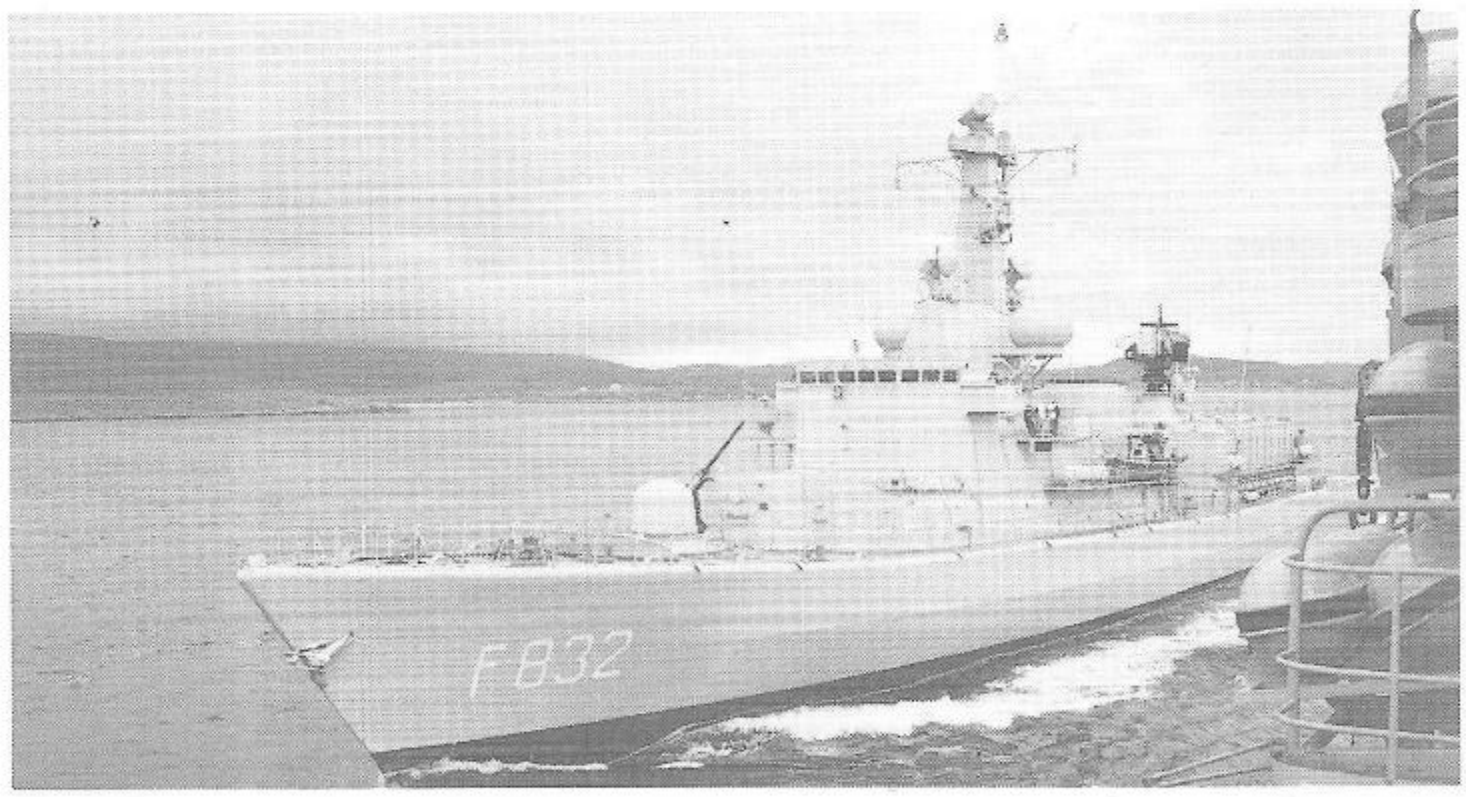
KAREL DOORMAN (F 827)
Builder Koninklijke Maatschappij De Schelde, Flushing, Netherlands
Laid down 26 Feb 1985
Launched 20 Apr 1988
Commissioned 31 May 1991

WILLEM VAN DER ZAAN (F 829)
Builder Koninklijke Maatschappij De Schelde, Flushing, Netherlands
Laid down 6 Nov 1985
Launched 21 Jan 1989
Commissioned 28 Nov 1991

TJERK HIDDES (F 830)
Builder Koninklijke Maatschappij De Schelde, Flushing, Netherlands
Laid down 28 Oct 1986
Launched 9 Dec 1989
Commissioned 3 Dec 1992

VAN AMSTEL (F 831)
Builder Koninklijke Maatschappij De Schelde, Flushing, Netherlands
Laid down 3 May 1988
Launched 19 May 1990
Commissioned 27 May 1993

ABRAHAM VAN DER HULST (F 832)
Builder Koninklijke Maatschappij De Schelde, Flushing, Netherlands
Laid down 8 Feb 1989
Launched 7 Sep 1991
Commissioned 15 Dec 1993



Abraham van der Hulst *(F 832) conducting a 'steam-past' in Loch Ewe in 1995* (Jane's/David Miller)

VAN NES (F 833)
Builder Koninklijke Maatschappij De Schelde, Flushing, Netherlands
Laid down 10 Jan 1990
Launched 16 May 1992
Commissioned 2 Jun 1994

VAN GALEN (F 834)
Builder Koninklijke Maatschappij De Schelde, Flushing, Netherlands
Laid down 7 Jun 1990
Launched 21 Nov 1992
Commissioned 1 Dec 1994

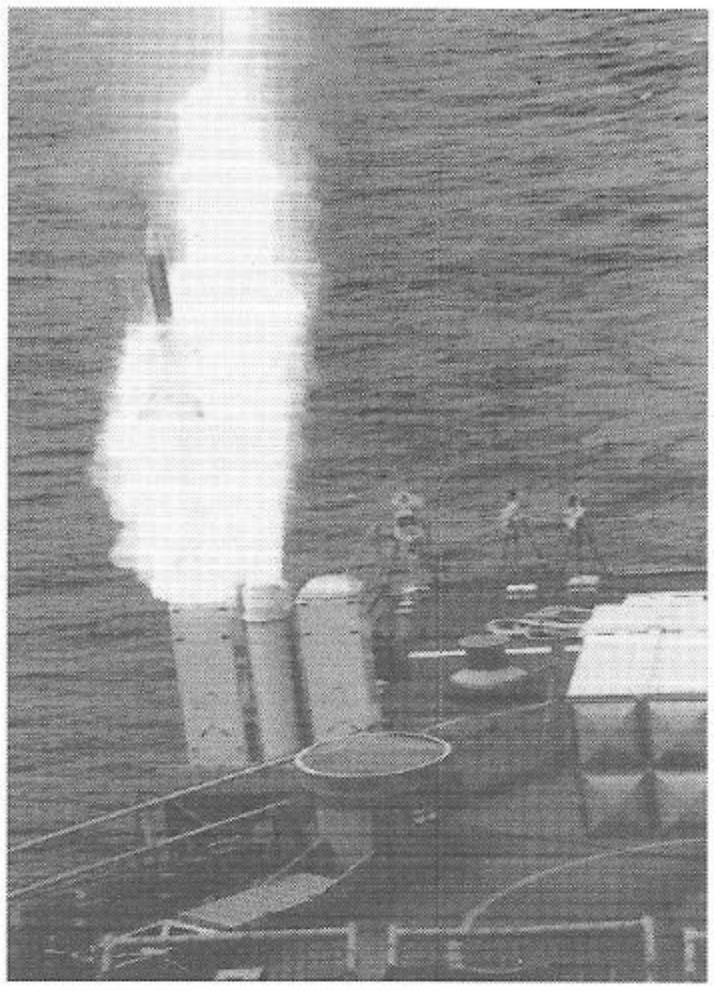
VAN SPEIJK (F 828)
Builder Koninklijke Maatschappij De Schelde, Flushing, Netherlands
Laid down 1 Oct 1991
Launched 26 Mar 1994
Commissioned Aug 1995

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84C Block 1C Harpoon

Eight Harpoon anti-ship missile canisters are mounted immediately abaft the stack; there are two groups of four launchers, with each group pointing across the ship to the opposite beam. The missiles are the Block 1C version, which has additional options, compared to previous blocks, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-



NATO Sea Sparrow SAM lifts off from the Mk 48 launcher with the rocket efflux being directed outboard across the ship's rails. At the after end of the row of missile tubes is the drum-like antenna array of the APECS-II ESM/ECM system (Royal Netherlands Navy)

Van Galen *(F 834) in the North Atlantic waters for which the class was designed. The very neat installation for the Sea Sparrow missiles down the port side of the hangar can be seen, as can the two APECS-II arrays — one at the after end of the hangar, the other on the starboard side of the bridge screen*

skimming approach or a low-apogee 'pop-up' trajectory.

Specifications

Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile)
US Naval Weapons Center, China Lake, California, USA (warhead)
Thiokol, Elkton, Maryland, USA (booster)

SURFACE-TO-AIR MISSILES (SAM)

Mk 48 Mod 1 VLS

There is one Mk 48 Mod 1 VLS with eight pairs of twin launch canisters in a single row along the port side of the hangar. The units are made up of pairs of vertical canisters, each with its own efflux system, which turns the gases through 90° to exhaust over the ship's side.

Raytheon Sea Sparrow point-defence missile system

The system uses RIM-7M Sea Sparrow missiles, with two STIR illuminators. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg blast fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications

RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturer/Contractors

Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

TUBES

Two 324 mm US Mk 32 torpedo tubes are mounted at the forward end of the after superstructure.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications

Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Mk 100 Compact

There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck. This is the latest version with an improved rate of fire.

Specifications

Calibre: 76.2 mm (3.0 in)
Barrel length: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 100 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

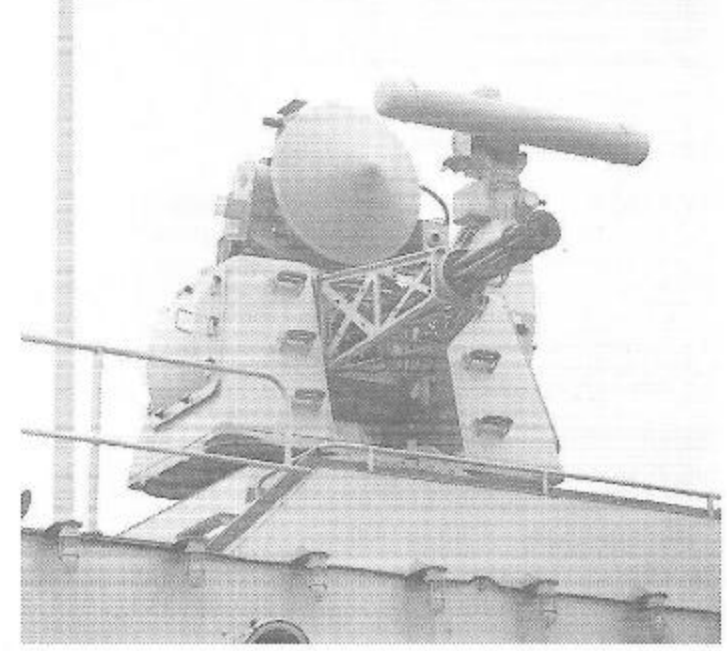
Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

Signaal/Hughes SGE-30 30 mm Goalkeeper close in weapons system

One Signaal/Hughes 30 mm 7-barrelled Gatling Goalkeeper close in weapons system is mounted in the hangar roof on the port side. Goalkeeper is an autonomous, fully automatic system, consisting of a Hughes Sea Vulcan 30 gun, I-band search radar, I/K-band tracking radar, TV camera, and ancillaries. The Sea Vulcan 30 is based upon the electrohydraulically powered GAU-8/A 30 mm seven-barrel, Gatling gun, with each barrel firing once during each revolution of the barrel cluster. The gun is very reliable, with 33,000 mean rounds between stoppages. The mounting has an ammunition capacity of 1,190 rounds carried in a linkless system using a feed and storage drum, which is claimed to be sufficient for several target engagements before reloading is necessary. The warhead kill capability of Goalkeeper against anti-ship missiles is achieved by use of MPDS rounds which have high-density, tungsten-alloy penetrators. For 'soft' targets, HEI and TP types of ammunition can be used.

The I-band search radar uses a 2,050 × 280 mm linear array antenna with an integrated sidelobe



Signaal SGE-30 Goalkeeper, combines the Hughes Vulcan 30 mm Gatling seven-barrel gun with Signaal radar and control systems. Firing rate is 4,200 rounds per minute (Signaal)

suppression antenna. The antenna rotates at 60 rpm and has a horizontal beamwidth of 1.7° and a vertical beamwidth of 60°. The radar is powered by a water-cooled, synthesiser-driven, TWT transmitter with high output power for greater frequency and PRF flexibility in the face of ECM threats.

Specifications
Calibre: 30 mm
Muzzle velocity: 1,020 m/s (TP, HEI); 1,150 m/s (APDS)
Traverse: 360°
Elevation: −25 to +85°
Mounting weight: 6,800 kg
Crew: 0
Range: 1.61 n miles (200 m to 3 km)
Rate of fire: 4,200 rds/min
Ammunition: 369 g (TP, HEI, HEISD, API, MPDS)

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands (system/radar)

Oerlikon 20 mm
Two single Oerlikon 20 mm guns are mounted either side of the bridge superstructure.

Specifications
Calibre: 20 mm
Barrel length: 70 calibres
Muzzle velocity: 835 m/s (2.740 ft/s)
Range:
surface target: 1.5 km
air target: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°

ELECTRONIC WARFARE SYSTEMS

ELECTROMAGNETIC SUPPORT MEASURES/COUNTERMEASURES (ESM/ECM)

APECS II radar detection and jamming system
APECS II is an advanced modular ESM/ECM system covering frequencies from 0.5 to 18 GHz, which is designed to counter most known radar threats. It is a fully automatic system, identifying and jamming threat emitters using a mixture of IFM receivers and microprocessor-controlled jammers, with high-speed switching enabling up to 16 threats to be jammed simultaneously. There are two arrays: one is mounted on a small platform on the starboard side of the bridge screen and the other on the after port corner of the hangar. Both consist of two DF arrays, one omnidirectional unit and two monopulse units; system processing equipment.

Specifications
ESM frequency coverage: 0.5-18 GHz
High sensitivity: up to −67 dBm
Detection range: 200 n miles ships; 50 n miles aircraft
DF accuracy: 4° RMS; 2° RMS fine DF
Automatic tracking: 500 active signals in dense signal environment
Signal identification speed: <1s
ECM azimuth coverage: 360° using a 60-beam jammer (one beam per 6° azimuth sector)
Radiated power: 180 kW nominal mid-band
ECM frequency coverage: 7.5-18 GHz

Manufacturer/Contractor
ARGOSystems Inc, Sunnyvale, California.

DECOYS

Two Loral Hycor SRBOC
There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mark 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
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Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

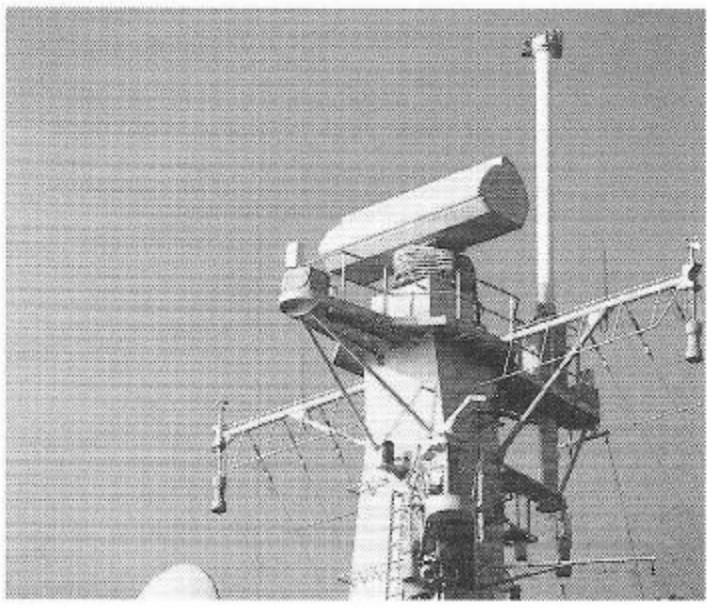
COMBAT DATA SYSTEMS

SEWACO VIIB
SEWACO VIIB is installed in the Royal Netherlands Navy's eight 'Karel Doorman' class frigates (M-frigate) and is the first of a new generation of SEWACO systems with an increased level of integration and automation.

The core system comprises three computer complexes: Data Handling Computer Complex (two SMR-4 and one SMR-MU computers); Communications Complex (two SMR-4 computers); and Mass Memory and Message Handling Complex (two mainframe VAX 4000, two MC-68030 multiprocessor nodes). Each of these complexes has two elements, which are split between the fore and aft ends of the ship to ensure survivability. Connections between the elements are achieved by three separate systems: the system databus (triple Ethernet connection); voice and communications databus (fibre optic ring); video bus (compiled from CCTV components). All buses feature automatic reconfiguration to implement bypasses in the event of damage. In addition, the sensors are connected with the core system, either by interfacing with the bus, or via duplicated direct links.

The sensors are, in general, autonomous subsystems with embedded processing power enabling them to convert detected targets into tracks automatically. Radars are:
- LW-08 — long-range, 2D, D-band radar, with IFF
- SMART-S — medium-range, 3D, F-band radar

Sonars:
- PHS-36 — hull-mounted active/passive system
- TACTAS — long-range, towed array



Main air/surface search radar is the Signaal SMART, located at the masthead. The small arrays on the fore and aft platforms are part of the Argo APECS-II ESM/ECM system, and the antenna on the spiralled platform below is for the navigational Racal-Decca 1226 (Signaal)

RADARS

Type	SMART	LW-08	Type 1226 (two)	AN/SPG-51C (two)	STIR
Maker	Signaal	Signaal	Decca	Raytheon	Signaal
Role	Air/surface search (3D)	Air/surface search	Navigation	Fire control	Fire control
Band	F	D	I	G/I	I/J/K
Beam	Horizontal: 2° Vertical: 9°	2.2 × csc² to 40°	1.2°	Track: 1.6° Illum: 0.9°	1.4°
Peak Power	150 kW	150 kW	25 kW	Track: 81 kW Illum: 5 kW	220 kW
Gain	Tx: 23 dB Rx: 31.5 dB	30 dB	30 dB	Track: 39.5 dB Ilum: 45 dB	—
Pulsewidth	0.6 µs	35/69 µs	0.05/0.25/ 1.0 µs	Track: 2.1-3.2 µs	0.29 µs
PRF	3,800 pps	1,000/500 pps	n/a	Surface: 4.1 kHz Air: 9.5-16.7 kHz	1,800/3,600 pps
Scan rate	27 rpm	7.5/15 rpm	28 rpm	—	—
Typical range	—	145 n miles at 26,000 m for 2 m² target	48 n miles	—	76 n miles (140 km) for 1 m² target

Tjerk Hiddes *(F 830). The large mushroom radomes cover the new Signaal satellite communications terminal*

ESM:
- APECS II – EW system

Weapons systems are also mainly autonomous subsystems, with their own embedded processors responsible for automatic handling of engagements, the most important elements being:
- MultiPurpose Weapon Control System (MWCS), which controls the vertically launched Sea Sparrow SAM and the 76 mm gun
- The two STIR tracking systems and both weapons systems are scheduled and assigned to the most important targets automatically
- Harpoon surface-to-surface missile system
- Goalkeeper CIWS accepts and engages targets assigned by the core system, but also has the ability to conduct autonomous engagements within set parameters
- The ECM system can conduct noise and deception repeater jamming on orders from the core system.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11; Link 16; JMCIS (may be fitted)
Satellite communications: Electrospace SHF

SONARS

Signaal PHS-36 hull-mounted search and attack sonar

The PHS-36 provides information for the data handling functions of active sonar, passive sonar, acoustic support and track management and other functions such as equipment monitoring. The sound velocity processing and recording system also provides data for acoustic support.

The transducer is based on that of the French TSM 2080 but with Signaal electronics. A colour-coded presentation on a Signaal GOS, high-resolution console gives a graphic picture of sonar information. The dual-processing system performs FM and CW processing

The second element in the air/surface search system is the Signaal LW 08, a D-band radar with an IFF interrogator above the main array (Signaal)

simultaneously to cope with both noise-limited and reverberation-limited conditions, as well as with a variety of submarine running conditions as provided for ASW scenarios. The main functions performed by the sonar processor are auto-detection, auto-track initiation and auto-track processing.

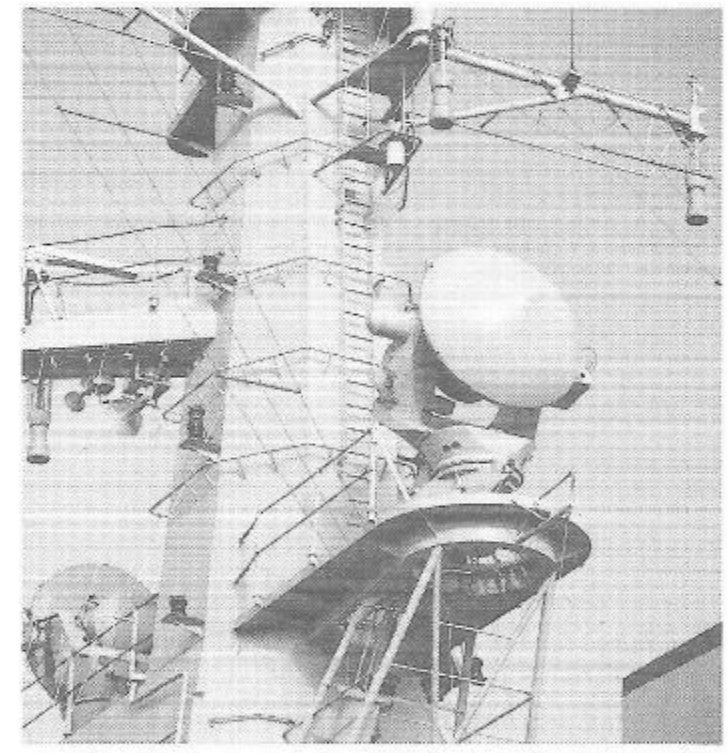
Specifications

Transmission
Frequencies: 5.5 kHz, 6.5 kHz, 7.5 kHz
Pulse type: CW, FM, FM + CW (a sequential transmission per interval)
Pulse length: 75-1,200 ms depending on range-scale/pulse type selections

Reception
Preformed beams: 32
Bandwidth passive mode: Band I low; Band II high
Accuracy:
Range: CW (300 ms) <70 yd; FM <20 yd
Bearing: <2°
Doppler speed: CW (300 ms) <0.2 kts
Vertical beamwidth: 13° (narrow beam); 24° (wide beam)

Manufacturer/Contractor

Hollandse Signaalapparaten, Hengelo, Netherlands.



There are two Signaal STIR (Signaal Target Indication Radars), one forward and one aft of the mast. These provide I- and K-band tracking and target illumination for missile and gunfire control (Signaal)

Anaconda Tactical Towed Array Sonar (TACTAS)

Thomson-CSF Sonar produced an export TACTAS, specifically for the M-type frigates, which was derived from the French Navy's DSBV 61A, with an advanced technology sonar receiver built around the Mustang processor. This latter equipment was developed by Thomson-CSF to increase the performance of all sonars, particularly in automatic detection, narrowband analysis, automatic tracking, adaptive beam-forming and self-noise cancellation. Anaconda is a very low-frequency passive towed array sonar system consisting of a linear array, a towing cable (which is also used for data transmission), a winch for handling and storage of array and cable, and the necessary signal processing and data extraction electronics. The 'dry-end' interfaces with SEWACO VII. The design allows two selectable towing modes: critical angle towing or towing behind a VDS 'fish'.

Manufacturer/Contractor

Thomson-Sintra, France.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 24.2 m (79.5 ft) × 14.4 m (47.2 ft)
Hangar: Single hangar

HELICOPTER

One Westland SH-14D Lynx
(Note: all RNethN SH-14B/C Lynxes have now been converted to SH-14D standard.)

Specifications
SH-14D
Dimensions:
main rotor diameter: 12.80 m (42.00 ft)
tail rotor diameter: 2.21 m (7.25 ft)
length overall (rotors turning): 15.165 m (49.75 ft)
Weights
empty: 2,740 kg (6,040 lb)
empty, equipped (ASW): 3,343 kg (7,370 lb)
Performance:
cruising speed: 125 kts (232 km/h)
speed for max endurance: 70 kts (130 km/h)
max rate of climb: 661 m (2,170 ft)/min
time on station (ASW) 50 n miles (93 km) radius: 2 h
max range: 320 n miles (593 km)
max endurance: 2 h 50 min
Power plant: 2 Rolls-Royce Gem 42-1 with max contingency rating of 835 kW (1,120 shp)
Crew: 2 (pilot and co-pilot/observer)
Radar: Ferranti Sea Spray Mk 1 lightweight search and tracking radar
Mission: Alcatel DUAV-4 dipping sonar; FLIR systems 2000HP FLIR
Navigation: Trimble Type 2200; Doppler 91
ESM: Ferranti AWARE-3 ESM
ASW armament: 2 Mk 46 homing torpedoes; depth charges

PROPULSION

Specifications
System: Combined diesel or gas turbine (CODOG)
Main engines: 2 Rolls-Royce Spey SM1C; 25.2 MW (33,800 hp) sustained (early ships of the class will initially only have SM1A gas generators and 23 MW (30,800 hp) sustained available); 2 Stork-Wartsila 12 SW 280 diesels; 7.2 MW (9,790 hp(m)) sustained
Shafts: 2
Propellers: cp
Auxiliary generators: 4 diesel generators; each 650 kW
Emergency generator: 1 diesel generator; 120 kW

FURTHER INFORMATION

PROGRAMME

The M-type frigates were required to be multipurpose ships able to operate as part of a task group in any of the world's oceans, but with particular emphasis on the North Atlantic. The principle tasks are anti-submarine warfare, surface action and local air defence, with an additional requirement of serving in a surveillance role towing a TACTAS array. The M-type was intended to take over from the 'Van Speijk' class and was designed in the early 1980s, which meant that, as with so many other designs of that period, the lessons of the Falklands (Malvinas) War were fresh in the minds of the naval staff and the designers.

The declaration of intent was signed on 29 February 1984, although the actual contract was not signed until 29 June 1985, by which time the design had been completed. A further four were ordered on 10 April 1986. Names have been shuffled to make the new *Van Speijk* the last of the class but she has retained her allocated pennant number.

DESIGN

The hull has been optimised to meet the latest design criteria on rolling and pitching, slamming, shipping green water, flight deck movement and minimising underwater radiated noise. The result is a hull with a flared-out bow, a V-shaped stern cross-section and a prominent, full-length knuckle at the G-deck level. There are two controllable-pitch propellers and an unusual arrangement of twin rudders angled out at 20°, which are controlled by an adaptive autopilot and function as combined rudders and stabilisers.

STEALTH

Great attention has been paid to minimising the ships' signatures. IR radiation has been reduced by insulating hot spots such as diesel generator exhausts and the stack, while areas with a high ambient temperature such as the galley have been sited amidships.

Severe limitations have been placed on permitted sound levels. Rotating machinery is mounted on flexible mountings and piping systems are interconnected with flexible couplings. Gear transmissions are claimed to be among the quietest of their type in any ship, while hydrodynamic design of the propellers has been optimised to avoid cavitation. One of the reasons for developing the rudder roll stabilisation is that this produces less noise than the usual stabilisers.

Radar cross-section has also been minimised. Large surfaces have been avoided and the knuckle extends over the entire length of the hull. In the superstructure, right angles have been avoided, all walls and decks avoid the vertical, and the decks are at slightly different angles to avoid presenting large surfaces when the ship rolls.

Van Amstel *(F 831) with a Belgian Navy Alouette III landing onboard. The Dutch and Belgian navies are now under combined control* (H & L van Ginderen Collection)

DAMAGE CONTROL

Considerable attention has been paid to reducing the vulnerability of the ship and its crew, particularly in the light of the Falklands (Malvinas) War.

Firefighting measures include three pump systems with a capacity of 610 m³/h and fire mains are doubled with numerous cross-connections to minimise risk under damage conditions. A portable fire pump is also available.

The spread of smoke, fire and water is inhibited by subdividing the ship into a number of watertight and smoke-tight compartments, and in vital areas (such as the engine rooms) special heat-resistant materials have been fitted to prevent the spread of fires.

NBC protection includes gastight citadels, filter units, an elaborate prewetting system, cleaning stations and extensive distribution of radiological equipment.

All relevant information on fire, flooding and smoke alarms, watertight doors, hatches and NBC filters is displayed on the ship's integrated monitoring and control system.

Extensive electromagnetic pulse protection (EMPP) measures have been taken.

There is a high degree of built-in redundancy in all systems.

MODERNISATION

There were some delays in installing some items of equipment. Early ships did not have the TACTAS towed array and lacked the full EW suite, and the control system was designated SEWACO VII(A) to indicate this. By mid-1994, however, all had been fitted with APECS II EW system and the Anaconda towed array and the SEWACO system was redesignated VII(B) to indicate this.

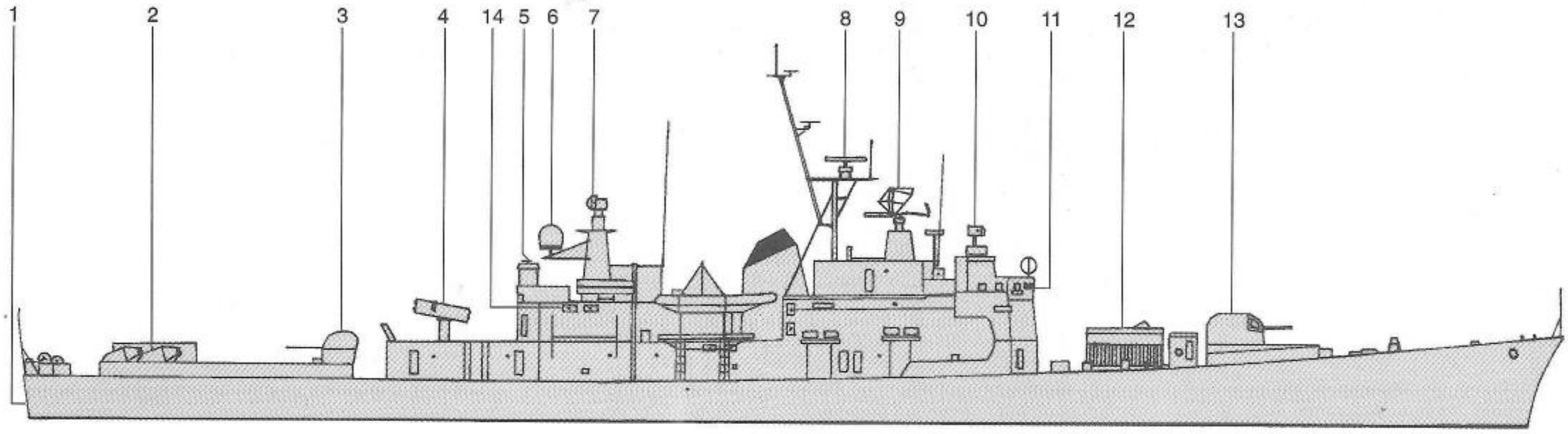
The recently installed SHF Satcom is based on the USN WSC-6, with twin antennas under the pancake-shaped domes, providing 360° coverage, even at high latitudes.

SMART-L is replacing SMARTY in a programme starting in 1996 and, under present plans, this will in turn be replaced by APAR (Active Phased-Array Radar), starting in about 2003-2004.

TRIALS

A containerised Signaal IRSCAN infra-red detector was fitted on the hangar roof in *Willem van der Zaan* (F 829) for trials in 1993.

OSLO



Trondheim (Ian Sturton)

1 *Thomson-CSF/Simrad TSM 2633 VDS* **2** *Four NFT Penguin Mk 2 anti-ship missiles* **3** *Bofors 40 mm/70 anti-aircraft cannon* **4** *Mk 29 eight-cell launcher for NATO Sea Sparrow SAM* **5** *Saab TVT 300 tracker* **6** *Satcom* **7** *Raytheon Mk 95 fire control (part of Mk 91 MFCS)* **8** *Racal-Decca TM 1226 surface search radar* **9** *Siemens-Plessey AWS-9 air search radar* **10** *CelsiusTech 9LV 218 Mk 2 fire control* **11** *Racal-Decca 1226 navigation radar* **12** *NFT Terne III six-tube ASW mortar* **13** *US twin 76 mm (3 in)/50 Mk 33 guns* **14** *US Mk 32 324 mm triple torpedo tubes*

GENERAL SPECIFICATIONS

Operator: Norway

Class: OSLO (FFG)

Built: 5
Active: 4

Displacement:
standard: 1,450 t
full load: 1,745 t

Hull strengthening in 1995-96 is resulting in an increase in both standard and full load displacements of some 200 t

Dimensions
Length: 96.6 m (316.9 ft)
Beam: 11.2 m (36.7 ft)
Draught: 5.5 m (18 ft) (screws) (possibly increasing after hull strengthening)

Speed: 25 kts
Range: 4,500 n miles at 15 kts

Complement: 150 (11 officers)

SHIPS

BERGEN (F 301)

Builder	Marinens Hovedverft, Horten, Norway
Laid down	1964
Launched	23 Aug 1965
Commissioned	15 Jun 1967

TRONDHEIM (F 302)

Builder	Marinens Hovedverft, Horten, Norway
Laid down	1963
Launched	4 Sep 1964
Commissioned	2 Jun 1966

STAVANGER (F 303)

Builder	Marinens Hovedverft, Horten, Norway
Laid down	1965
Launched	4 Feb 1966
Commissioned	1 Dec 1967

Narvik *(F 304) the last of six 'Oslo' class frigates to be built for the Royal Norwegian Navy, which were commissioned in 1966-67. Five remain in service* (H & L van Ginderen Collection)

NARVIK (F 304)

Builder	Marinens Hovedverft, Horten, Norway
Laid down	1964
Launched	8 Jan 1965
Commissioned	30 Nov 1966

WEAPONS SYSTEMS

ANTI-SHIP MISSILES

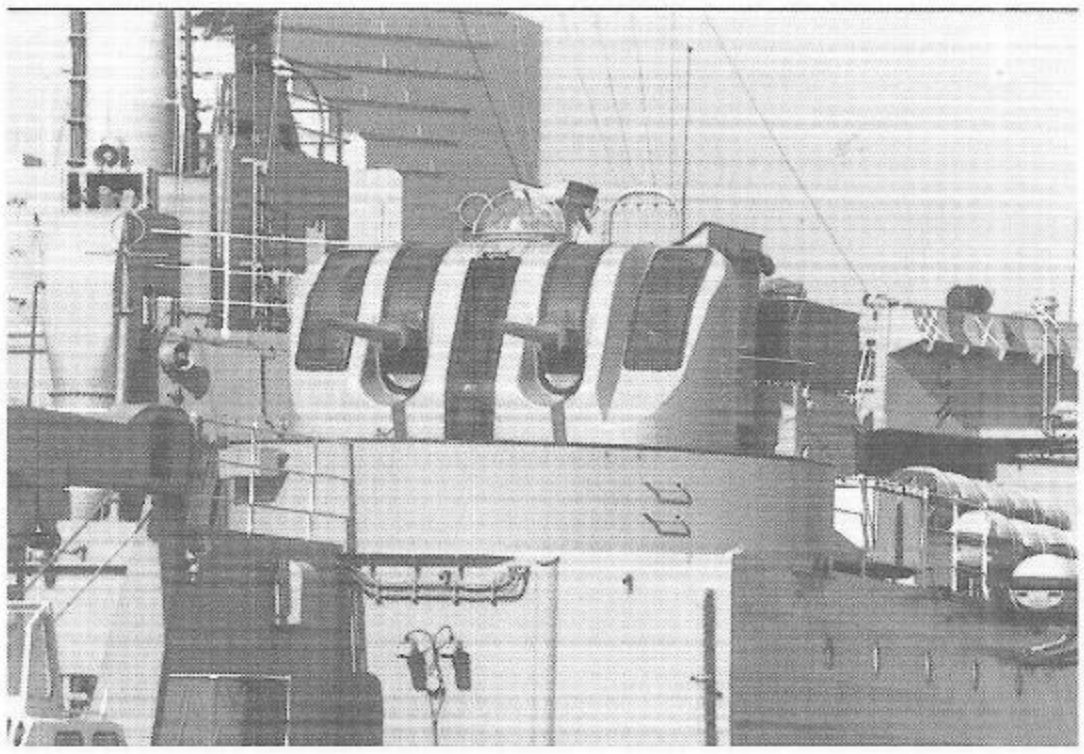
Penguin Mk 2 (RB 12)

Four Penguin Mk 2 missiles are carried in weather-prooof launcher-containers mounted on the quarter-deck. The Penguin is a Norwegian-designed and developed anti-ship missile system consisting of the missile, a launching system and a control cabinet which interfaces with the fire-control system.

The missile is relatively small (3.0 m (9.8 ft) long; 28 cm (11.0 in) in diameter; 1.42 m (4.6 ft) wing span), with a rocket booster/sustainer, a 120 kg (265 lb) semi-armour-piercing warhead (based on the Bullpup missile warhead), and an impact fuze. Compared to the Mk 1, the Mk 2 has an improved IR seeker, a modified inertial navigation unit incorporating angled trajectories and a redesigned actuation system. The shipboard control system consists of a control cabinet based upon a Kongsberg SM-3 computer, an operations panel integrated into the fire-control system and an independent emergency firing panel on the bridge.

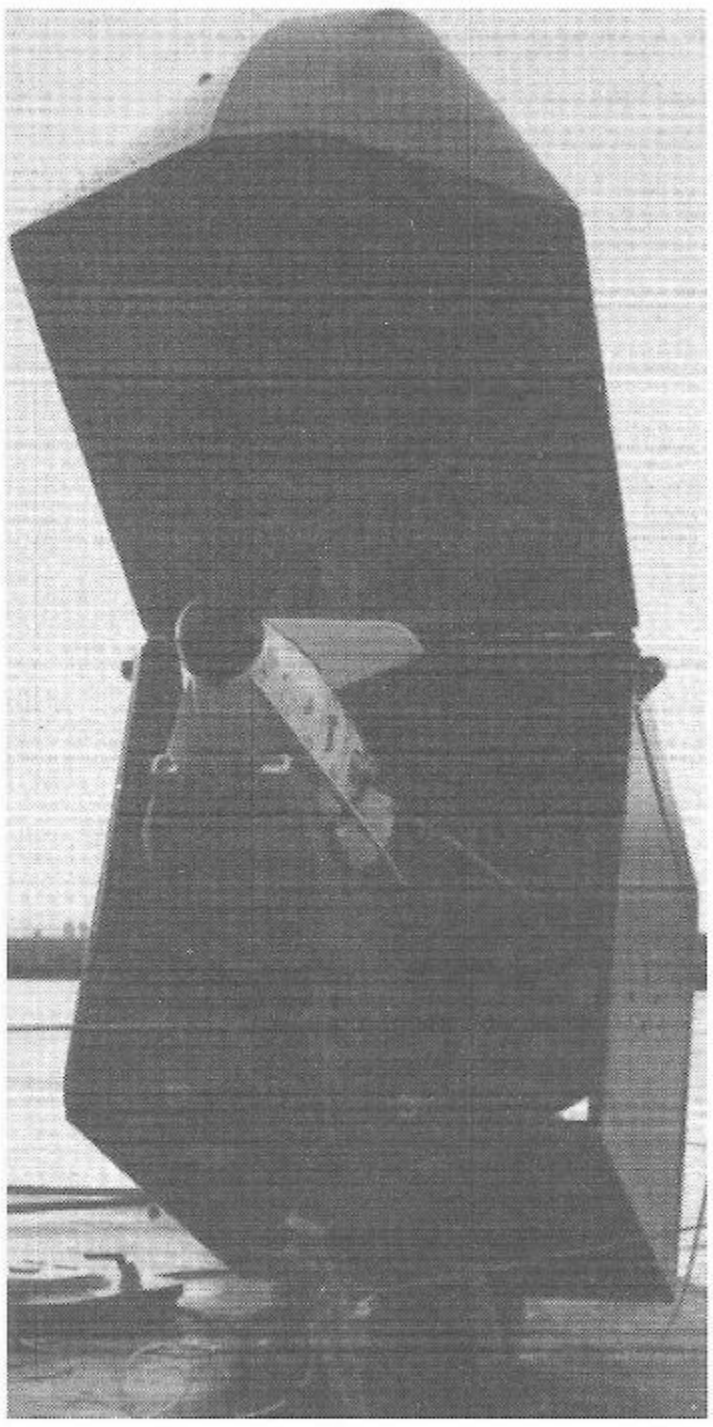
On acquiring the target, the fire-control computer calculates the bearing to the predicted point of impact which is then fed through the missile control system into the missile's inertial navigation system. The operator can select from a set of shapes and sizes of the seeker field and programmes the seeker to ignore some in order to target specific ships. On launch, the booster takes the missile clear of the ship and once at cruising speed the missile follows a programmed course in the target's general direction, the radio altimeter keeping it at a height of 80 m (262 ft). The missile may fly a direct course to the target or it may make one 'dog-leg' to achieve an indirect approach. In the search mode the seeker has two scanning options of varying width. Once the seeker acquires the target it switches to tracking mode for the terminal phase and guides the missile in such a way as to hit the target at a point close to the waterline.

(Note: The Penguin launchers were installed in the late 1970s refit, six launchers being mounted aft. In the late 1980s modernisation, two of those launchers were removed, leaving the present four.)



Twin 76 mm (3 in) guns in Mk 33 mounting of the type in Norway's 'Oslo' class (W Donko)

Narvik *(F 304). For their size, these ships carry a heavy armament. Aft there are four Penguin launchers, one 40 mm Bofors and an eight-cell Sea Sparrow launcher, and forward are twin 76 mm guns and the unusual six-tube Terne III ASW mortar. There are also two sets of triple 324 mm torpedo tubes amidships* (Jane's/HM Steele)



A Norwegian Navy Penguin anti-ship missile in its launch container (NFT)

Specifications
Penguin Mk 2
Length: 3.0 m (9.8 ft)
Diameter: 28 cm (11.0 in)
Span: 1.42 m (4.6 ft)
Launch weight: 340 kg (750 lb)
Speed: Mach 0.8
Range: 1.5-14 n miles (2.5-27 km)
Guidance: Inertial and passive IR

Manufacturer/Contractor
Norsk Forsvarsteknologi (NFT), Kongsberg, Norway.

SURFACE-TO-AIR MISSILES (SAM)

Raytheon Sea Sparrow point-defence missile system
There is a single Mk 29 eight-cell launcher for the NATO Sea Sparrow system which is located aft. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85.1 lb) blast fragmentation warhead and a dual-purpose proximity impact fuze. The magazine contains 24 missiles.

Specifications
RIM-7M
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 1.02 m (3.35 ft)
Weight: 226.8 kg (500 lb)
Speed: Mach 2.5
Range: 8 n miles (14.5 km)
Warhead (WAU-17/B): 38.6 kg (85.1 lb)
Guidance: Semi-active radar

Manufacturers/Contractors
Raytheon Company, Equipment Division (prime system contractor).
Raytheon Company, Missile Systems Division (prime missile contractor).
Hughes Missile Systems (second missile source).
Naval Weapons Center, Crane, USA (warhead).

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited at the foot of the mainmast.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Sting Ray lightweight anti-submarine weapon
The 'Oslo' class carry British Sting Ray torpedoes.

Specifications
Length: 2.59 m (8.5 ft)
Diameter: 324 mm (12.75 in)
Weight: 267 kg (589 lb) (in air)
Warhead: 35 kg (77 lb)
Speed: 45 kts (estimated)
Range: 6 n miles (11 km) (estimated)
Endurance: Approximately 8 minutes
Depth: 750 m (2,461 ft)

Manufacturer/Contractor
GEC-Marconi Underwater Weapons Systems, Wateroolville, Hampshire, UK.

GUNS

US Navy 76 mm (3 in) L/50 Mk 33 Mod 4 gun mounting
There are two twin 76 mm (3 in) mounts; one is on the foredeck, the other aft. This is a twin gun, power-driven, base-ring mount, with local or remote control, with a gun house (Mod 4). It uses two Mk 22 guns.

Specifications
Mk 22 gun
Calibre: 76.2 mm
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,700 ft/s) (new gun, nominal); 808 m/s (2,651 ft/s) (mid-life)
Range: 7 n miles (13 km)
Altitude: 8,951 m (29,368 ft)
Ammunition: 10.9 kg (24 lb)

Mk 33 mount
Traverse: 360°
Elevation: −14/15 to +85°
Traverse rate: 30°/s
Elevation rate: 24°/s
Rate of fire: 100 rds/min

Bofors 40 mm L/70 twin mounting
In the late 1980s refit the after 76 mm turret was removed and its loss was partially compensated by mounting a single Bofors 40 mm/70 aft.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

NFT KV-SK 20 20 mm cannon
The KV-SK 20 is produced under licence by Norsk Forsvarsteknologi (NFT) and is a modified version of the Rheinmetall Rh-202, 20 mm cannon. One of the lessons of Gulf deployments is the need for a light, short-range gun and many NATO navies are now mounting 20 mm guns such as these. The 'Oslo' class carries two.

Specifications
KV-SK 20
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,101 ft/s)
Rate of fire: 800-1,000 rds/min
Range: 1 n mile (1.85 km)
Traverse: 360°
Elevation: −10 to +55°
Crew: 1-2

Manufacturer/Contractor
Norsk Forsvarsteknologi (NFT), Oslo, Norway (under licence from Rheinmetall).

ANTI-SUBMARINE MORTARS

NFT Terne ASW rocket launcher system
The 'Oslo' class are the only ships to carry the Norwegian-developed Terne ASW rocket launcher system.

This is a quick reaction short/medium-range ASW system for frigate and corvette-size ships, using rocket-propelled depth charges, which is mounted on the foredeck. Sonar data is received through the ship command system and transmitted to a ballistic computer which receives further inputs from the weapon order panel.

The weapon handling and launching system is forward of the bridge and consists of a six-cell retractable launching rail on a mounting which ensures stability in pitch and roll but can incline the launching rail at angles of 47 to 77°. The launcher system is covered by retractable doors and below it is a loading ring with six salvos of missiles; a trained three-man crew can load the launcher within 30 seconds. The missile carries explosive which is comparable with TNT and variable depth, impact and proximity fuze options are available. The motor consists of a double-base propellant in a steel case.

Specifications

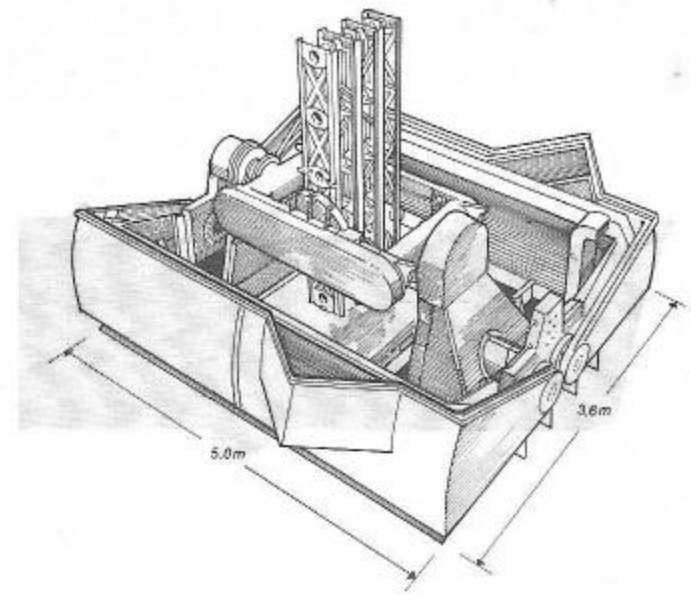
Rocket	Mk 7	Mk 8
Length	1.97 m (6.5 ft)	2.00 m (6.6 ft)
Diameter	20 cm (7.8 in)	20 cm (7.8 in)
Weight	121 kg (267 lb)	121 kg (267 lb)
Warhead	50 kg (110 lb)	70 kg (154 lb)
Range	400-4,000 m (2.15 n miles)	

Manufacturer/Contractor

Norsk Forsvarsteknologi, Kongsberg, Norway.

MINES

These ships have a minelaying capability.



Terne launcher (NFT via Jane's Naval Weapon Systems)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

ARGO Systems AR 700 APECS II

ARGOSystems AR 700 APECS II radar detection and jamming system is an advanced modular ESM/ECM system covering frequencies from 0.5 to 18 GHz, which is designed to counter most known radar threats. It is a fully automatic system, identifying and jamming threat emitters using a mixture of IFM receivers and microprocessor-controlled jammers, with high-speed switching enabling up to 16 threats to be jammed simultaneously. The antenna array consists of a mast-mounted ESM antenna assembly with two DF arrays, one omnidirectional unit and two monopulse units; system processing equipment; operator's console and two ECM transmitters (port and starboard) with their antenna systems located inside the transmitter units.

Specifications

ESM frequency coverage: 0.5-18 GHz
High sensitivity: Up to −67 dBm
Detection range: 200 n miles ships; 50 n miles aircraft
DF accuracy: 4° RMS; 2° RMS fine DF
Automatic tracking: 500 active signals in dense signal environment
Signal identification speed: <1s
ECM azimuth coverage: 360° using a 60-beam jammer (one beam per 6° azimuth sector)
Radiated power: 180 kW nominal mid-band
ECM frequency coverage: 7.5-18 GHz

Manufacturer/Contractor

ARGOSystems Inc, Sunnyvale, California, USA.

DECOYS

There are two chaff launchers; type unknown.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

MSI-3100/WCS tactical picture compilation and weapon designation system

MSI-3100 conducts tactical data handling to permit the ship to meet a variety of simultaneous threats. It has a distributed architecture, using the KS500 and KS800 computers with Mary language software. Functions are carried out automatically, although there are provisions for manual override or support at any stage. The computers control the most important weapons and sensors and this integration reduces decision making and reaction times. The manufacturer claims that the time from target detection to the point when the weapon is ready to engage is less than 10 seconds.

There are two KMC9000 multipurpose consoles each with two operators. One console acts as the weapons control system (KMC9000 WCC) while the other acts as the tactical control system (KMC9000 TCC). Each of the KMC9000 consoles has two KS500 computers; one is for general operating functions, with 256 k of memory, while the other acts in a dedicated role with 128 k of memory. The KS800 computer is used as a scan converter and display controller, and an NFT REX-II radar data extractor is also fitted. In the KMC9000 WCC the dedicated computer is used for fire control for the Terne ASW rocket system while in the KMC9000 TCC the computer acts in an air defence and ASV fire-control role. All elements of the system are linked via the NFT-designed BUDOS bus data transmission system, which operates to NATO STANAG 4156 standards.

The limited memory of the system means that a manual plotting board is kept. A new air-warning system is currently being installed, based upon the Siemens Plessey ASW 9 (2D) radar.

Specifications

Air-sea search radar: AWS-9
Fire-control radar: NobelTech 9LV 218 Mk 2
Navigation radar: Racal-Decca TM 1226
Sonar: AN/SQS 36

Manufacturer/Contractor

Norsk Forsvarsteknologi, Kongsberg, Norway.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11; Link 14.
Satcom: A Satcom link is fitted.

WEAPONS CONTROL

Mk 91 Mod 1 air defence fire-control system

The Mk 91 fire-control system operates in either automatic or semi-automatic modes from target acquisition to interception. It is a mainframe system using an NFT (Norsk Forsvarsteknologi) Mk 157 digital computer which performs all necessary calculations, stores data and is responsible for data distribution. There are two Mk 91 directors — one is on the bridge roof, the other atop a small tower aft — using the Mk 95 radar.

Because of its I-band frequency the Mk 91 will detect sea-skimming missiles sooner than lower-frequency search radars; the system can thus be fully autonomous, conducting search, detection and engagement automatically. It can also accept outside designations from radar, EW or optic sources. Radar data from the director is passed to the signal data processor to provide range and angle tracking data. This data is passed to the firing officer's console from where prelaunch data and firing commands are relayed to the Mk 29 trainable launcher and missile. The launcher then trains in azimuth to the intercept point and in superelevation to optimum angle to maximise missile kinetic energy. Should the correct azimuth be blocked by the ship's superstructure, the launcher trains to the nearest clear azimuth and commands the missile to 'fly around the corner' to the direct path to the intercept. On launch, the missile flies a proportional navigation path (lead angle intercept) directly to the intercept point in a lofted trajectory which maximises energy and minimises image effects.

Manufacturer/Contractor

Raytheon Company, Equipment Division (prime).

Saab TVT-300 electro-optic director

The Saab TVT-300 director tracks objects automatically, using the optical contrasts of an object against its background as seen by a TV camera. The system consists of a TV camera on a gyrostabilised platform, a monitor, and an electronics unit containing video processing and servo-control circuits. The operator uses a joystick to place an electronic 'window' on the target and then initiates automatic tracking, with the servo-control circuits keeping the 'window' centred on the target contrast and also aligning the target to the centre of the camera field of view. The platform angular positions in bearing and elevation are used for automatic tracking of the guns, which are slaved to the system.

Specifications

Traverse: 360°
Elevation: −30 to +85°
Speed (elevation and traverse): 40°/s

Manufacturer/Contractor

Saab Missiles, Linkoping, Sweden.

SONAR

TSM 2633 hull-mounted sonar

The 'Oslo' class is fitted with the Thomson-CSF TSM 2633 hull-mounted and VDS Spherion system. The hull-mounted element is a long-range active sonar for ASW surface combatants. It comprises a spherical hull-mounted array with an electronic processing system that allows for real-time computation in transmission and reception modes; three-dimensional stabilisation to compensate for pitch, roll and yaw in the parent vessel; and a beam-tilting capability to counter

adverse sound velocity profiles and strong reverberation.

The VDS is a similar diameter spherical array with 160 transducers. This is mounted in a 'fish' and streamed over the stern.

Specifications

Acoustic array: Spherical with 160 individual transducers
Frequency: 7 kHz (approx)
Transmitter: Omnidirectional and sectoral transmissions in CW and FM modes, various modes including TRDT
Receiver: 36 preformed beams stabilised in azimuth and elevation; advanced processing with replica correlator in FM and spectrum analysis (FFT) in CW
Video processing: Data processing in FM and CW modes: automatic detection and tracking; simultaneous multitrack extraction (up to 64); target analysis (apparent length, Doppler measurement)
Display: High-resolution, flicker-free colour TV monitors
Total weight: 4,000 kg (8,820 lb)

Manufacturer/Contractor

Thomson Sintra Activités Sous-Marines, Sophia Antipolis Cedex, France.

RADARS

Type	AWS-9	TM 1226	9LV 218 Mk 2	Mk 95	—
Maker	Siemens-Plessey	Racal-Decca	NobelTech	Raytheon	Racal-Decca
Role	Air search	Surface search	Gun fire control	Missile fire control (Mk 91 MFCS)	Navigation
Band	E/F	I	D/I/J	H/I	I
Beam	—	1.2°	Search: 6-8 × 20-25° Track: 1.1 × 7°		
Peak power	125 kW	25 kW	Search: 200 kW Track: 65 kW	2 kW	
Gain	—	30 dB	—		
Pulsewidth	2/20 µs	0.05/0.25/1 µs	—		
PRF	700-800 pps	—	—		
Scan rate	30 rpm	28 rpm	—		
Range	MPA at 80 n miles (150 km)	—	—		

PROPULSION

Specifications

System: Steam turbine
Main machinery: 2 Babcock & Wilcox boilers; 42.18 kg/cm² (600 psi); 454°C (850°F); 1 set De Laval Ljungstrom PN20 geared turbines; 14.7 MW (20,000 hp(m))
Shafts: 1

FURTHER INFORMATION

PROGRAMME

The five ships of the 'Oslo' class were the first (and up till now, the only) major surface units built for the Norwegian Navy since the Second World War. They were constructed under a five-year naval construction programme, which was approved by the Norwegian Storting (Parliament) in late 1960. Fifty per cent of the cost of the ships was provided by the USA under the Mutual Defense Aid Program (MDAP) and the balance by Norway, and all five ships were constructed in the Norwegian Naval Dockyard.

DESIGN

The design of the hull and propulsion system of these ships was based on that of the US Navy's 'Dealey' class destroyer escorts, which have now all been deleted. Certain parts of the design were, however, modified to meet Norwegian requirements, especially those of cold weather and high seas, including, in particular the much greater freeboard forward.

MODERNISATION

The ships were given their first modernisation in the late 1970s, when the Penguin SSMs, Sea Sparrow SAMs and Mk 32 torpedo tubes were fitted, together with many new electronic equipments.

A second substantial modernisation took place in the late 1980s, the ships completing their programme in the order: F 302 — 30 November 1987; F 304 — 21 October 1988; F 303-5 Jun 1989; F 301 — 4 April 1990. The work involved removing the after twin 76 mm mounting and one pair of Penguin SSM launchers so that a Thomson-CSF Spherion VDS could be installed. Decoy rocket launchers were also fitted.

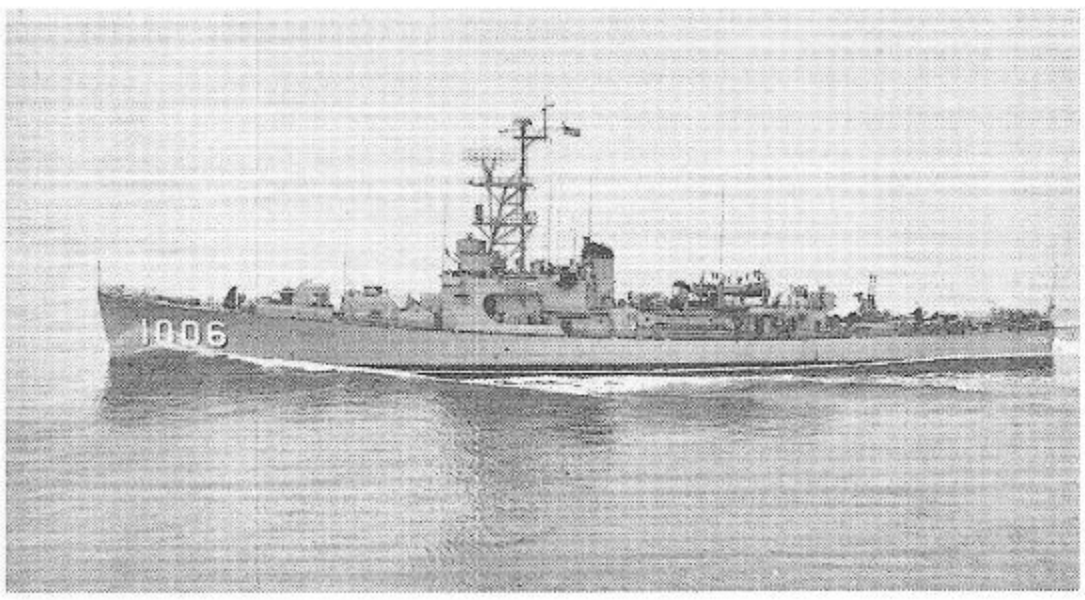
In a further updating, Plessey AWS-9 radar is being fitted in 1996-97 together with Link 11 and GPS.

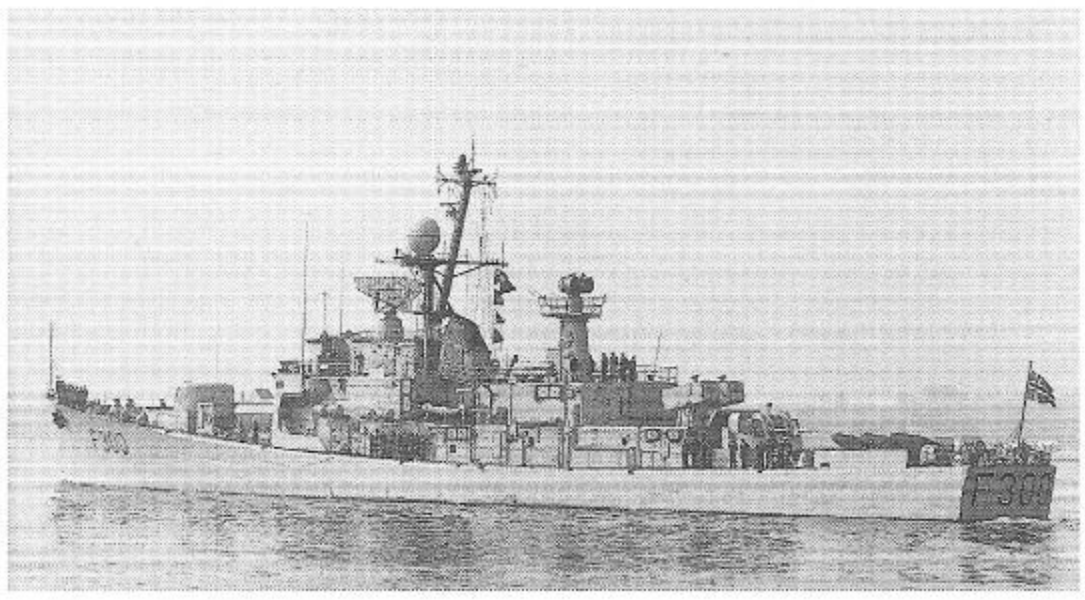
STRUCTURE

The hulls have become stressed as a result of towing the VDS in heavy seas, an activity for which they were not designed.

Then the name-ship of the class, *Oslo* (F 300), was lost in 1994, the ship suffering an engine failure in heavy weather, which resulted in it running aground. The ship was towed back into deep water and then taken under tow, but sank in the continuing bad weather.

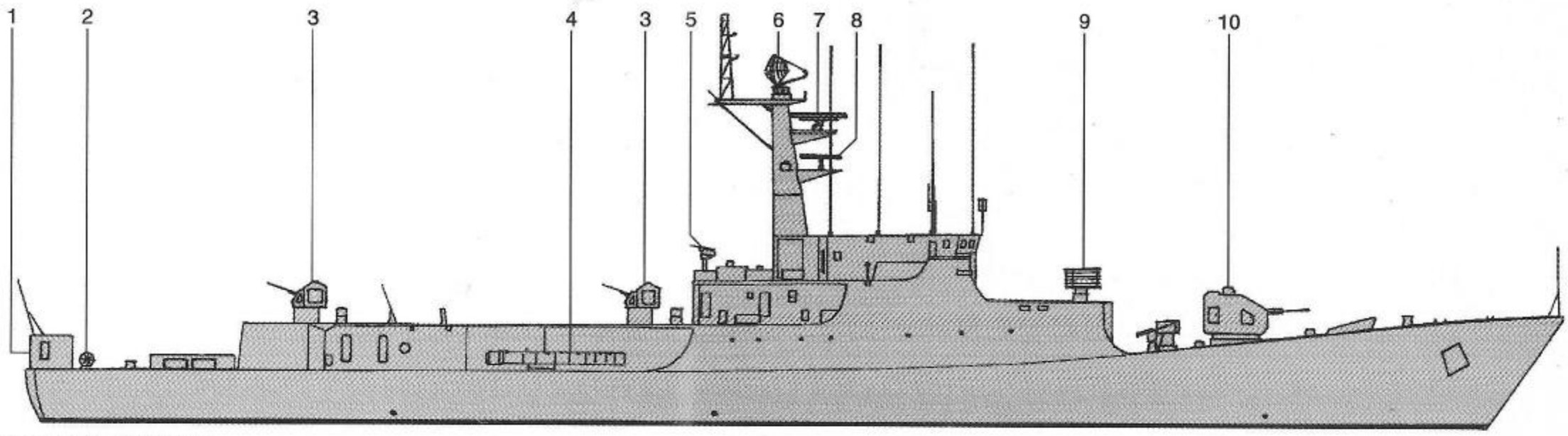
As a result, the remaining ships have been restricted in their deep water operations until the hulls have been strengthened and the complements have also been reduced. The strengthening programme started in 1995 with *Narvik* (F 304) and all will be completed by the end of 1996. This will result in an increase in displacement of some 200 tonnes.





The 'Oslo' class design was based on the US Navy's 'Dealey' class destroyer escort (left), but with considerable modification to meet the Norwegian operational requirement and environmental conditions. As can be seen from Oslo *(F 300) (right) the hulls were similar, but otherwise they were very different* (top: US Navy; bottom: Miko)

KASZUB (TYPE 620)



Kaszub (Ian Sturton)

1 *Dipping sonar* **2** *Depth charge rails* **3** *ZV-23-2M Wrobel* **4** *Twin 533 mm (21 in) torpedo tubes (four total)* **5** *SA-N-5 four-tube launcher for SAM (two)* **6** *Strut Curve air/surface search radar* **7** *Nogat SRN 7453 surface search radar* **8** *SRN 442 XT navigation radar* **9** *RBV-6000 twelve-tube ASW rocket launcher* **10** *Russian AK-176 76 mm (3 in)/66 automatic gun*

GENERAL SPECIFICATIONS

Operator: Poland
Type: Type 620

Class: KASZUB

Built: 1
Active: 1
Proposed: 8

Displacement:
standard: 1,051 t
full load: 1,183 t

Dimensions
Length: 82.34 m (270.1 ft)
Beam: 10.0 m (32.8 ft)
Draught: 2.90 m (9.51 ft) (hull); 4.90 m (16.1 ft) (sonar)

Speed: 27 kts
Range: 2,000 n miles at 18 kts; 2,800 n miles at 14 kts

Complement: 80 (9 officers)

SHIPS

KASZUB (240)

Builder	Northern Shipyard, Gdansk, Poland	**Launched**	4 Oct 1986
Laid down	9 Jun 1984	**Commissioned**	15 Mar 1987

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 'Grail' (Strela-2M)

There are two, four-missile launchers for the SA-N-5 short-range SAM system. SA-N-5 is the NATO designation for the Russian Strela-2M (Strela = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and he partially pulls the trigger to activate the missile gyros, which take some four to six seconds to warm up. The operator uses stadia reference marks in his optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spinning it up. Then, at a distance of 6 m (19.7 ft), the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M the (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has improved fragmentation uniformity.

According to a Polish source, the missile installation is designated Fasta 4M while the missiles are designated Strzala-2M and a total of 16 missiles is carried.

Specifications
Strela 2
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 2.6 n miles (5.5 km)
Altitude: 18-4,500 m (60-15,000 ft)
Guidance: IR homing

Manufacturer/Contractor
Fakel, Russia.

TUBES

There are four 533 mm (21 in) Model DTA-53-620 torpedo tubes mounted two on either side in the waist. The two pairs of tubes are individual units located side by side and are fixed, pointing ahead at about 15° to the centreline.

TORPEDOES

SET-53M

Russian SET-53M active/passive torpedoes are carried. These are homing torpedoes, with a range of 8.1 n miles (15 km) and a speed of 40 knots. They carry a 205 kg (452 lb) warhead.

GUNS

AK-176M 76 mm L/59

There is one AK-176M 76 mm L/59 gun mounted in 'A' position on the foredeck. The AK-176M is a four-man mounting, which is hydraulically operated, with manual reversion in the event of power failure. The AK-176M would normally be controlled by a Bass Tilt or a Kite Screech director, but, in this case, there is no director (although there is space for such a device in the bridge roof). This suggests that the gun is only fired under local control using either the Kondensor sight, which is normally only used as a back-up in the event of the failure of 'Bass Tilt', or the WD-221 optical sight. Alternatively, the Nogat radar may be used in a directing role, although this would not be particularly satisfactory.

Specifications
AK-176
Calibre: 76 mm (3.0 in)
Length of barrel: 59 calibres
Muzzle velocity: n/k
Traverse: 360° at 35°/s
Elevation: −3 to +85° at 30°/s
Ammunition (total): 16 kg (35.3 lb)
Rate of fire: 120 rds/min
Range:
anti-surface: 8 n miles (15 km)
anti-air: 7,000 m (22,967 ft)

Ammunition
UOFB-62
Weight:
complete round: 12.8 kg (28.2 lb)
projectile: 4.6 kg (10.1 lb)
explosive: 400 g (A-IX-2)
Fuze: Point impact fuze (VG-67)

Wrobel-I ZU-23-2M twin 23 mm cannon

There are three twin Wrobel-I ZU-23-2M 23 mm mounts. Two are located close abreast of each other at the rear of the bridge structure and the third is at the after end of the superstructure. The ZU-23-2 was manufactured for

Kaszub *(240). The design is based — somewhat loosely — on the Russian 'Grisha' class. Note the RBU-6000 launcher on the foredeck and the two Wrobel 23 mm guns aft* (Jane's/H M Steele)

some years in Poland and this particular mounting is designated Wrobel-I and consists of twin 23 mm cannon mounted side by side in an open tub-type mounting, but with a clear glass cover of either glass or plastic.

The ZU-23-2 consists of two air-cooled 2A14 cannon of monobloc construction. Each barrel weighs 27.2 kg (60 lb), is 2.01 m (6.6 ft) long including flash suppressor, and they fit into separate cradles. A hot barrel may be replaced by a cool one in 15-20 seconds. The weapon has a vertically moving breech block and is fed from 50-round belts in boxes fitted to each side of the trunnions. A ZAP-23 optical sight is attached to the rear of the weapon which is on a manually operated firing platform.

The mounting has a five-man crew, of whom two are on the mounting and three are ammunition carriers and loaders.

Specifications

Wrobel-I ZU-23-2M
Calibre: 23 mm
Length of barrel: 87 calibres
Traverse: Unlimited
Elevation: −10 to +90°
Traverse speed: n/k
Elevation speed: n/k
Rates of fire: 200 rds/min/barrel
Projectile: 0.19 kg (0.42 lb)
Range:
anti-surface: 1.1 n mile (2 km)
anti-air: 1,500 m (4,922 ft)

Saluting gun

There is one 45 mm saluting gun on the port side of the foredeck.

ANTI-SUBMARINE MORTARS

RBU-6000

Two RBU-6000, 12-tubed trainable anti-submarine rocket launchers are located immediately before the bridge. These are conventional Russian-pattern systems; 98 rockets are carried.

Specifications

RBU-6000
Launch tubes: 12
Tube arrangement: Circular
Calibre: 300 mm
Tube length: 0.6 m (2.0 ft)
Elevation: +50°
Traverse: 360° (theoretical)
Rocket weight: 100 kg (220 lb)
Warhead: 31 kg (68 lb)
Range: 3.25 n miles (6,000 m)

DEPTH CHARGES/MINES

There are two rails at the stern. These can be used for either 24 depth charges or 20 mines.

ELECTRONIC WARFARE SYSTEM

ELECTRONIC SUPPORT MEASURES (ESM)

ORLO

There is one radar intercept and direction-finding equipment, designated ORLO.

DECOYS

There are four 16-tube PK-16 chaff launchers.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar

Kaszub's air search radar is the Russian MR-302 (NATO = Strut Curve) a medium-range, general purpose, F band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m² aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Nogat SRN-7453

The SRN-7453 is the surface search radar. No other details are known.

SRN-441XT

SRN-441XT is the navigational radar.

Square Head Naval IFF System

The antenna of this shipborne system consists of a broadside array of dipoles with a rectangular reflector/support frame measuring about 1.4 m (4.6 ft) high by 2 m (6.6 ft) wide. It was originally thought to be a long wavelength search radar of modest power, but later evidence confirms that its function is that of an IFF interrogator antenna, or directional array for transmission of guidance signals to surface-to-surface missiles. It is most frequently seen on the older types of Russian Federation missile carrying boats, and these

carry two or four such arrays on sponsons fore and aft of the mainmast. Recent information strongly suggests that the system operates in G-band.

SONARS

MG-322T
MG-322T is a bow-mounted, active search, medium-frequency sonar.

MG-329M
MG-329M is a stern-mounted, dipping sonar, mounted in a large cylinder on the transom. which appears to have been developed from a helicopter sonar.

Kaszub (240). *Among the items of Polish equipment aboard are the Nogat SRN 441XT surface search radar below the Strut Curve and the SRN 441X7 navigation radar on the smaller platform below* (H & L van Ginderen Collection)

PROPULSION

Specifications
System: Combined diesel and diesel (CODAD)
Main machinery: 4 Sulzer-Cegielski 16AS-V25/30 diesels; 12.80 MW (17,400 hp(m)) at 1,000 rpm

Shafts: 2
Auxiliary power: 4 Russian diesels, each 200 kW

FURTHER INFORMATION

PROGRAMME

The first warship to have been designed and built in Poland since the 'Jaskolka' class minesweepers in the mid-1930s, *Kaszub* has not proved to be a great success. The ship entered service in 1987 but ten years later it is still not completely equipped.

A class of eight was planned but the second ship was cancelled in 1989 and, despite public statements that more will be built when funds are available, it appears unlikely that this will actually happen.

STRUCTURE

The design is based very loosely on that of the Russian 'Grisha' class but with numerous alterations, including the armament and the use of diesel engines rather than the Russian ships' diesels.

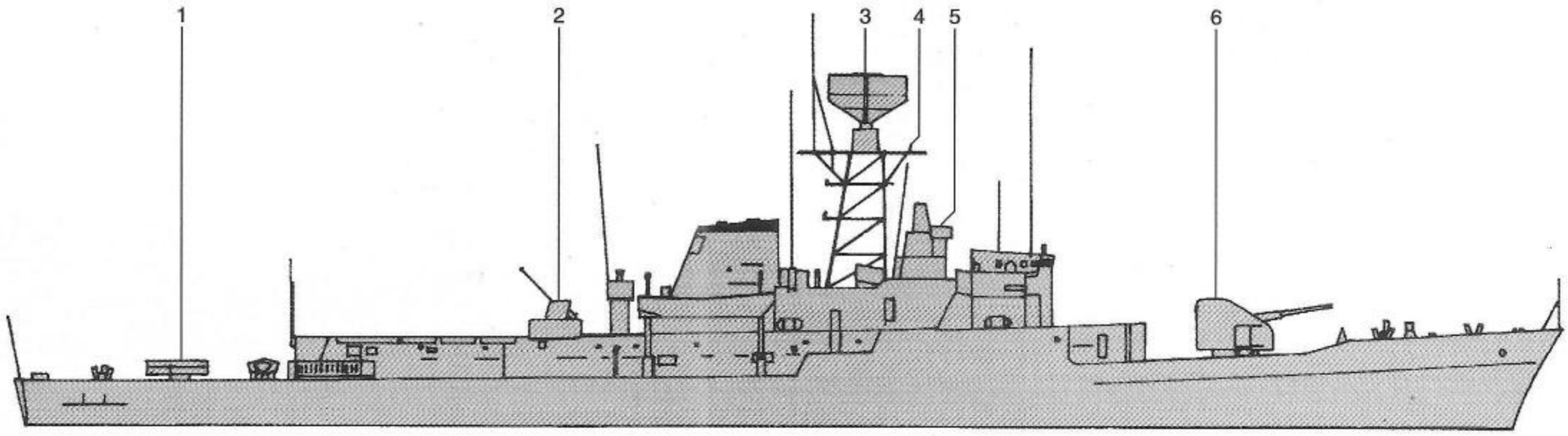
MODERNISATION

There are reports that further changes are to be made, including fitting AK-630 Gatlings in place of the Wrobel I ZU-23-2 23 mm guns and fitting a fire director for the 76 mm gun. The Polish shipbuilding industry is, however, in some disarray and the Gdansk shipyard closed recently, so there may well be greater priorities.

DEPLOYMENT

It took from 1987 to 1990 for the ship to attain operational status and it then spent several months with the coastguard before transferring to the navy in 1991. Since then it has sailed abroad on several occasions and has made at least one visit to the UK.

BAPTISTA DE ANDRADE



Baptista de Andrade (Ian Sturton)
1 *US Navy Mk 32 324 mm triple torpedo tubes* **2** *Bofors 40 mm/70 anti-aircraft gun* **3** *Plessey AWS 2 air/surface search radar* **4** *Racal-Decca RM 316P navigation radar* **5** *Thomson-CSF Pollux fire control (for 100 mm gun)* **6** *Creusot-Loire 100 mm (3.9 in) Modile 1968 gun*

GENERAL SPECIFICATIONS

Operator: Portugal

Class: BAPTISTA DE ANDRADE

Built: 4
Active: 4

Displacement:
standard: 1,203 t
full load: 1,380 t

Dimensions
Length: 84.6 m (277.5 ft)
Beam: 10.3 m (33.8 ft)
Draught: 3.1 m (10.2 ft)

Speed: 22 kts
Range: 5,900 n miles at 18 kts

Complement: 122 (11 officers) plus marine detachment

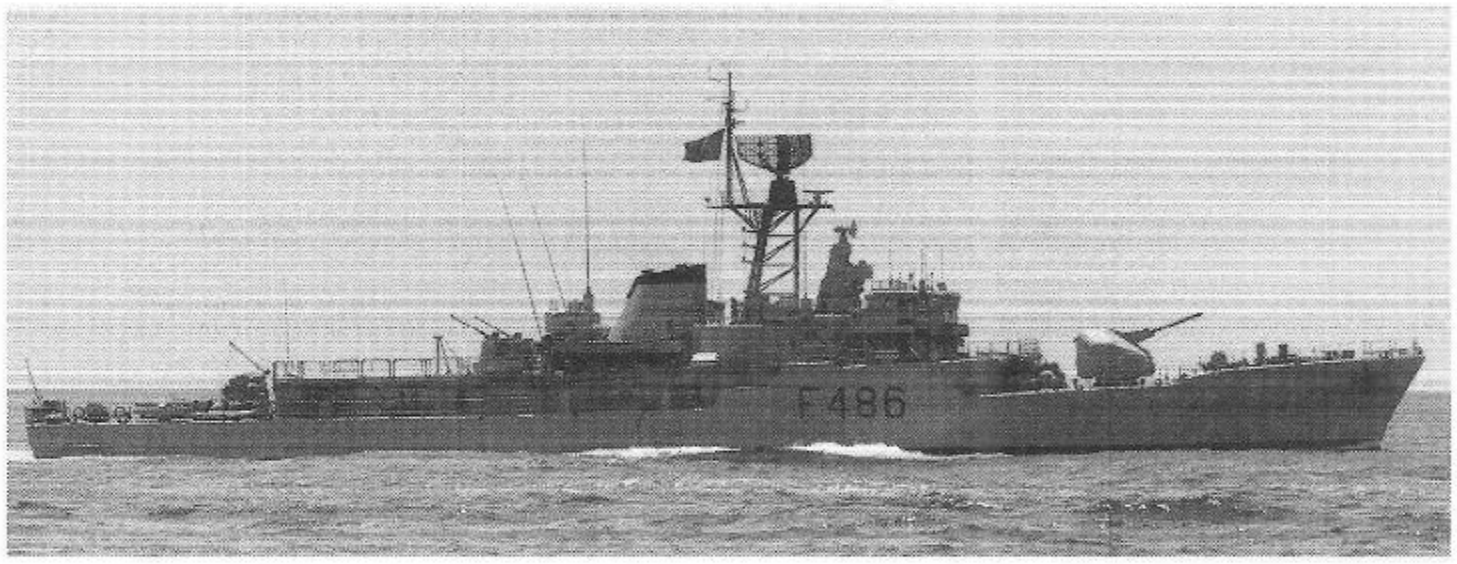
SHIPS

BAPTISTA DE ANDRADE (F 486)
Builder Empresa Nacional Bazan, Cartagena, Spain
Laid down 1 Sep 1972
Launched 13 Mar 1973
Commissioned 19 Nov 1974

JOÃO ROBY (F 487)
Builder Empresa Nacional Bazan, Cartagena, Spain
Laid down 1 Dec 1972
Launched 3 Jun 1973
Commissioned 18 Mar 1975

ALFONSO CERQUEIRA (F 488)
Builder Empresa Nacional Bazan, Cartagena, Spain
Laid down 10 Mar 1973
Launched 6 Oct 1973
Commissioned 26 Jun 1975

OLIVEIRA E CARMO (F 489)
Builder Empresa Nacional Bazan, Cartagena, Spain
Laid down 1 Jun 1973
Launched 22 Feb 1974
Commissioned 28 Oct 1975



Baptista de Andrade *(F 486)*

WEAPONS SYSTEMS

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited on the quarterdeck.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5, 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

100 mm/55 Modéle 1968

There is one single Creusot-Loire 100 mm (3.9 in) Modéle 1968 dual-purpose gun located on the fore-deck, which is normally operated in the fully automatic remote mode with an unmanned turret, although there is a fallback manual mode, requiring two men in the turret.

Specifications
Calibre: 100 mm (3.9 in)
Length of barrel: 55 calibres
Muzzle velocity: 870 m/s (2,854 ft/s)
Traverse: 360° at 40°/s
Elevation: −15 to +80° at 25°/s
Mounting weight: 21 t
Crew: 2 (optional) and 2 loaders
Range:
anti-surface: 9.15 n miles (17 km)
anti-air: 8,000 m (26,000 ft)
Rate of fire: 60-78 rds/min
Ammunition: 13.5 kg (30 lb) (multipurpose projectile); 9.7 kg (21.4 lb) (charge)

Manufacturers/Contractors
Direction des Constructions Navales (DCN) (prime).
Mécanique Creusot-Loire, Marine Products (mountings).
DCN Ruelle (gun).
CSEE Défense (servo equipment).

Bofors 40 mm L/70 twin mounting

There are two single Bofors 40 mm/70 mounted side by side abaft the stack.

Specifications
Traverse: 360° (nominal) at 90°/s

Elevation: −13 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,000 m/s (3,280 ft/s)

Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)

Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Thomson-CSF Vega Pollux command and weapon control system

The version of the Vega I command and weapon control system in the 'Baptista de Andrade' class is Vega Pollux, which combines the Plessey AWS-2 search radar, Thomson-CSF Diodon sonar and the Thomson-CSF Pollux fire-control director.

Manufacturer/Contractor

Thomson-CSF, Paris, France.

SONAR

Thomson Sintra Diodon hull-mounted depth sonar

Diodon is a panoramic medium-frequency sonar. Embedded facilities include passive listening, sound ray tracer, an acoustic propagation prediction for the day and a recording system that can be used for debriefing and training.

Specifications

Acoustic array: 24 identical staves
Frequencies: 11 kHz, 12 kHz, 13 kHz.
Transmitter: Omnidirectional transmission in CW and FM modes
Receiver: 36 preformed beams; advanced processing with replica correlator in FM and spectrum analysis (FFT) in CW

RADARS

Set	AWS-2	Type RM 316P	Pollux
Company	Plessey	Decca	Thomson-CSF
Role	Air search	Navigation	Fire control
Band	E/F	I	I/J
Beam	1.5 × 40°		2°
Peak power	750 kW		200 kW
Gain	32 dB		30 dB
Pulsewidth	0.35/1.5 µs		0.3 µs
PRF	1,000/400 pps		1,500 pps
Scan rate	12/20 rpm		—
Typical ranges	60 n miles (110 km)		17 n miles (31 km) for 2 m² target

Video processing: Data processing in FM and CW modes: automatic detection and tracking; simultaneous multitrack extraction (up to 64); target analysis (apparent length, Doppler measurement)
Range scales: Max 15,000 m (49,215 ft)
Display: High-resolution flicker-free colour TV monitors
Total weight: 1,500 kg (3,307 lb)

Manufacturer/Contractor

Thomson CSF, Sophia Antipolis Cedex, France.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 12 × 8 m (40 × 26 ft)

HELICOPTERS

The flight deck will accept a Westland Lynx helicopter, but there is no hangar or other aviation facilities

PROPULSION

Specifications

System: Diesel
Main machinery: 2 OEW Pielstick 12 PC2.2 V 400 diesels; 8.82 MW (12,000 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These ships were originally built for South Africa, but, as with the French 'Agosta' class submarines and Type A 69 corvettes, the order was overtaken by the United Nations mandatory embargo in 1977. As a result, the order was taken over by the Portuguese Navy.

DESIGN

The 'Baptista de Andrada' class uses exactly the same hull and propulsion as the 'Joao Coutinho' class but has a different armament and sensor fit, which was presumably originally tailored to the South African requirement. Thus, the 'de Andrade' class has a more powerful main gun, a better fire-control system, and more effective radars and sonars.

MODERNISATION

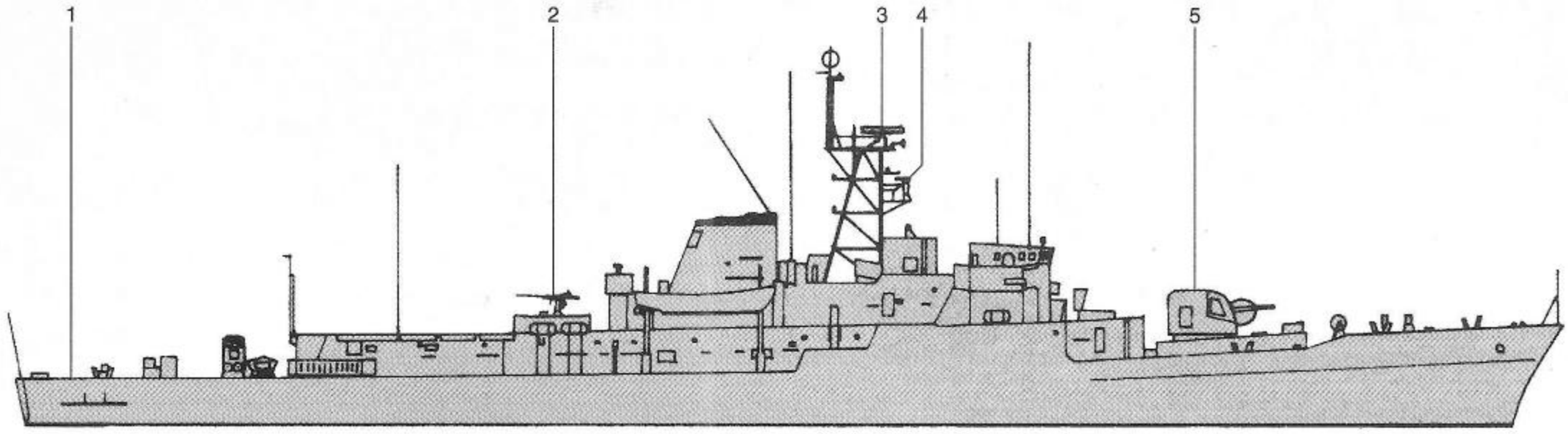
Communications equipment was updated in 1988-91, but a programme to install Sea Sparrow and an SSM system has been postponed until 1999, even though space and weight allowance is available.

FUTURE

There was a proposal in 1977 to sell these four ships to Colombia, but the deal fell through and, as far as is known, there have been no further attempts to sell them.

João Roby *(F 487)*

JOÃO COUTINHO



João Coutinho (Ian Sturton)
1 *Mine rails* **2** *Bofors twin 40 mm/60 (open mount)* **3** *Kelvin Hughes air/surface search radar* **4** *Racal-Decca RM 1226C navigation radar* **5** *US Navy twin 76 mm (3 in)/50 Mk 33 (enclosed mount)*

GENERAL SPECIFICATIONS

Operator: Portugal

Class: JOÃO COUTINHO

Built: 6
Active: 6

Displacement:
standard: 1,203 t
full load: 1,380 t

Dimensions
Length: 84.6 m (277.5 ft)
Beam: 10.3 m (33.8 ft)
Draught: 3.3 m (10.8 ft)

Speed: 22 kts
Range: 5,900 n miles at 18 kts

Complement: 77 (9 officers)

SHIPS

ANTONIO ENES (F 471)

Builder	Empresa Nacional Bazan, Cartagena, Spain
Laid down	10 Apr 1968
Launched	16 Aug 1969
Commissioned	18 Jun 1971

JOÃO COUTINHO (F 475)

Builder	Blohm + Voss, Hamburg, Germany
Laid down	24 Dec 1968
Launched	2 May 1969
Commissioned	28 Feb 1970

JACINTO CANDIDO (F 476)

Builder	Blohm + Voss, Hamburg, Germany
Laid down	10 Feb 1969
Launched	16 Jun 1969
Commissioned	29 May 1970

GENERAL PEREIRA D'ECA (F 477)

Builder	Blohm + Voss, Hamburg, Germany
Laid down	21 Apr 1969
Launched	26 Jul 1969
Commissioned	10 Oct 1970

AUGUSTO DE CASTILHO (F 484)

Builder	Empresa Nacional Bazan, Cartagena, Spain
Laid down	15 Oct 1968
Launched	4 Jul 1969
Commissioned	14 Nov 1970

HONORIO BARRETO (F 485)

Builder	Empresa Nacional Bazan, Cartagena, Spain
Laid down	20 Feb 1968
Launched	11 Apr 1970
Commissioned	15 Apr 1971

WEAPONS SYSTEMS

GUNS

US Navy 76 mm (3 in) L/50 Mk 33 Mod 4 gun mounting

There is one twin 76 mm (3 in) mount in 'A' position. This is a twin gun, power-driven, base-ring mount, with local or remote control, with a gun house (Mod 4). It uses two Mk 22 guns.

Specifications
Mk 22 gun
Calibre: 76.2 mm
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,700 ft/s) (new gun, nominal); 808 m/s (2,651 ft/s) (mid-life)
Range: 7 n miles (13 km)
Altitude: 8,951 m (29,368 ft)
Ammunition: 10.9 kg (24 lb)

Mk 33 mount
Traverse: 360°
Elevation: −14/15° to +85°
Traverse rate: 30°/s
Elevation rate: 24°/s
Rate of fire: 100 rds/min
Elevation: −3 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Bofors 40 mm/60 Mk 9

There is one twin Bofors 40 mm/60 Mk 9 mount abaft the stack.

Specifications
Traverse: 360° (nominal) at 90°/s

MINES

There are two mine rails.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Mk 51 Gun Fire Control System (GFCS)

There are two Mk 51 Gun Fire Control Systems (GFCS), one for each Bofors 40 mm mounting. The system is a lead-computing gunsight.

Mk 63 Gun Fire Control System (GFCS)

The Mk 63 GFCS is associated with the 76 mm gun and is a combination of the Mk 51 sight and an SPG-34 radar (see below).

RADARS

Kelvin Hughes

A Kelvin Hughes radar is used for air/surface search. Type is not known.

Racal-Decca RM-1226C

There is one Racal-Decca RM 1226C navigation radar.

Specifications
Role: Surface search
Band: I
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB

Pulsewidth: 0.05/0.25/1 µs
Scan rate: 28 rpm

Manufacturer/Contractor
Racal-Decca

AN/SPG-34 fire-control radar

Specifications
Role: Fire control
Band: I
Beam: 2.5°
Peak power: 50 kW

Gain: 36 dB
Pulsewidth: 0.3 µs
Scan rate: 28 rpm
PRF: 1,800 pps

Manufacturer/Contractor
Western Electric

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 12 × 8 m (40 × 26 ft)
Facilities: No hangar and no other helicopter facilities

PROPULSION

System: Diesel
Main machinery: 2 OEW-Pielstick 12 PC2.2 V400 diesels; 8.82 MW (12,000 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

Six ships were built between 1968 and 1971, replacing a miscellaneous collection of elderly sloops, corvettes and destroyer escorts.

DESIGN

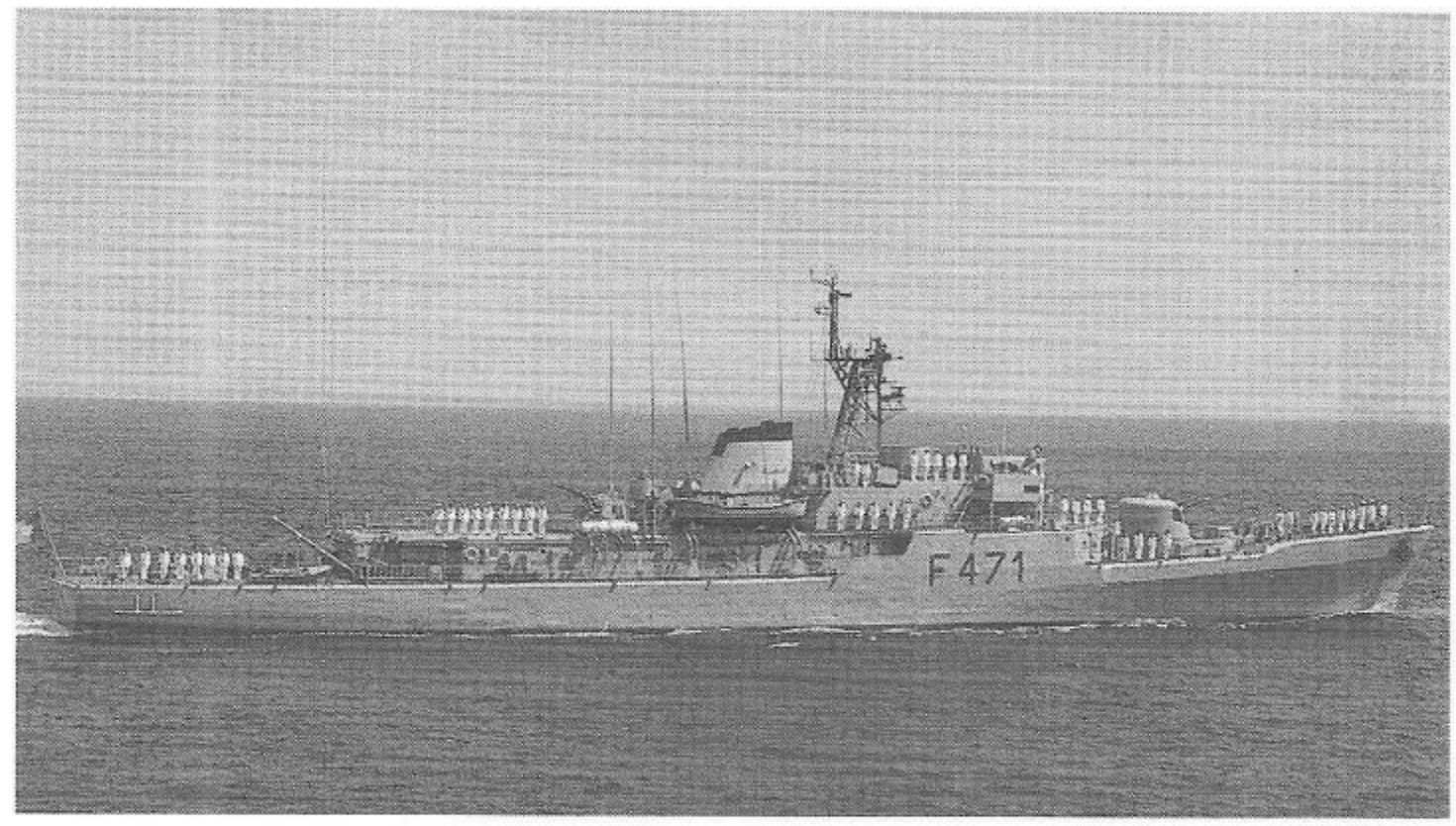
This design was prepared by the German company Blohm + Voss of Hamburg, which then built three in its yard, while the other three were built by Bazan in Spain. They are similar in concept to a number of other European designs for a light frigate for 'colonial' duties, such as the French 'Commandant Riviere' class.

The 'Joao Coutinho' class is small and lightly equipped, and the ships as built, were armed with a twin 76 mm gun, two Bofors 40 mm cannon, six torpedo tubes and a Hedgehog ASW mortar. Despite their small size they have accommodation for a platoon (34 men) of marines, as part of their 'colonial' role.

MODERNISATION

It was planned at one stage to fit this class with SSMs and PDMS, but this was shelved for budgetary reasons. Meanwhile, the ASW equipment, including the Hedgehog mortar and twin torpedo tubes has all been removed.

In 1989-91 the main radar was updated and SIFICAP was installed. This is a data exchange system with satellite links between a main base ashore and ships at sea on fishery protection duties.

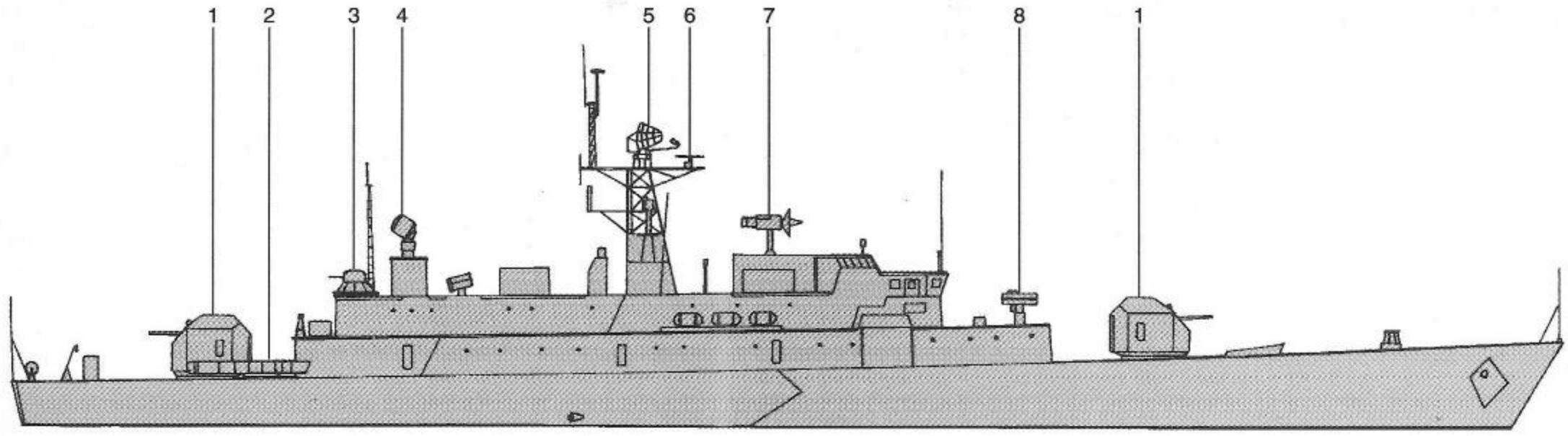


Antonio Enes *(F 471)* (H & L van Ginderen Collection)

DEPLOYMENT

These ships are now employed on Fishery Protection duties and, with their ASW equipment removed, their value as warships is very small.

TETAL



Admiral Petre Barbuneanu (Ian Sturton)

1 Russian twin AK-726 76 mm (3 in)/60 gun 2 Two 533 mm (21 in) torpedo tubes 3 AK-230 twin 30 mm/65 cannon 4 Drum Tilt fire-control radar (for AK-230) 5 Strut Curve air/surface search radar 6 Nayada navigation radar 7 Hawk Screech fire control (for AK-726) 8 RBV-2500 anti-submarine rocket launcher

GENERAL SPECIFICATIONS

Operator: Romania

Class: TETAL

Built: 4
Active: 4

Displacement:
full load: 1,440 t

Dimensions
Length: 92.4 m (303.1 ft)
Beam: 11.7 m (38.4 ft)
Draught: 3.1 m (9.8 ft)

Speed: 24 kts

Complement: 95

SHIPS

ADMIRAL PETRE BARBUNEANU (260)
Builder Mangalia Shipyard, Romania
Launched 1981
Commissioned 4 Feb 1983

VICE ADMIRAL VASILE SCODREA (261)
Builder Mangalia Shipyard, Romania
Launched 1982
Commissioned 3 Jan 1984

VICE ADMIRAL VASILE URSEANU (262)
Builder Mangalia Shipyard, Romania
Launched 1983
Commissioned 3 Jan 1985

VICE ADMIRAL EUGENIU ROSCA (263)
Builder Mangalia Shipyard, Romania
Launched 1985
Commissioned 23 Apr 1987

WEAPONS SYSTEMS

TUBES

There are two fixed 533 mm (21 in) torpedo tubes on either side of the after 76 mm gun turret.

TORPEDOES

Torpedoes used are the Russian 53-65, a passive/wake homing torpedo, with a range of 13.5 n miles (25 km) at 50 knots. It carries a 300 kg (661 lb) warhead.

GUNS

AK-726 twin 76 mm L/59 mount

There are two twin 76 mm/59 mounts, one each in 'A' and 'Y' positions. AK-726 is a multirole weapon system designed for air defence, surface engagement and shore bombardment roles, and consists of two 76 mm guns mounted in a turret with a 5 mm metal shield. Each gun has its own loading system.

There is a five-man crew in the turret: the gun captain, two layers and two loaders. There is a further team of four loaders in the below-decks magazine.

AK-726 is associated with 'Hawk Screech' radar which features a circular dish antenna (2.3 m (7.5 ft) diameter) with central feed on four 'legs'. The transmitter, receiver, turning and stabilisation gears are behind the antenna and the whole director is mounted on a pedestal, approximately 2 m high (6.5 ft).

'Hawk Screech' may also incorporate electro-optic sensors. In addition to radar fire control there is local control through the Prisma optical sighting system, which may be used for engaging targets with speeds of up to 600 m/s (1,969 ft/s, Mach 1.75).

Specifications
AK-726
Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,215 ft/s)
Traverse: 360° at 36°/s
Elevation: −7 to +85° at 32°/s
Rate of fire: 90 rds/min (whole mounting)
Range:
anti-surface: 8 n miles (15 km)
anti-air: 10,000 m (32,810 ft) (max)
anti-air: 7,000 m (22,967 ft)

Ammunition
UOFB-62
Complete round: 12.8 kg (28 lb)
Projectile: 4.6 kg (10 lb)
Explosive: 400 g (A-IX-2)
Fuze: VG-67 point impact fuze

30 mm L/65 AK-230 twin mounting

There are two twin 30 mm/65 AK-630 mounts at either corner of the after superstructure. The AK-230 is a remotely operated, twin barrel, automatic anti-aircraft gun designed to engage air targets at heights of up to 4,000 m (13,124 ft). It is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically powered mounting consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system.

The fire-control radar is the I/J-band Rys (NATO = Drum Tilt) fire-control radar, whose maximum acquisition range is approximately 22 n miles (40 km), with each radar director controlling two gun mountings.

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,445 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
AA: 4,000 m (13,124 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,095-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
type: armour-piercing tracer
weight (complete round): 1.47 kg (3.24 lb)
weight (projectile): 0.35 kg (0.77 lb)
OF-83D:
type: high explosive
weight (complete round): 1.40 kg (3.0 lb)
projectile: 0.27 kg (0.6 lb)
explosive: 30 g (A-XI-2)

14.5 mm KPV heavy machine gun

There are two 14.5 mm KPV heavy machine guns. The KPV (Vladimirov Heavy Machine Gun) was designed during the Second World War but is still an effective short-range weapon. It is short-recoil operated with gas assistance supplied by a muzzle booster. The body is a simple metal cylinder to which various attachments are riveted. The barrel is chromium plated with a flash suppressor. API, API-T and I-T rounds are available.

Specifications
KPV
Weight: 49.1 kg (108 lb)
Length: 2 m (6.5 ft)
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 600 rds/min (cyclical)

ANTI-SUBMARINE MORTARS

RBU 2500
There are two RBU 2500 launchers on the foredeck. RBU 2500 consists of 16 rocket launcher tubes arranged horizontally in two rows with a steel beam across the top above the rear of the upper row. The tubes, which may be elevated to +85°, are fitted to a large yoke fitting which enables the weapon to be traversed through a nominal 360°. Each tube has a diameter of 250 mm (10 in), is 1.6 m (5.25 ft) long and fires manually loaded rockets, each with 21 kg (46.3 lb) warhead, up to 1.5 n miles (2.8 km). This weapon seems to be associated with older, hull-mounted, HF active search and attack sonars such as Wolfs Paw (Herkules) and the similar system which operates at about 24 kHz and has the NATO designation Buck Toe and the Soviet designation Pegas.

Specifications
RBU 2500
Calibre: 250 mm (10 in)
Launcher tubes: 16
Elevation: +85°
Traverse: 360°
Warhead: 21 kg (46.3 lb)
Range: 1.5 n miles (2.8 km)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog
There are two Watch Dog arrays. Watch Dog is an intercept and radar warning system which has been in service for over 30 years. It is a wide open system with an array consisting of four tiers of eight microwave horns, covering frequencies from D to H-band and normally has two arrays, one on each side of the ship.

DECOYS

PK-16 chaff launcher
There are two PK-16 chaff launchers.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar
The air search radar is the Russian MR-302 (NATO = Strut Curve) a medium-range, general purpose, F-band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m^2 (21.5 sq ft) aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Drum Tilt
There is one 'Rys' (NATO = Drum Tilt) fire-control system for the AK-230. This is an I/J-band system with a pedestal-mounted director whose antenna is in a weatherproof container and is mounted atop a small tower just forward of the AK-230 mounts. Maximum acquisition range is approximately 22 n miles (40 km).

Hawk Screech
The director for the AK-726 is the 'Hawk Screech' which features a circular dish antenna (2.3 m (7.5 ft) diameter) with central feed on four 'legs'. The transmitter, receiver, turning and stabilisation gears are behind the antenna and the whole director is mounted on a pedestal, approximately 2 m (6.5 ft) high.

'Hawk Screech' may also incorporate electro-optic sensors.

Nayada
Nayada is a standard Russian I-band navigation radar.

IFF
High Pole.

SONAR

These ships are fitted with a hull-mounted, active, search and attack, medium-frequency sonar.

PROPULSION

Specifications
System: Diesel
Main machinery: 4 diesels; 9.9 MW (13,000 hp(m))
Shafts: 4

FURTHER INFORMATION

PROGRAMME

One of President Ceausescu's grandiose ideas was to build a large naval force, constructed to the greatest possible extent from Romanian resources. The navy was to create a task group consisting of the 'battle-cruiser' *Muntenia* and four anti-submarine escorts — the 'Tetal' class frigates.

These four ships were laid down in the late 1970s and commissioned between 1983 and 1987. Construction ended with the fourth hull and building then switched to the 'Improved Tetal' (see next entry).

DESIGN

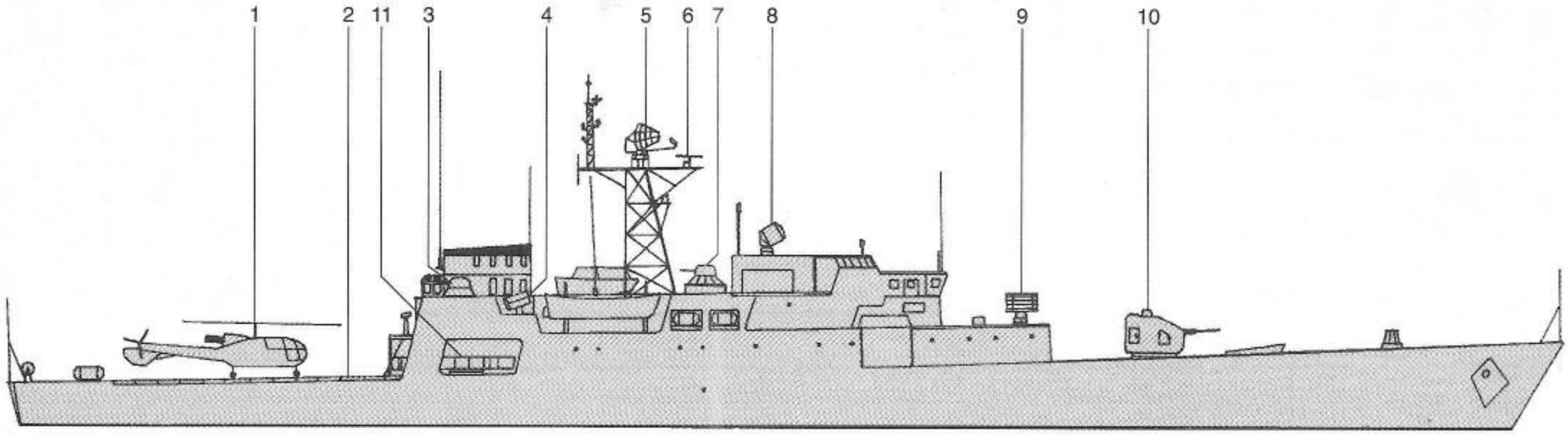
The 'Tetal' class hull has approximately the same dimensions as the Russian 'Koni' class frigate, but the form is quite different and there may be no relationship between the two. Also, the Russian ship has a CODAG propulsion system, whereas the Romanian employs diesels. The Romanians could not, however, avoid a large dependence on Russian weapons and electronic equipment.

DEPLOYMENT

These four ships operate from the main Romanian naval base at Constanza.

Admiral Petre Barbuneanu *(260) one of four 'Tetal' class frigates, which were designed and built in Romania in the early 1980s.*

IMPROVED TETAL



Contre Admiral Eustatiu Sebastian (Ian Sturton)

1 *IAR-316 Alouette III* **2** *Flight deck* **3** *AK-306 30 mm/65 six-barrelled cannon* **4** *PK-16 chaff launcher* **5** *Strut Curve air/surface search radar* **6** *Spin Trough navigation radar* **7** *AK-630 30 mm/65 six-barrelled cannon* **8** *Drum Tilt fire control* **9** *RBU-6000 anti-submarine rocket launcher* **10** *AK-176M 76 mm/59 gun* **11** *Twin 533 mm (21 in) torpedo tubes*

GENERAL SPECIFICATIONS

Operator: Romania

Class: IMPROVED TETAL

Built: 1
Active: 1
Completing: 1 (see 'Further Information')

Displacement:
full load: 1,500 t

Dimensions
Length: 92.4 m (303.1 ft)
Beam: 11.7 m (38.4 ft)
Draught: 3.1 m (10 ft)

Speed: 24 kts

Complement: 95

SHIPS

CONTRE ADMIRAL EUSTATIU SEBASTIAN (264)
Builder Mangalia Shipyard, Romania
Launched 1988
Commissioned 30 Dec 1989

— (265)
Builder Mangalia Shipyard, Romania
Launched 1992
Commissioned ?

WEAPONS SYSTEMS

TORPEDOES

There are two twin 533 mm (21 in) torpedo tubes, which pivot outwards to launch. The weapons are Russian 53-65 torpedoes, which use passive/wake-homing. They have a speed of 50 knots and a range of 13.5 n miles (25 km).

GUNS

AK-176M 76 mm L/59

There is one AK-176M 76 mm L/59 gun mounted in 'A' position on the foredeck. The AK-176M is a four-man mounting, which is hydraulically operated, with manual reversion in the event of power failure. The AK-176M is controlled by the Drum Tilt director. There is also a Kondensor sight, used as a backup in the event of the failure of Drum Tilt, or the WD-221 optical sight.

Specifications
AK-176 m
Calibre: 76 mm (3.0 in)
Length of barrel: 59 calibres
Traverse: 360° at 35°/s
Elevation: −3 to +85° at 30°/s
Ammunition (total): 16 kg (35.3 lb)
Rate of fire: 120 rds/min
Range:
anti-surface: 8 n miles (15 km)
anti-air: 7,000 m (22,967 ft)

Ammunition
UOFB-62
Weight:
complete round: 12.8 kg (28 lb)
projectile: 4.6 kg (10 lb)
explosive: 400 g (A-IX-2)
Fuze: Point impact fuze (VG-67)

30 mm L/65 AK-630 twin mounting

There are two twin 30 mm/65 AK-630 mounts immediately forward of the mast. The AK-230 is a remotely operated, twin barrel, automatic anti-aircraft gun designed to engage air targets at heights of up to 4,000 m (13,124 ft). It is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically powered mounting consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system.

The fire-control radar is the I/J-band Rys (NATO = Drum Tilt) fire-control radar, whose maximum acquisition range is approximately 22 n miles (40 km), with each radar director controlling two gun mountings.

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,445 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,124 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,095-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
type: Armour-piercing tracer
weight (complete round): 1.47 kg (3.24 lb)
weight (projectile): 0.35 kg (0.77 lb)

OF-83D:
type: High explosive
weight (complete round): 1.40 kg (3.0 lb)
projectile: 0.27 kg (0.6 lb)
explosive: 30 g (A-XI-2)

AK-306 30mm/65 cannon

There are also two 30 mm/65 AK 306. This is also a six-barrelled weapon and is very similar to the AK-630. However, it is a different weapon and according to recent reports is optimised for the anti-surface role, whereas the AK-630 is a CIWS air defence system.

ANTI-SUBMARINE MORTARS

RBU-6000

Two RBU-6000, 12-tubed trainable anti-submarine rockets launchers are located immediately before the bridge. These are conventional Russian-pattern systems; 98 rockets are carried.

Specifications
RBU-6000
Launch tubes: 12
Tube arrangement: Circular
Calibre: 300 mm
Tube length: 0.6 m (2.0 ft)
Elevation: +50°
Traverse: 360° (theoretical)
Rocket weight: 100 kg (220 lb)
Warhead: 31 kg (68 lb)
Range: 3.25 n miles (6,000 m)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog
There are two Watch Dog arrays. Watch Dog is an intercept and radar warning system which has been in service for over 30 years. It is a wide open system with an array consisting of four tiers of eight microwave horns, covering frequencies from D to H-band and normally has two arrays, one on each side of the ship.

DECOYS

PK-16
There are two PK-16 16-tube chaff launchers.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar
The air search radar is the Russian MR-302 (NATO = Strut Curve) a medium-range, general purpose, F band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m² aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Drum Tilt
There is one 'Rys' (NATO = Drum Tilt) fire-control system for the AK-230. This is an I/J-band system with a pedestal-mounted director whose antenna is in a weatherproof container and is mounted atop a small tower just forward of the AK-230 mounts. Maximum acquisition range is approximately 22 n miles (40 km).

Spin Trough
Spin Trough is an I-band navigation radar.

IFF
High Pole.

SONAR

These ships are fitted with a hull-mounted, active, search and attack, medium-frequency sonar. This could well be the Russian Herkules.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 17 × 11 (55 × 38 ft)
Helicopters: 1 IAR-316 Alouette III

Specifications
Dimensions:
main rotor diameter: 11.02 m (36.15 ft)
length overall (rotor turning): 12.84 m (42.15 ft)
fuselage length: 10.17 m (33.7 ft)
height to rotor head: 3.00 m (9.84 ft)
Weights:
empty: 1,143 kg (2,520 lb)
max take-off: 2,200 kg (4,850 lb)
Performance:
max speed (never exceed): 113 kts (210 km/h)
max cruising speed: 100 kts (185 km/h)
service ceiling: 3,200 m (10,500 ft)
range (max fuel): 267 n miles (495 km)
Engines: 1 — 694 kW (870 shp) Turbomeca Artouste IIIB turboshaft derated to 425 kW (570 shp)
Accommodation: 7 (pilot plus six)
Weapons: In the ASW role the IAR-316B would carry 2 lightweight torpedoes

PROPULSION

Specifications
System: Diesel
Main machinery: 4 diesels; 9.6 MW (13,000 hp(m))
Shafts: 4

FURTHER INFORMATION

PROGRAMME

This is the follow-on to the original 'Tetal' class, with the first ship launched in 1988, followed by the second in 1992. The first was commissioned in 1989, but the second has suffered a series of delays and there are now serious doubts that it will ever be completed.

STRUCTURE

The hull and propulsion system are the same as in the original 'Tetal' class. There are, however, major changes in the weapons and sensors, primarily in order to enable the ship to accommodate a flight deck and a hangar.

The superstructure is more substantial than in the earlier ships and the bridge is one deck level higher. There is also a recognisable stack, something that is missing in the Tetal design.

DEPLOYMENT

Eustatiu Sebastian is based at Constanta with the four original 'Tetal' class frigates.

Contre Admiral Eustatiu Sebastian *(264), first of the 'Improved Tetal' class. A second was launched in 1992 but has still not been completed*

PETYA

OVERVIEW

Some 54 'Petya' class frigates were built between 1960 and 1982 with production split between Kaliningrad and Khabarovsk. They were small and handy vessels designed specifically for the ASW mission and were designated *'storozhevoy korabl'* (SKR) by the Russian Navy.

Petya I. This was the original version for the Russian Navy with two twin 76 mm guns, two RBU-2500 ASW rocket launchers, five 406 mm torpedo tubes and 22 mines. Six were built, all of which have been scrapped.

Petya I Mod. Production switched to a modified version, which had two extra RBU-2500 rocket launchers. Ten were built, all of which have been scrapped.

Petya II. This was the major production version for the Russian Navy, of which 27 were built. This had two RBU 6000 forward and a second bank of 400 mm torpedo tubes mounted aft in place of the second pair of RBU-2500 in the Petya I Mod. Petya IIs remain in service, of which three are with the Russian Navy. Five were exported at the end of their service with the Russian Navy: two to Ethiopia and three to Vietnam.

Petya II Mod. The two ships transferred to Ethiopia had the after bank of torpedo tubes replaced by a large multibarrelled rocket launcher. Whether this was done before the transfer or was a local modification in Ethiopia is not known.

Petya III. This version was specifically designed for export. 18 were built, which were exported to: Ethiopia — 2; India — 10; Syria — 2; and Vietnam — 2. The remaining two were retained by the Russian Navy for demonstration and crew training for the export customers. This version had the same hull as Petya II, but with one triple bank of 533 mm torpedo tubes in place of the 406 mm tubes in earlier versions. It also had four RBU-2500 as in Petya I Mod.

A Petya II Mod of the now defunct navy of Ethiopia and Eritrea. This ship was a standard Petya II while serving with the Russian Navy, but on transfer it had a multibarrel rocket launcher installed on the after deck (Ethiopian Navy)

Current Position

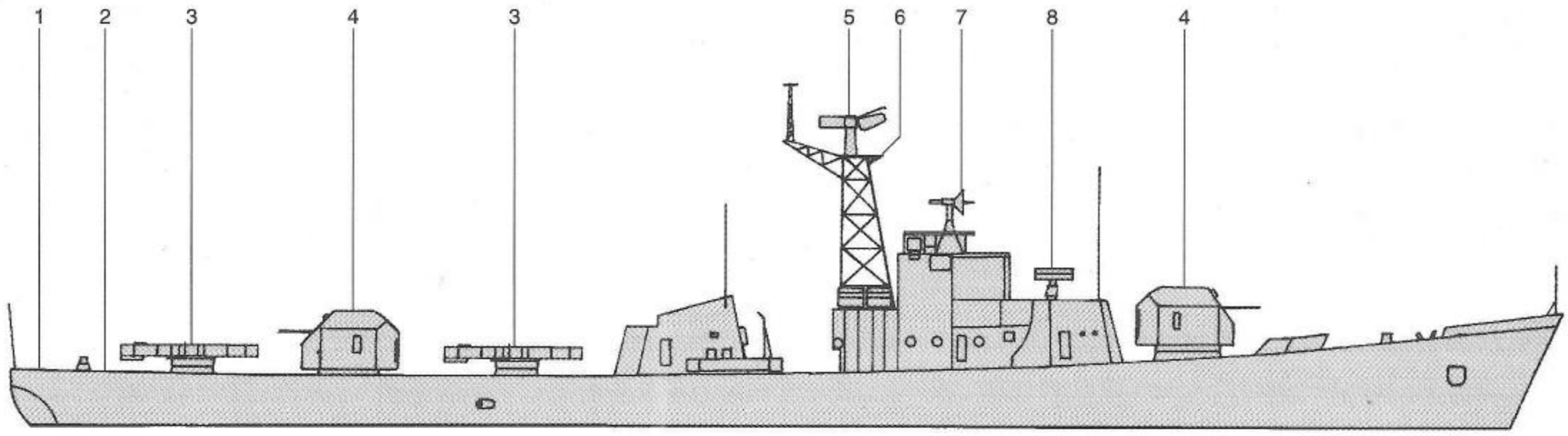
Ethiopia. With the break-up of Ethiopia and Eritrea the position of the remains of the fleet is unclear. The four Petyas supplied by Russia have all either been scrapped or are lying derelict; they are not, therefore, included in the following entries.

In service

Currently in service are:

Russia — three Petya II
India — four Petya III
Syria — two Petya III
Vietnam — three Petya II, two Petya III

PETYA II



Petya II (Ian Sturton)
1 *Depth charges* **2** *Mine rails* **3** *Five-tube 406 mm (16 in) torpedo tubes (two sets)* **4** *AK-726 76 mm (3 in)/60 twin guns* **5** *Slim Net air/surface search radar* **6** *Don 2 navigation radar* **7** *Hawk Screech fire control (AK-726)* **8** *RBU-6000 ASW rocket launcher*

GENERAL SPECIFICATIONS

Operator: Russia
Type: Project 159A

Class: PETYA II

Built: 27
Active: 3

Displacement:
standard: 950 t
full load: 1,180 t

Dimensions
Length: 81.8 m (268.3 ft)
Beam: 9.1 m (29.9 ft)
Draught: 2.9 m (9.5 ft)

Speed: 32 kts
Range: 4,870 n miles at 10 kts; 450 n miles at 29 kts

Complement: 98

WEAPONS SYSTEMS

TORPEDOES

There are two banks, each of five 406 mm (16 in) torpedo tubes. One bank is forward of the after turret, the other immediately abaft it. The torpedo normally used is the SAET-40, an anti-submarine torpedo with active/passive homing to 5.4 n miles (10 km) at a speed of 30 knots.

GUNS

Two AK-726 twin 76 mm (3 in)/59 mountings

There are two twin AK-726 turrets, one forward in 'A' position, the other aft in 'Y' position. The AK-726 is a multirole weapon system designed for air defence, surface engagement and shore bombardment roles and consists of two 76 mm guns mounted in a turret with a 5 mm metal shield. The whole mounting can contain 60 rounds of which two are on the feeder rail and four are on the hoists at any one time. The prime ammunition is the UOFB-62, a fixed round which weighs 12.8 kg (28.2 lb). The projectile weighs 4.6 kg (10.1 lb) and has 400 g of A-IX-2 explosive and a VG-67 point impact fuze.

There is a five-man crew in the turret: the gun captain, two layers and two loaders. There is a further team of four loaders in the below-decks magazine. In this installation AK-726 is associated with Hawk Screech radar, but, in addition to radar fire control there is also local control through the Prisma optical sighting system, which may be used for engaging targets with speeds of up to 600 m/s (Mach 1.75).

Specifications

Calibre: 76 mm
Barrel length: 59 calibres
Muzzle velocity: 980 m/s (3,215 ft/s)
Traverse: 360° at 36°/s
Elevation: −7 to +85° at 32°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 90 rds/min (whole mounting)
Range:
surface/surface: 8.5 n miles (15.7 km)
AA (max): 10,000 m (32,808 ft)
AA (effective): 7,000 m (22,965 ft)

ANTI-SUBMARINE MORTARS

RBU-6000

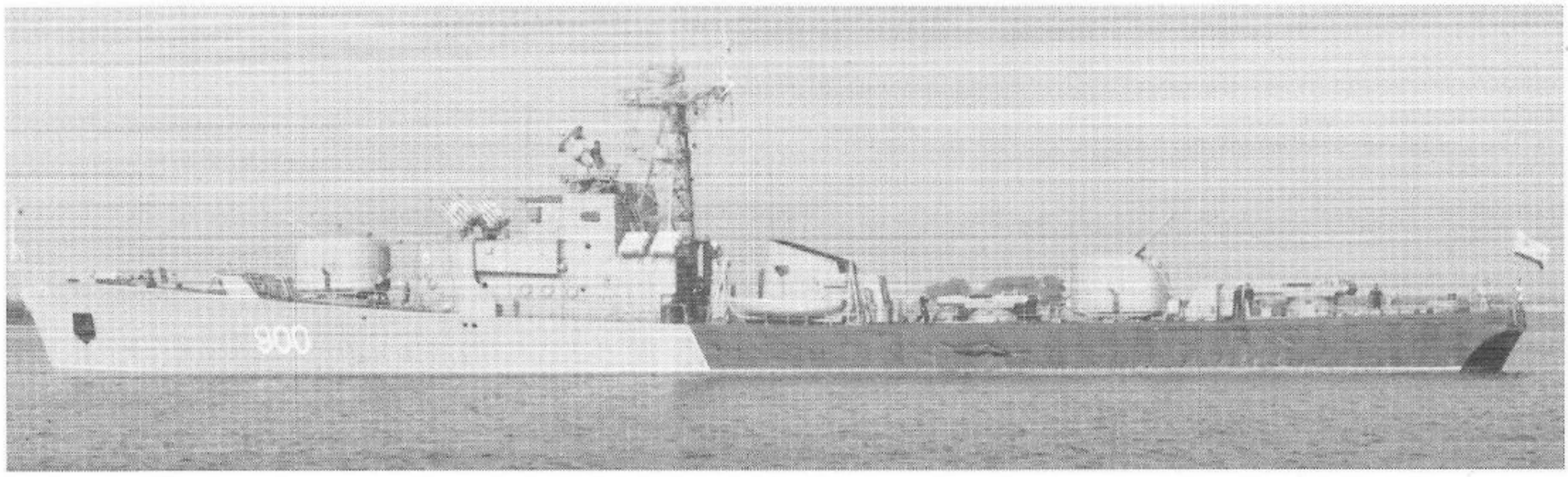
There are two 12-tube RBU-6000 mortars immediately before the bridge. The mounting can traverse through 360° and elevation limits are −15°/+60°. Loading is automatic from a below-deck magazine. It is estimated that the rockets weigh 110 kg, with a 25 kg warhead. Pairs of tubes are fired in sequence. The RGB-60 rocket is fitted with an impact time fuze, which detonates either on hitting a solid object (such as a submarine) or when it reaches a preset depth. Firing is usually conducted in a full salvo of 12 rockets, but it is also possible to fire single rockets, or four- or eight-rocket salvos, if the tactical situation requires it.

DEPTH CHARGES

There are two depth-charge racks.

MINES

22 mines can be carried.



A Petya II of the Russian Navy (H & L van Ginderen Collection)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog

There are two Watch Dog arrays. Watch Dog is an intercept and radar warning system which has been in service for over 30 years. It is a wide-open system with an array consisting of four tiers of eight microwave horns, covering frequencies from D to H-band and normally has two arrays, one on each side of the ship.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar

The air search radar is the MR-302 (NATO = Strut Curve) a medium-range, general purpose, F-band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m² aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Don 2

All Grishas have one Don 2, I-band, navigation radar.

Hawk Screech fire-control radar

Hawk Screech fire-control radar has a circular dish scanner, behind which are mounted the transmitter and receiver, as well as turning and stabilisation gear. The 2.3 m (7.5 ft) diameter scanner has a central feed supported by a four-leg structure. Feed arrangements could incorporate a rotating dipole to provide a conical scan search pattern. Dish diameter is approximately 2 m (6.56 ft) and the operating frequency is in the H/I-band for both types. The NATO designation, Hawk Screech, is apparently derived from signal characteristics noted in the course of ELINT monitoring. The principal function is that of gunfire director against aircraft targets, although this type probably also has a certain capability against surface targets, and possibly splash detection. In the Petyas Hawk Screech is associated with the 76 mm guns.

IFF

High Pole B.

SONARS

Herkules

The Petya II is equipped with Herkules (NATO = Wolf Paw) a sonar more usually found in submarines. It is a hull-mounted, active search and attack, medium-frequency system.

VDS

Some Petya IIs are reported to be fitted with a VDS.

PROPULSION

Specifications

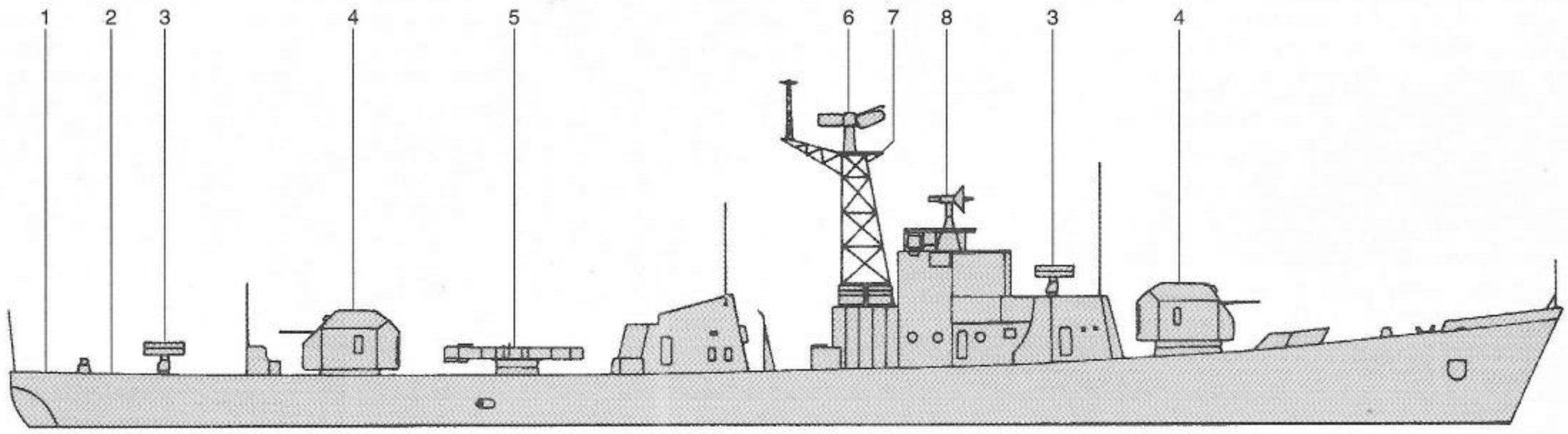
System: Combined diesel and gas turbine (CODAG)
Main machinery: 2 gas turbines; 22 MW (30,000 hp(m); 1 Type 61V-3 diesel; 3.97 MW (5,400 hp(m)) sustained (centre shaft)
Shafts: 3

FURTHER INFORMATION

Only three Petya IIs remain in service with the Russian Navy: two in the Northern Fleet and one in the Caspian Sea. All other Russian Petya IIs have either been scrapped, sold abroad (Ethiopia — 2; Vietnam — 3), or defected to the Ukraine (one, which has since been scrapped).

A 'Petya II' class ship of the Russian Navy. Note the two sets of five torpedo tubes (one between the stack and the aft gun; one aft of the gun) and the chutes in the transom for mines and depth charges

ARNALA (PETYA III)



Arnala (Petya III) (Ian Sturton)
1 *Depth Charge racks* **2** *Mine rails* **3** *RBU-2500 16-tube ASW rocket launchers (two)* **4** *AK-726 twin 76 mm (3 in)/60 guns* **5** *Three 533 mm (21 in) torpedo tubes* **6** *Slim Net surface search radar* **7** *Don 2 navigation radar* **8** *Hawk Screech fire control (AK-726)*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: India
Type: Project 159A

Class: PETYA III

Purchased: 12
Active: 4

Displacement:
standard: 950 t
full load: 1,100 t

Dimensions
Length: 82.3 m (270 ft)
Beam: 9.1 m (29.9 ft)
Draught: 3.2 m (10.5 ft)

Speed: 32 kts
Range: 4,000 n miles at 20 kts
Complement: 98

SHIPS

ARNALA (P 68)
Builder Khabarovsk, Russia
Transferred to India Aug 1972

ANDROTH (P 69)
Builder Khabarovsk, Russia
Transferred to India Aug 1972

ANJADIP (P 73)
Builder Khabarovsk, Russia
Transferred to India Feb 1973

AMINI (P 75)
Builder Khabarovsk, Russia
Transferred to India Mar 1974

WEAPONS SYSTEMS

TORPEDOES

There is one bank of three 533 mm (21 in) torpedo tubes abaft the stack. The torpedo normally used is the SAET-60, an anti-submarine torpedo with active/passive homing to 8.1 n miles (15 km) at a speed of 40 knots. It carries a 400 kg (880 lb) warhead.

GUNS

Two AK-726 twin 76 mm (3 in)/59 mountings

There are two twin AK-726 turrets, one forward in 'A' position, the other aft in 'Y' position. The AK-726 is a multirole weapon system designed for air defence, surface engagement and shore bombardment roles and consists of two 76 mm guns mounted in a turret with a 5 mm metal shield. The whole mounting can contain 60 rounds of which two are on the feeder rail and four are on the hoists at any one time. The prime ammunition is the UOFB-62, a fixed round which weighs 12.8 kg (28.2 lb). The projectile weighs 4.6 kg (10.1 lb) and has 400 g of A-IX-2 explosive and a VG-67 point impact fuze.

There is a five-man crew in the turret: the gun captain, two layers and two loaders. There is a further team of four loaders in the below-decks magazine. In this installation AK-726 is associated with Hawk Screech radar, but, in addition to radar fire control there is also local control through the Prisma optical sighting system, which may be used for engaging targets with speeds of up to 600 m/s (Mach 1.75).

Specifications
Calibre: 76 mm
Barrel length: 59 calibres
Muzzle velocity: 980 m/s (3,215 ft/s)
Traverse: 360° at 36°/s
Elevation: −7 to +85° at 32°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 90 rds/min (whole mounting)
Range:
surface/surface: 8.5 n miles (15.7 km)
AA (max): 10,000 m (32,808 ft)
AA (effective): 7,000 m (22,965 ft)

ANTI-SUBMARINE MORTARS

RBU-2500

There are four RBU-2500 launchers. RBU-2500 is about 2.5 m (8.2 ft) high and consists of 16 rocket launcher tubes arranged horizontally in two rows with a steel beam across the top above the rear of the upper row. The tubes, which may be elevated to +85°, are fitted to a large yoke fitting which enables the weapon to be traversed through a nominal 360°. Each tube has a diameter of 250 mm (9.8 in), is 1.6 m (5.2 ft) long and fires manually loaded rockets, each with a 21 kg (46.3 lb) warhead, up to 1.5 n miles.

DEPTH CHARGES

There are two depth-charge racks.

MINES

22 mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Slim Net

Slim Net is a surface warning, high-definition radar of generally conventional naval design, with the typical Russian characteristic of balancing vanes behind the scanner. It also has an air search capability. The scanner is of open lattice construction and approximately 5.5 m (18.0 ft) span and 1.8 m (5.9 ft) maximum depth. The general shape is of a tapered rectangle, and the balance vanes also are rectangular. The horn feed is mounted on a boom overhanging the scanner. Operating frequency is in the E/F-band of the spectrum.

Don 2

All Grishas have one Don 2, I-band, navigation radar.

Hawk Screech fire-control radar

Hawk Screech fire-control radar has a circular dish scanner, behind which are mounted the transmitter and receiver, as well as turning and stabilisation gear. The 2.3 m (7.5 ft) diameter scanner has a central feed supported by a four-leg structure. Feed arrangements could incorporate a rotating dipole to provide a conical scan search pattern. Dish diameter is approximately

2 m (6.56 ft) and the operating frequency is in the H/I-band for both types. The NATO designation, Hawk Screech, is apparently derived from signal characteristics noted in the course of ELINT monitoring. The principal function is that of gunfire director against aircraft targets, although this type probably also has a certain capability against surface targets, and possibly splash detection. In the Petyas, Hawk Screech is associated with the 76 mm guns.

IFF

High Pole B.

SONAR

Herkules

The Petya III is equipped with Herkules (NATO = Wolf Paw) a sonar more usually found in submarines. It is a hull-mounted, active search and attack, medium-frequency system.

PROPULSION

Specifications

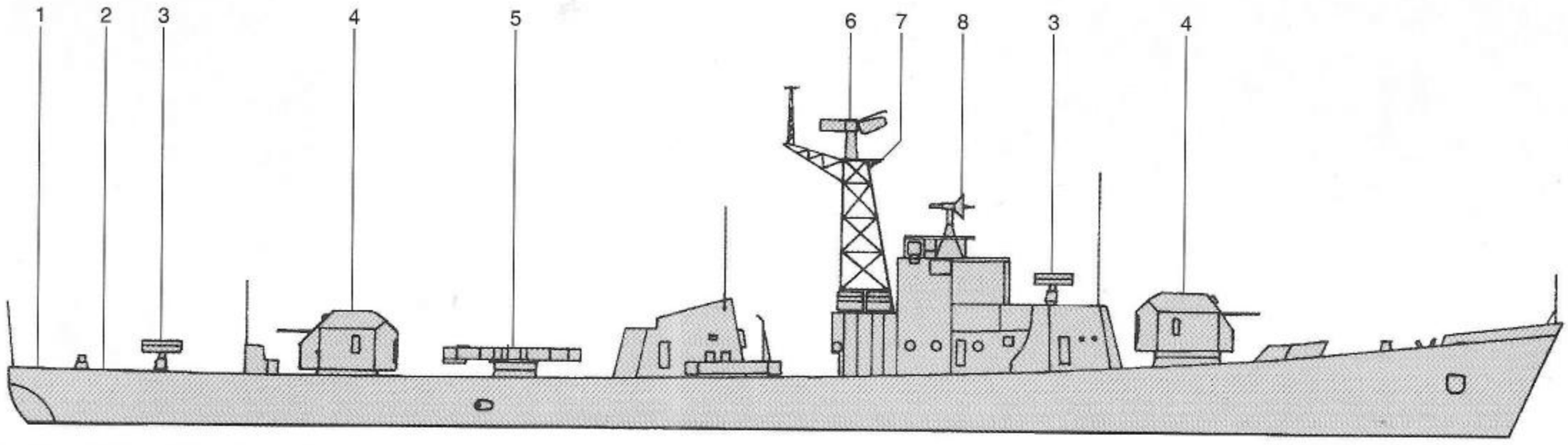
System: Combined diesel and gas turbine (CODAG)
Main machinery: 2 gas turbines; 22 MW (30,000 hp(m)); 2 Type 61V-3 diesels; 3.97 MW (5,400 hp(m)) sustained (centre shaft)
Shafts: 3

FURTHER INFORMATION

The Indian Navy acquired 12 Petya IIIs from the (then) Soviet Union between 1969 and 1974. These were special export versions with three 533 mm torpedo tubes in place of the ten 406 mm tubes in the Soviet Navy version, and with four RBU-2500 instead of two RBU-6000. They also had simpler communications equipment.

Seven have been stricken and one, *Andaman* (P 74) sank in heavy weather in the Bay of Bengal on 22 August 1990 with the loss of 14 lives.

AL HIRASA (PETYA III)



Al Hirasa (Petya III) (Ian Sturton)
1 *Depth charge racks* **2** *Mine rails* **3** *RBU-2500 16-tube ASW rocket launchers (two)* **4** *AK-726 twin 76 mm (3 in)/60 guns* **5** *Three 533 mm (21 in) torpedo tubes* **6** *Slim Net surface search radar* **7** *Don 2 navigation radar* **8** *Hawk Screech fire control (AK-726)*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Syria
Type: Petya III

Class: AL HIRASA

Acquired: 2
Active: 2

Displacement:
standard: 950 t
full load: 1,100 t

Dimensions
Length: 81.8 m (268.3 ft)
Beam: 9.1 m (29.9 ft)
Draught: 2.9 m (9.5 ft)

Speed: 32 kts
Range: 450 n miles at 29 kts; 4,000 n miles at 20 kts; 4,870 n miles at 10 kts

Complement: 98 (8 officers)

SHIPS

1/508

Builder	Khabarovsk, Russia
Transferred to Syria	Jul 1975

AL HIRASA (2/508)

Builder	Khabarovsk, Russia
Transferred to Syria	Mar 1975

WEAPONS SYSTEMS

TORPEDOES

There is one bank of three 533 mm (21 in) torpedo tubes abaft the stack. The torpedo normally used is the SAET-60, an anti-submarine torpedo with active/passive homing to 8.1 n miles (15 km) at a speed of 40 knots. It carries a 400 kg (880 lb) warhead

GUNS

Two AK-726 twin 76 mm (3 in)/59 mountings

There are two twin AK-726 turrets, one forward in 'A' position, the other aft in 'Y' position. The AK-726 is a multirole weapon system designed for air defence, surface engagement and shore bombardment roles and consists of two 76 mm guns mounted in a turret with a 5 mm metal shield. The whole mounting can contain 60 rounds of which two are on the feeder rail and four are on the hoists at any one time. The prime ammunition is the UOFB-62, a fixed round which weighs 12.8 kg (28.2 lb). The projectile weighs 4.6 kg (10.1 lb) and has 400 g of A-IX-2 explosive and a VG-67 point impact fuze.

There is a five-man crew in the turret: the gun captain, two layers and two loaders. There is a further team of four loaders in the below-decks magazine. In this installation AK-726 is associated with Hawk Screech radar, but, in addition to radar fire control there is also local control through the Prisma optical sighting system, which may be used for engaging targets with speeds of up to 600 m/s (Mach 1.75).

Specifications
Calibre: 76 mm
Barrel length: 59 calibres
Muzzle velocity: 980 m/s (3,215 ft/s)
Traverse: 360° at 36°/s
Elevation: −7 to +85° at 32°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 90 rds/min (whole mounting)
Range:
surface/surface: 8.5 n miles (15.7 km)
AA (max): 10,000 m (32,808 ft/s)
AA (effective): 7,000 m (22,965 ft/s)

ANTI-SUBMARINE MORTARS

RBU-2500

There are four RBU-2500 launchers. RBU-2500 is about 2.5 m (8.2 ft) high and consists of 16 rocket launcher tubes arranged horizontally in two rows with a steel beam across the top above the rear of the upper row. The tubes, which may be elevated to +85°, are fitted to a large yoke fitting which enables the weapon to be traversed through a nominal 360°. Each tube has a diameter of 250 mm (9.8 in), is 1.6 m (5.2 ft) long and fires manually loaded rockets, each with a 21 kg (46.2 lb) warhead, up to 1.5 n miles.

DEPTH CHARGES

There are two depth-charge racks.

MINES

22 mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Slim Net

Slim Net is a surface warning, high-definition radar of generally conventional naval design, with the typical Russian characteristic of balancing vanes behind the scanner. It also has an air search capability. The scanner is of open lattice construction and approximately 5.5 m (18.0 ft) span and 1.8 m (5.9 ft) maximum depth. The general shape is of a tapered rectangle, and the balance vanes also are rectangular. The horn feed is mounted on a boom overhanging the scanner. Operating frequency is in the E/F-band of the spectrum.

Don 2

One Don 2, I-band, navigation radar.

Hawk Screech fire-control radar

Hawk Screech fire-control radar has a circular dish scanner, behind which are mounted the transmitter and receiver, as well as turning and stabilisation gear. The 2.3 m (7.5 ft) diameter scanner has a central feed supported by a four-leg structure. Feed arrangements could incorporate a rotating dipole to provide a conical scan search pattern. Dish diameter is approximately 2 m (6.5 ft) and the operating frequency is in the H/I-band for both types. The NATO designation, Hawk Screech, is apparently derived from signal characteristics noted in the course of ELINT monitoring. The principal function is that of gunfire director against aircraft targets, although this type probably also has a certain capability against surface targets, and possibly splash

detection. In the Petyas, Hawk Screech is associated with the 76 mm guns.

IFF
High Pole B. Two Square Head.

SONARS

Herkules
The Petya III is equipped with Herkules (NATO = Wolf Paw) a sonar more usually found in submarines. It is a hull-mounted, active search and attack, medium-frequency system.

PROPULSION

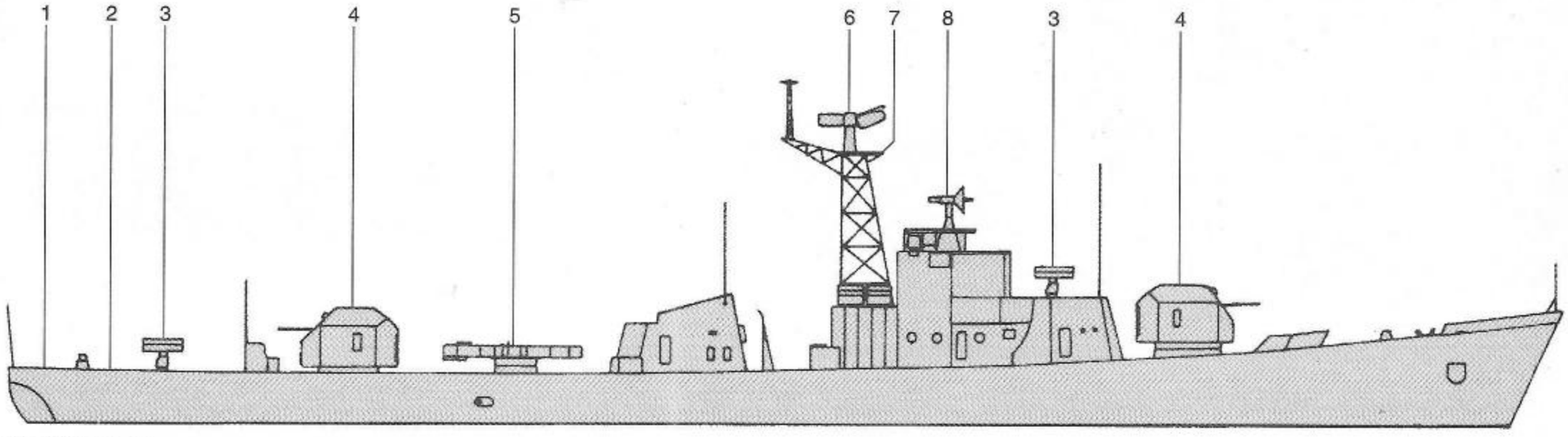
Specifications
System: Combined diesel and gas turbine (CODAG)
Main machinery: 2 gas turbines; 22 MW (30,000 hp(m)); 1 Type 61V-3 diesel; 3.97 MW (5,400 hp(m)) sustained (centre shaft)
Shafts: 3

FURTHER INFORMATION

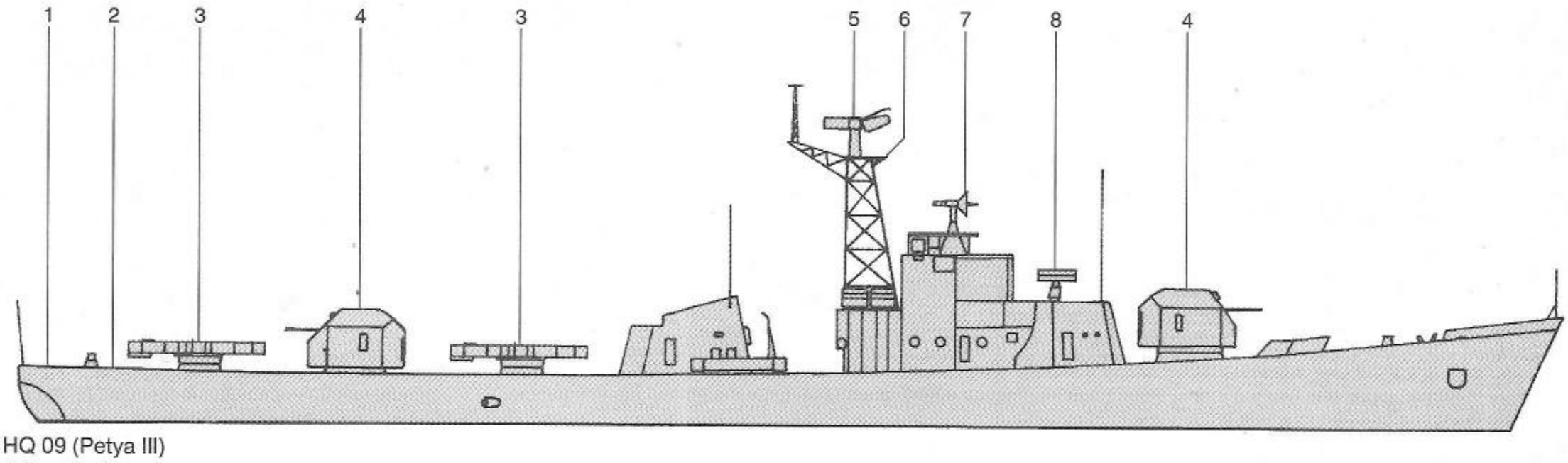
These two ships were acquired from the (then) Soviet Union in 1975 and are the largest surface warships in the Syrian Navy. They are based at Tartous and occasionally go to sea.

Al Hirasa *(1/508) at sea* (UK Mod)

HQ 01 (PETYA II/III)



HQ 13 (Petya II)
1 *Depth Charge racks* **2** *Mine rails* **3** *RBU-2500 16-tube ASW rocket launchers (two)* **4** *AK-726 twin 76 mm (3 in)/60 guns* **5** *Three 533 mm (21 in) torpedo tubes* **6** *Slim Net surface search radar* **7** *Don 2 navigation radar* **8** *Hawk Screech fire control (AK-726)*



HQ 09 (Petya III)
1 *Depth charges* **2** *Mine rails* **3** *Five-tube 406 mm (16 in) torpedo tubes (two sets)* **4** *AK-726 76 mm (3 in)/60 twin guns* **5** *Slim Net air/surface search radar* **6** *Don 2 navigation radar* **7** *Hawk Screech fire control (AK-726)* **8** *RBU-6000 ASW rocket launcher*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Vietnam
Type: Petya II, III

Class: HQ 01

Acquired: 5
Active: 5

Displacement:
standard: 950 t
full load: 1,180 t

Dimensions
Length: 81.8 m (268.3 ft)
Beam: 9.1 m (29.9 ft)
Draught: 2.9 m (9.5 ft)

Speed: 32 kts
Range: 4,870 n miles at 10 kts; 450 n miles at 29 kts

Complement: 98

SHIPS

PETYA III

HQ 09	
Builder	Khabarovsk, Russia
Transferred to Vietnam	Dec 1978
HQ 11	
Builder	Khabarovsk, Russia
Transferred to Vietnam	Dec 1978

PETYA II

HQ 13	
Builder	Khabarovsk, Russia
Transferred to Vietnam	Dec 1983
HQ 15	
Builder	Khabarovsk, Russia
Transferred to Vietnam	Dec 1983
HQ 17	
Builder	Khabarovsk, Russia
Transferred to Vietnam	Dec 1984

WEAPONS SYSTEMS

TORPEDOES

Petya II only. There are two banks of five 406 mm (16 in) tubes each. The torpedo is the SAET-40, an active/passive homing type with a range of 5.5 n miles (10 km) at 30 kts. It has a 100 kg (220 lb) warhead.
Petya III only. There is one bank of three 533 mm (21 in) torpedo tubes abaft the stack. The torpedo normally used is the SAET-60, an anti-submarine torpedo with active/passive homing to 8.1 n miles (15 km) at a speed of 40 kts. It carries a 400 kg (880 lb) warhead.

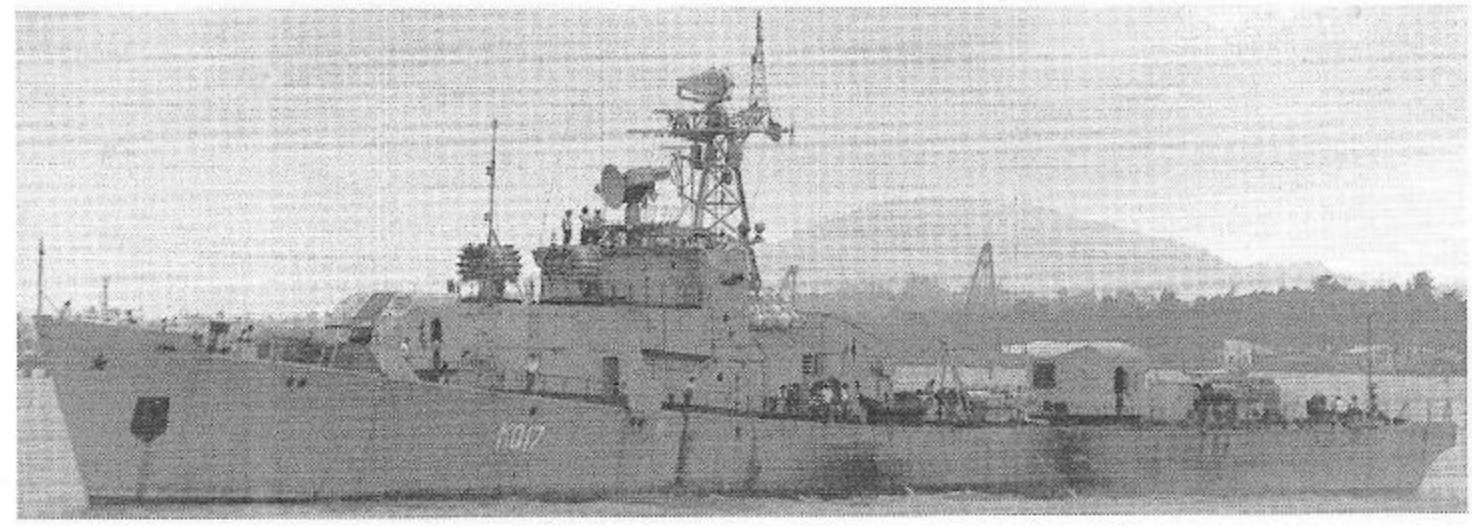
GUNS

Two AK-726 twin 76 mm (3 in)/59 mountings

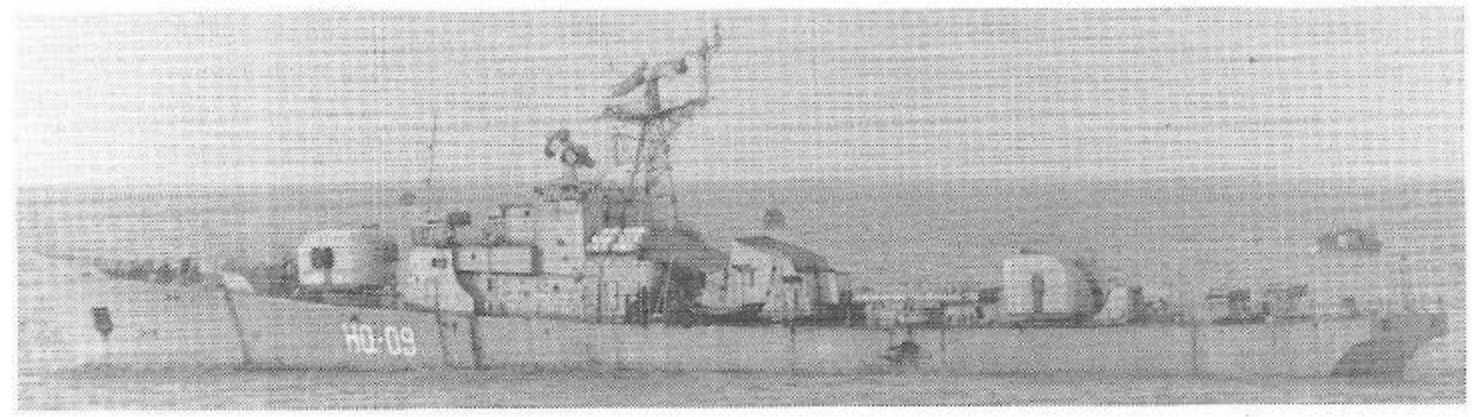
There are two twin AK-726 turrets, one forward in 'A' position, the other aft in 'Y' position. The AK-726 is a multirole weapon system designed for air defence, surface engagement and shore bombardment roles and consists of two 76 mm guns mounted in a turret with a 5 mm metal shield. The whole mounting can contain 60 rounds of which two are on the feeder rail and four are on the hoists at any one time. The prime ammunition is the UOFB-62, a fixed round which weighs 12.8 kg (28.2 lb). The projectile weighs 4.6 kg (10.1 lb) and has 400 g of A-IX-2 explosive and a VG-67 point impact fuze.

There is a five-man crew in the turret: the gun captain, two layers and two loaders. There is a further team of four loaders in the below-decks magazine. In this installation AK-726 is associated with Hawk Screech radar, but, in addition to radar fire control there is also local control through the Prisma optical sighting system, which may be used for engaging targets with speeds of up to 600 m/s (Mach 1.75).

Specifications
Calibre: 76 mm
Barrel length: 59 calibres
Muzzle velocity: 980 m/s (3,215 ft/s)
Traverse: 360° at 36°/s
Elevation: −7 to +85° at 32°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 90 rds/min (whole mounting)
Range:
surface/surface: 8.5 n miles (15.7 km)
AA (max): 10,000 m (32,808 ft)
AA (effective): 7,000 m (22,965 ft)



HQ 17, *one of the three former Russian Navy Petya IIs acquired by the Vietnamese Navy in 1983-84. One of the major characteristics of this version is the pair of RBU-6000 12-tube ASW rocket launchers before the bridge* (G Torremans)



HQ 09, *a Vietnamese Navy Petya III. Note that there are no torpedo tubes abaft the after gun mounting, and that there are four RBU-2500 rocket launchers, two forward and two aft*

ANTI-SUBMARINE MORTARS

RBU-6000

Petya II only. There are two 12-tube RBU-6000 mortars, immediately before the bridge. The mounting can traverse through 360° and elevation limits are −15°/+60°. Loading is automatic from a below-deck magazine. It is estimated that the rockets weigh 110 kg (242 lb), with a 25 kg (55 lb) warhead. Pairs of tubes are fired in sequence. The RGB-60 rocket is fitted with an impact-time fuze, which detonates either on hitting a solid object (such as a submarine) or when it reaches a preset depth. Firing is usually conducted in a full salvo of 12 rockets, but it is also possible to fire single rockets, or four- or eight-rocket salvos, if the tactical situation requires it.

RBU-2500

Petya III only. There are four RBU-2500 launchers. RBU-2500 is about 2.5 m (8.2 ft) high and consists of 16 rocket launcher tubes arranged horizontally in two rows with a steel beam across the top above the rear of the upper row. The tubes, which may be elevated to +85°, are fitted to a large yoke fitting which enables the weapon to be traversed through a nominal 360°. Each tube has a diameter of 250 mm (9.8 in), is 1.6 m (5.2 ft) long and fires manually loaded rockets, each with a 21 kg (46.2 lb) warhead, up to 1.5 n miles.

DEPTH CHARGES

There are two depth-charge racks in both Petya II and III.

MINES

Both types can carry up to 22 mines.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog

There are two Watch Dog arrays. Watch Dog is an intercept and radar warning system which has been in service for over 30 years. It is a wide-open system with an array consisting of four tiers of eight microwave horns, covering frequencies from D to H-band and normally has two arrays, one on each side of the ship.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar

The air search radar is the MR-302 (NATO = Strut Curve) a medium-range, general purpose, F band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m² aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Don 2

One Don 2, I-band, navigation radar.

Hawk Screech fire-control radar

Hawk Screech fire-control radar has a circular dish scanner, behind which are mounted the transmitter and receiver, as well as turning and stabilisation gear. The 2.3 m diameter scanner has a central feed supported by a four-leg structure. Feed arrangements could incorporate a rotating dipole to provide a conical scan search pattern. Dish diameter is approximately 2 m and the operating frequency is in the H/I-band for both types. The NATO designation, Hawk Screech, is apparently derived from signal characteristics noted in the course of ELINT monitoring. The principal function is that of gunfire director against aircraft targets, although this type probably also has a certain capability against surface targets, and possibly splash detection. In the Petyas, Hawk Screech is associated with the 76 mm guns.

IFF

High Pole B. Two Square Head.

SONARS

Herkules

All ships are equipped with Herkules (NATO = Wolf Paw) a sonar more usually found in submarines. It is a hull-mounted, active search and attack, medium frequency system.

PROPULSION

Specifications
System: Combined diesel and gas turbine (CODAG)
Main machinery: 2 gas-turbines; 22 MW (30,000 hp(m)); 1 Type 61V-3 diesel; 3.97 MW (5,400 hp(m)) sustained (centre shaft)
Shafts: 3

FURTHER INFORMATION

The Vietnamese Navy operates five of these ships. Two were the standard export version — Petya III — and were supplied brand new in December 1978. The other three were standard Russian Navy Petya IIs and were transferred after service in the Russian Navy, two in December 1983 and one in December 1984.

GRISHA

OVERVIEW

The successor to the 'Poti' class, the Grisha is a small anti-submarine ship of which at least 97 have been built. The Grisha has a full load displacement of 1,200 t, making it marginally smaller than the Danish Niels Juel frigate, and is known in the Russian Navy as *maly protivolodochny korabl* (small anti-submarine ship) or MPK, for short.

Propulsion is CODAG, with one gas turbine and two diesels. The main reason for the gas turbine is the sonar, which was developed from a helicopter set and requires the ship to stop to use it, then raise it and move rapidly to another spot — the so-called 'dip-and-dash' technique.

Grisha I. The basic version, this has the SA-N-4 launcher in the foredeck, with a twin 57 mm gun aft, four torpedo tubes, two depth-charge racks, and the inevitable RBU launchers. 16 were built, of which one was diverted to become the sole Grisha IV. Both Grisha I and II have a rectangular screen abaft the stack, which is not present in later types, which do not have the Muff Cob director, either. This suggests that the screen may have been related to the radiation patterns of Muff Cob.

Grisha II. This version was built for the KGB Border Guard units and has a second twin 57 mm mounting forward, displacing the SA-N-4 launcher. 17 were built.

Grisha III. The Grisha III has an AK-630 Gatling on a small tower aft, displacing the Muff Cob fire-control director in Grisha I and II. To make up for this, a Bass Tilt is mounted on the after deckhouse and performs fire control for both the 57 mm and the AK-630. 34 were built, the largest single group in the class, of which six were for the KGB Border Guard. The engines were more powerful, as well.

Zemaitis, one of two Grisha IIIs operated by the Lithuanian Navy. At least 97 have been built (Jane's/Kathleen Bunten)

Grisha IV. This was one of the Grisha I hulls, which was diverted to become a trials ship, but apparently had a 76 mm gun. It was used in the early 1980s as the trials ship for the SA-N-9 missile system and the associated Cross Sword fire-director.

Grisha V. This version has a 76 mm gun aft and a new air search radar, either Strut Pair or Half Plate B. It is also reported to have an improved sonar and two positions for shoulder-launched SAMs. One RBU-6000 was removed. Some units were for the KGB Border Guard, the remainder for the navy.

Lithuania
Two Grisha IIIs have been sold to Lithuania.

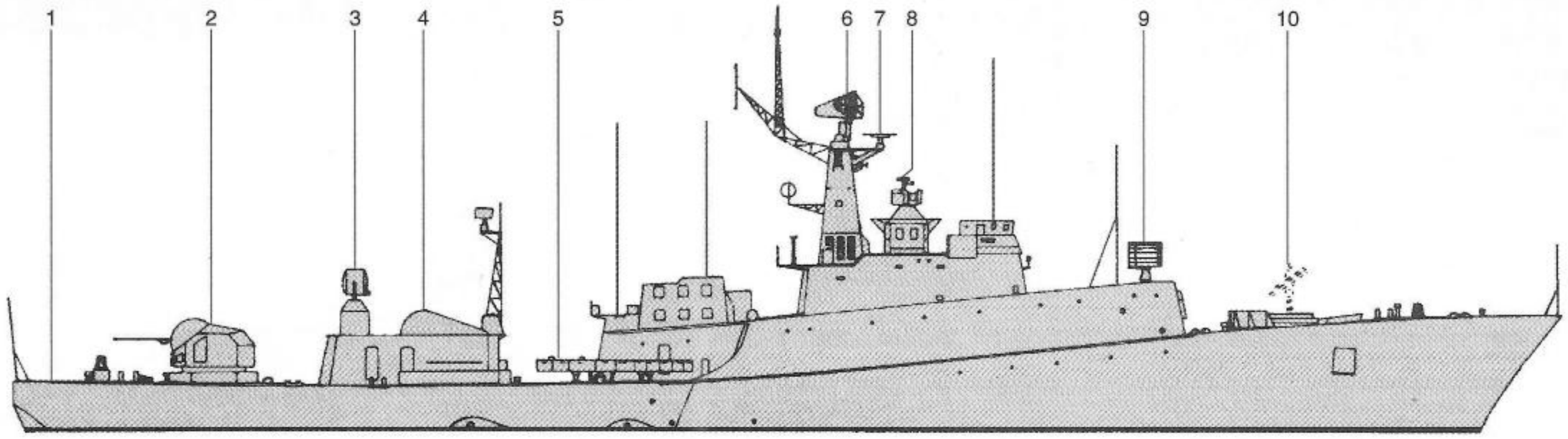
Ukraine
One Grisha V was claimed by the Ukraine in 1993 and three (possibly four) more are being built at Leninskaya Kuznitsa shipyard at Kiev.

TABLE I: GRISHA CLASS — SUMMARY

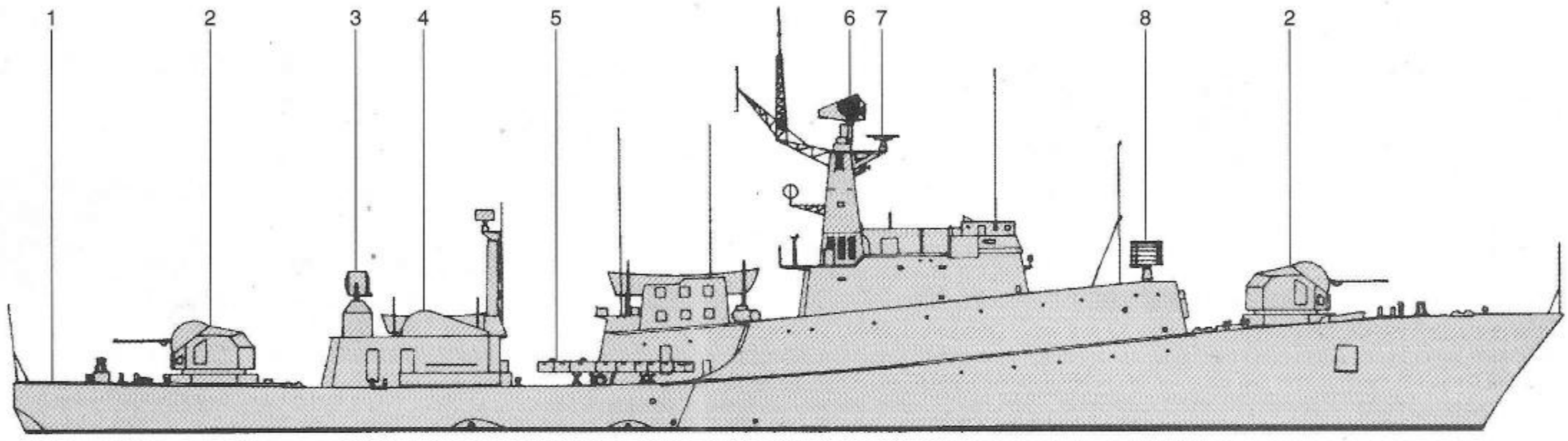
		Grisha I	Grisha II	Grisha III	Grisha IV	Grisha V
Project Nunmber		1124.1	1124A	1124M	1124.4	1124MU
Number produced		16	17	34	1	30
Years in production		1968-75	1973-84	1973-85		1982-
Shipyard		Kiev Khabarovsk	Zelenodolsk	Kiev Khabarovsk	Kiev	Kiev Khabarovsk Zelenodolsk
SAM		1 × SA-N-4	—	1 × SA-N-4	—	1 × SA-N-4
Guns	76 mm 57 mm 30 mm CIWS	— 1 × 2 —	— 2 × 2 —	— 1 × 2 1	1 — 1	1 × 1 — 1
Torpedo tubes		4	4	4	4	4
ASW mortar	RBU-6000	2	2	2	1	1
Depth charges	Racks DCs	2 12	2 12	2 12	2 12	2 12
Mines*		18	18	18	18	18
Radars	Air/surface search Navigation	Strut Curve Don 2	Strut Curve Don 2	Strut Curve Don 2	Strut Pair Don 2	Strut Pair/Half Plate B** Don 2
Fire control	SA-N-4 57 mm guns 76 mm, 57 mm and 30 mm	Pop Group Muff Cob —	— Muff Cob —	Pop Group — Bass Tilt	Pop Group — Bass Tilt	Pop Group Bass Tilt
IFF		High Pole A/B Square Head Salt Pot	High Pole A/B Square Head Salt Pot	High Pole A/B Square Head Salt Pot	High Pole A/B Square Head Salt Pot	High Pole A/B Square Head Salt Pot
Sonar	hull-mounted VDS	Bull Nose Elk Tail	Bull Nose Elk Tail	Bull Nose Elk Tail	Bull Nose Elk Tail	Bull Nose Elk Tail

Notes
* In lieu of depth charges
**Early Grisha Vs have Strut Pair; later ships have Half Plate B

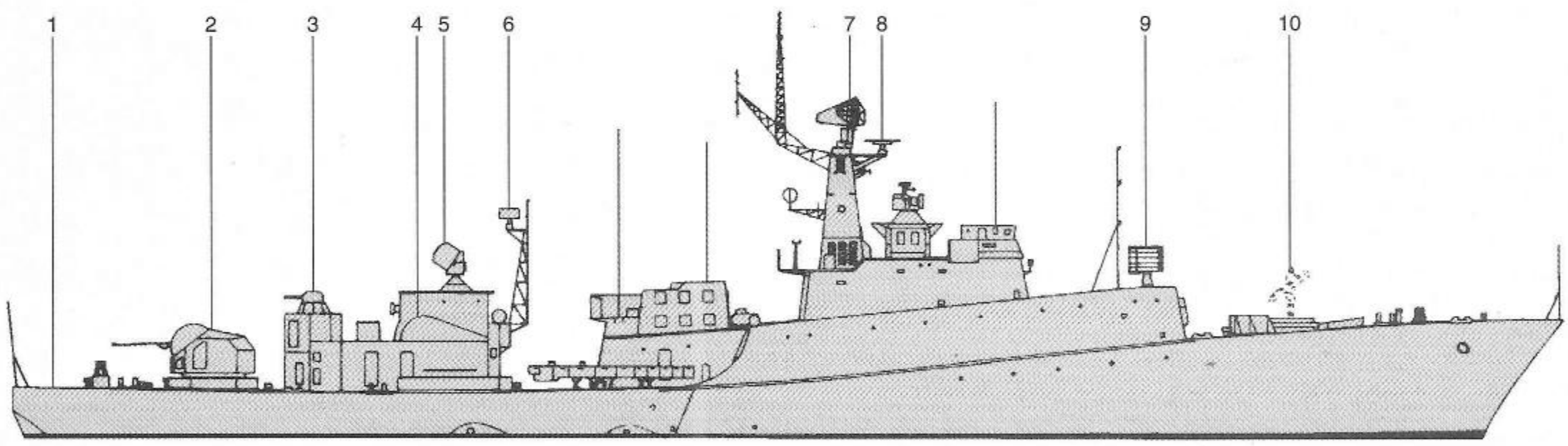
GRISHA



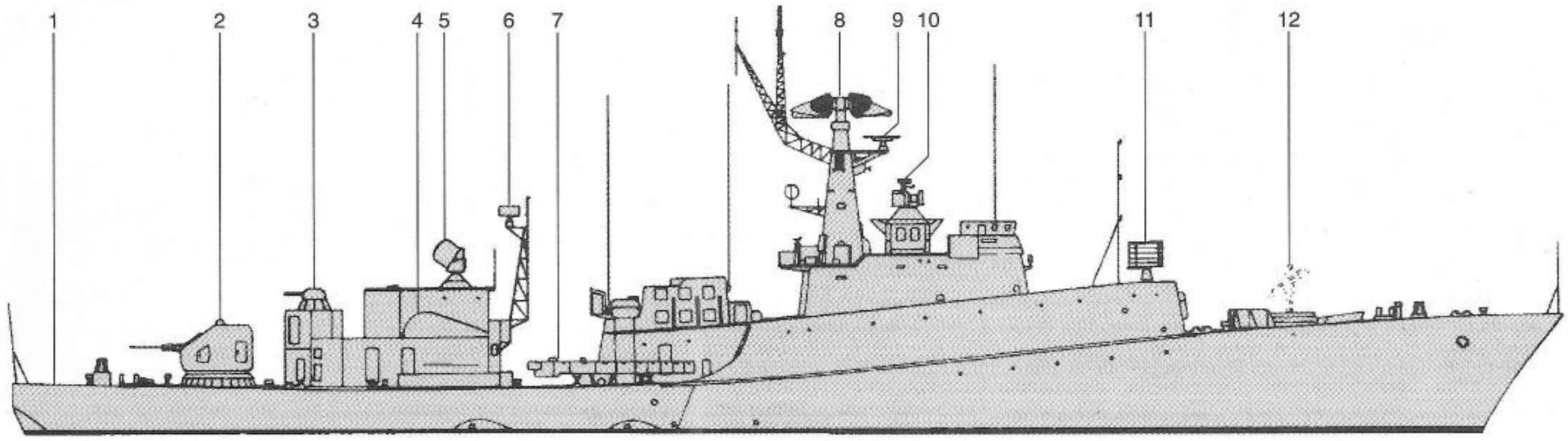
Grisha I (Ian Sturton)
1 *Depth charge racks (two, each 6 DCs)/18 mines* **2** *Twin 57 mm/80 in enclosed mount* **3** *Muff Cob fire control (for 57 mm guns)* **4** *Elk Tail variable depth sonar* **5** *Two twin 533 mm (21 in) torpedo tubes* **6** *Strut Curve air/surface search radar* **7** *Don 2 navigation radar* **8** *Pop Group fire control (for SA-N-4)* **9** *RBU-6000 12-barrel ASW rocket launcher (two)* **10** *SA-N-4 twin arm launcher for SAM*



Grisha II (Ian Sturton)
1 *Depth charge rack (12 DCs) or mines (18)* **2** *Twin 57 mm/80 in enclosed mount* **3** *Muff Cob fire control (for 57 mm guns)* **4** *Elk Tail variable depth sonar* **5** *Two twin 533 mm (21 in) torpedo tubes* **6** *Strut Curve air/surface search radar* **7** *Don 2 navigation radar* **8** *RBU-6000 12-barrel ASW rocket launcher (two)*



Grisha III (Ian Sturton)
1 *Depth charge racks (12 DCs) or mines (18)* **2** *Twin 57 mm/80 in enclosed mount* **3** *Six-barrel 30 mm/65 six-barrel CIWS* **4** *Elk Tail variable depth sonar* **5** *Bass Tilt fire control (for 57 mm and 30 mm CIWS)* **6** *Radar (unidentified)* **7** *Strut Curve air/surface search radar* **8** *Don 2 navigation radar* **9** *RBU-6000 12-barrel ASW rocket launcher* **10** *SA-N-4 twin-arm launcher for SAM*



Grisha V (Ian Sturton)
1 *Depth charge racks (12 DCs) or mines (18)* **2** *Single 76 mm (3 in) gun in enclosed mount* **3** *Six-barrel 30 mm/65 six-barrel CIWS* **4** *Elk Tail variable depth sonar* **5** *Bass Tilt fire control (for 57 mm and 30 mm CIWS)* **6** *Radar (unidentified)* **7** *Twin 533 mm (21 in) torpedo tube (two) (some have only one tube on each side)* **8** *Strut Pair air/surface search radar (Half Plate B in late Grisha Vs)* **9** *Don 2 navigation radar* **10** *Pop Group fire control (for SA-N-4)* **11** *RBU 6000 12 barrel ASW rocket launcher (one only, on port side)* **12** *SA-N-4 twin-arm launcher for SAM*

GENERAL SPECIFICATIONS

Operator: Russia
Type:
Grisha I: Project 1124
Grisha II: Project 1124P
Grisha III: Project 1124M
Grisha IV: Project 1124K
Grisha V: Project 1124EM
National designation:
Grisha I, III, V: *maly protivolodochny korabl* (small anti-submarine ship)

Grisha II: *pogranichny storozhevoy korabl* (border patrol ship)

Class: GRISHA

Displacement:
standard: 950 t
full load: 1,200 t

Dimensions
Length: 71.2 m (233.6 ft)
Beam: 9.8 m (32.2 ft)
Draught: 3.7 m (12.1 ft)

Speed: 30 kts
Range: 2,500 n miles at 14 kts; 1,750 n miles at 20 kts (diesels); 950 n miles at 27 kts

Complement:
Grisha I: 60
Grisha III: 70 (5 officers)

SHIPS

Grisha I	
Built	16
Active	7
Grisha II	
Built	17
Active	12
Grisha III	
Built	34
Sold to Lithuania	2
Active	28
Grisha IV	
Built	1
Active	0
Grisha V	
Built	30
Building	1 + ? (for Ukraine)
Transferred	1 (to Ukraine)
Active	29

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-4 'Gecko' (OSA-M) point defence system

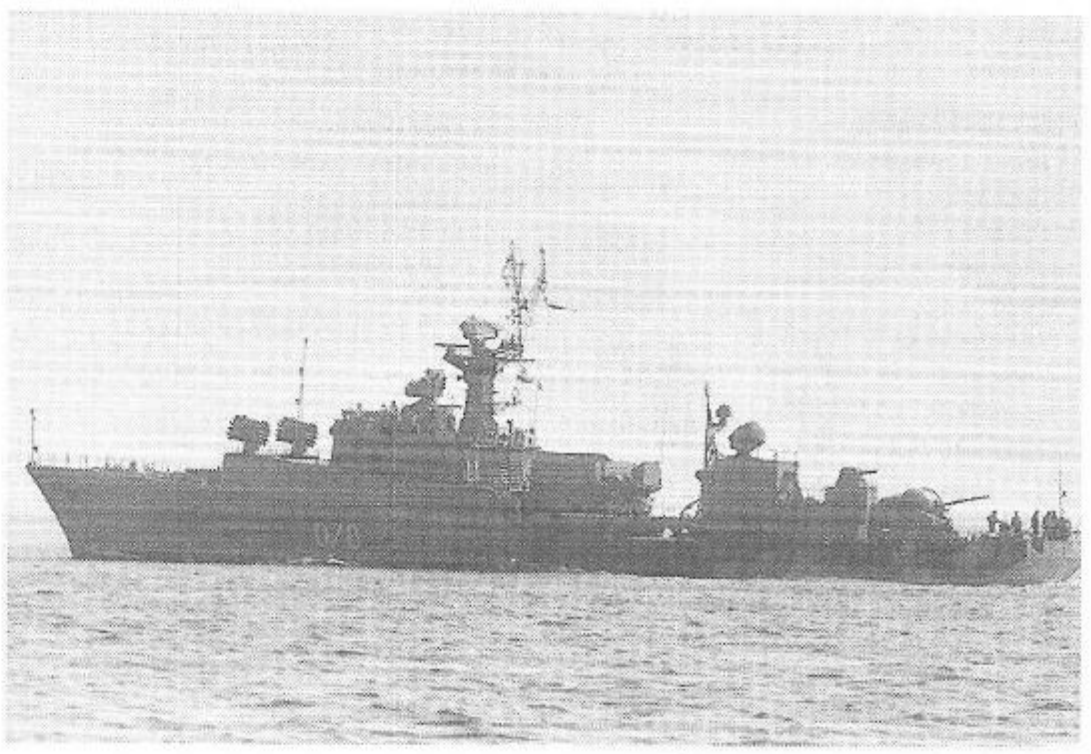
Grisha I, III and V only. There is one SA-N-4 launcher in the foredeck, with 20 missiles in a below-deck magazine. This system is known to NATO as SA-N-4 (reporting name = Gecko) but is known in Russia as the Osa-M system, while the missile itself is designated 9M33. SA-N-4 has a distinctive loading and launching system in which the twin-rail launcher lies beneath a hinged flat cover plate, emerges to launch its missiles, and then retracts in order to reload. This is likely to result in a low rate of fire which must be slowed even further by the need to close the magazine cover before firing. Underneath the launcher are four revolving drums each with five missiles while the electromechanical and hydraulic machinery is below that. On launch, the booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.5 km), following which the sustainer burns for 15 seconds.

SA-N-4 is controlled by the Pop Group system. There is a frequency-agile, monopulse radar with a parabolic rotating search antenna operating in H-band (6-8 GHz) and with a typical acquisition range of 16 n miles (30 km). There are two J-band (10-20 GHz) antennas, one of them for a pulse Doppler target-tracking element with a range of 10.75 n miles (20 km) and the smaller parabolic antenna being used to track the missile. Above the prime antennas is a smaller, circular one which emits an I-band (8-10 GHz) uplink capture beam which gathers the missile shortly after launch. The director also has a small, rectangular command uplink emitter.

Specifications

Range: 8 n miles (15 km)
Altitude: 39-3,048 m (130-10,000 ft)
Speed: Mach 2.5
Warhead: 50 kg (110.2 lb)

Grisha I. Weapons include SA-N-4 launcher in foredeck, two RBU-6000s before the bridge, two pairs of fixed 533 mm torpedo tubes and a twin 57 mm mounting aft (partially obscured by the diesel exhaust fumes). Note that the Muff Cob is offset to port, and the small rectangular array at the head of the small mainmast



Grisha II of the (then) KGB Border Guard. This version has two twin 57 mm guns

Grisha III. This version has a 30 mm CIWS and a Bass Tilt fire director offset to port

Grisha V. Note the Half Plate B air/surface search radar and the single 76 mm gun which are the main differences from Grisha III (H & L van Ginderen Collection)

TORPEDOES

All versions have two pairs of fixed torpedo tubes amidships, except for some late production Grisha V which have only one per side.

GUNS

57 mm twin L/75 (ZIF-72/AK 725)

Grisha I, III — one twin mounting. Grisha V — two mountings. Grisha I and III have one twin 57 mm L/75 mounting in 'Y' position; Grisha II has two such mounts in 'A' and 'Y' positions. This Russian weapon has been designed for prolonged air defence engagements, but can also be used against seaborne and land targets. The 4.57 m (15.0 ft) long barrels are water-cooled and the mounting consists of the elevating mass with two automatic weapons and the cradle, the rotating structure for the elevating mass with gun drives, firing system and other elements, all on a slip ring with two arrays of ball-bearings. Below decks are the ammunition handling system and the magazine. The turret is made of aluminium alloy. The 550-round linked belt is initially threaded into the feeder mechanism by hand and is advanced by the cocking mechanism; thereafter, the hydraulic mechanism takes over. The feeder system is capable of operating in bursts or in a sustained form with automatic interruption when only 50 rounds remain in the belt. Each round weighs 6.61 kg (14.6 lb) and the feeder mechanism has 15 per barrel within the turret.

There are two operators in the fire-control station, which is associated with the 'Muff Cob' fire-control system.

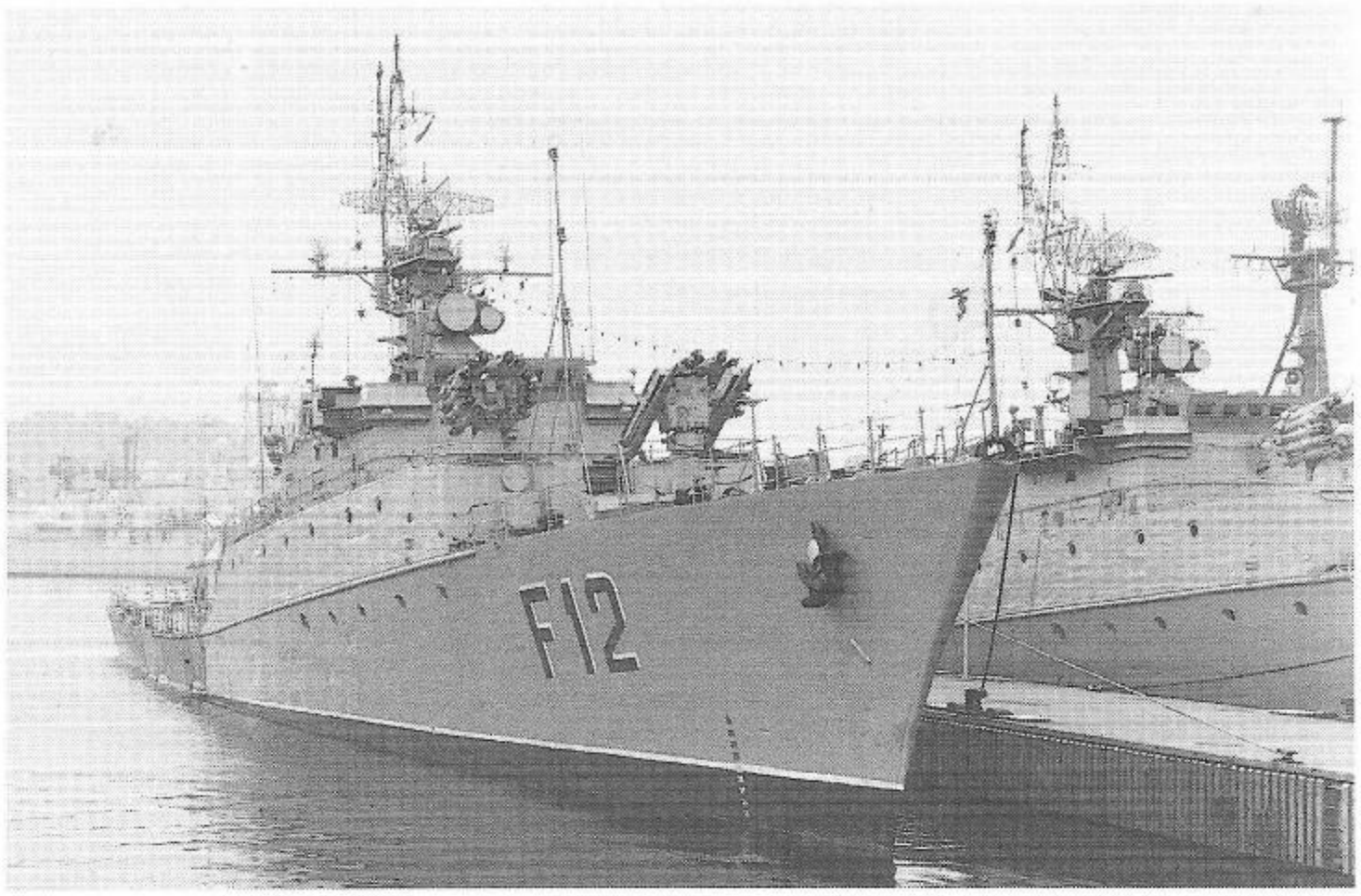
'Muff Cob' has its antenna in a 1 m (3.38 ft) wide, weather-proof mounting suspended from a trunnion-yoke carried on a traversing mounting. The radar is supplemented by an electro-optic sensor. The height of the mounting is about 3 m (9.8 ft) and the H-band radar can probably tilt from −10 to +50° as with the gun mounting. It is likely that control of the mounting is conducted from the compartment which houses the radar display system. Remote laying is controlled through a servo follower drive which ensures smooth slew rate changes at all speeds. Manual operation of the mounting is confined to maintenance and repair functions.

Specifications

Length of barrel: 75 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Traverse: ±200°
Elevation: −10 to +85°
Range:
anti-surface: 3.25 n miles (6 km)
anti-air: 6,000 m
Rate of fire: 120 rds/min/barrel
Projectile weight: 6.61 kg (14.6 lb)
Power requirements: 220 or 380 V, three phase

AK-176M 76 mm L/59

Grisha V only. There is one AK-176M 76 mm L/59 gun mounted in 'Y' position aft. The AK-176M is a four-man mounting, which is hydraulically operated, with manual reversion in the event of power failure. The AK-176M would normally be controlled by a Bass Tilt or a Kite Screech director, but, in this case, there is no director (although there is space for such a device in the bridge roof). This suggests that the gun is only fired under local control using either the Kondensor sight, which is normally only used as a back-up in the event of the failure of 'Bass Tilt', or the WD-221 optical sight. Alternatively, the Nogat radar may be used in a directing role, although this would not be particularly satisfactory.



Aukstaitis *(F 12), a Grisha III of the Lithuanian Navy. This picture shows the SA-N-4 missiles on their launcher with the associated Pop Group radar array on the bridge roof* (Jane's/H M Steele)

Specifications

AK-176
Calibre: 76 mm
Barrel length: 59 calibres
Muzzle velocity: n/k
Traverse: 360° at 35°/s
Elevation: −3 to +85° at 30°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 120 rds/min
Range:
Surface/surface: 8 n miles (15 km)
AA: 7,000 m (22.965 ft)

Ammunition (UOFB-62)
Weight:
complete round: 12.8 kg (28.2 lb)
projectile: 4.6 kg (10.1 lb)
explosive: 400 g (A-IX-2)
Fuze: Point impact fuze (VG-67)

AK-630 30 mm CIWS

Grisha III and V only. These ships have one 30 mm 65 calibre AK-630 Gatling close in weapon system mounted on a small tower in 'X' position overlooking the after gun.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,920 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range: 4,000 m (13,123 ft) (radar fire control), 5,000 m (16,404 ft) (electro-optic fire-control)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
UOF-84 HE-I weight: 384 g
UOR-84 HE-T weight: 388 g
Fuze: MG-32 point impact (both rounds)

ANTI-SUBMARINE MORTARS

RBU-6000

Grisha I, II, III — two. Grisha V — 1. The RBU-6000 is a 12-tubed, trainable, anti-submarine rocket launcher, which is located before the bridge. These are conventional Russian-pattern systems; 98 rockets are carried. Grisha V has only one RBU-6000, on the port side.

Specifications

RBU-6000
Launch tubes: 12
Tube arrangement: Circular
Calibre: 300 mm (11.8 in)
Tube length: 0.6 m (1.9 ft)
Elevation: +50°
Traverse: 360° (theoretical)
Rocket weight: 100 kg (220 lb)
Warhead: 31 kg (68 lb)
Range: 3.25 n miles (6,000 m)

DEPTH CHARGES

There are two rails; 12 depth charges are carried.

MINES

18 mines can be carried in lieu of depth charges.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Chaff launchers

All ships have two 10-barrelled chaff launchers.

Watch Dog

There are two Watch Dog arrays. Watch Dog is an intercept and radar warning system which has been in service for over 30 years. It is a wide-open system with an array consisting of four tiers of eight microwave horns, covering frequencies from D to H-band and normally has two arrays, one on each side of the ship.

RADARS

Strut Curve search radar

Grisha I, II, III. The air search radar in the first three groups is the Russian MR-302 (NATO = Strut Curve) a medium-range, general purpose, F band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m^2 aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Strut Pair

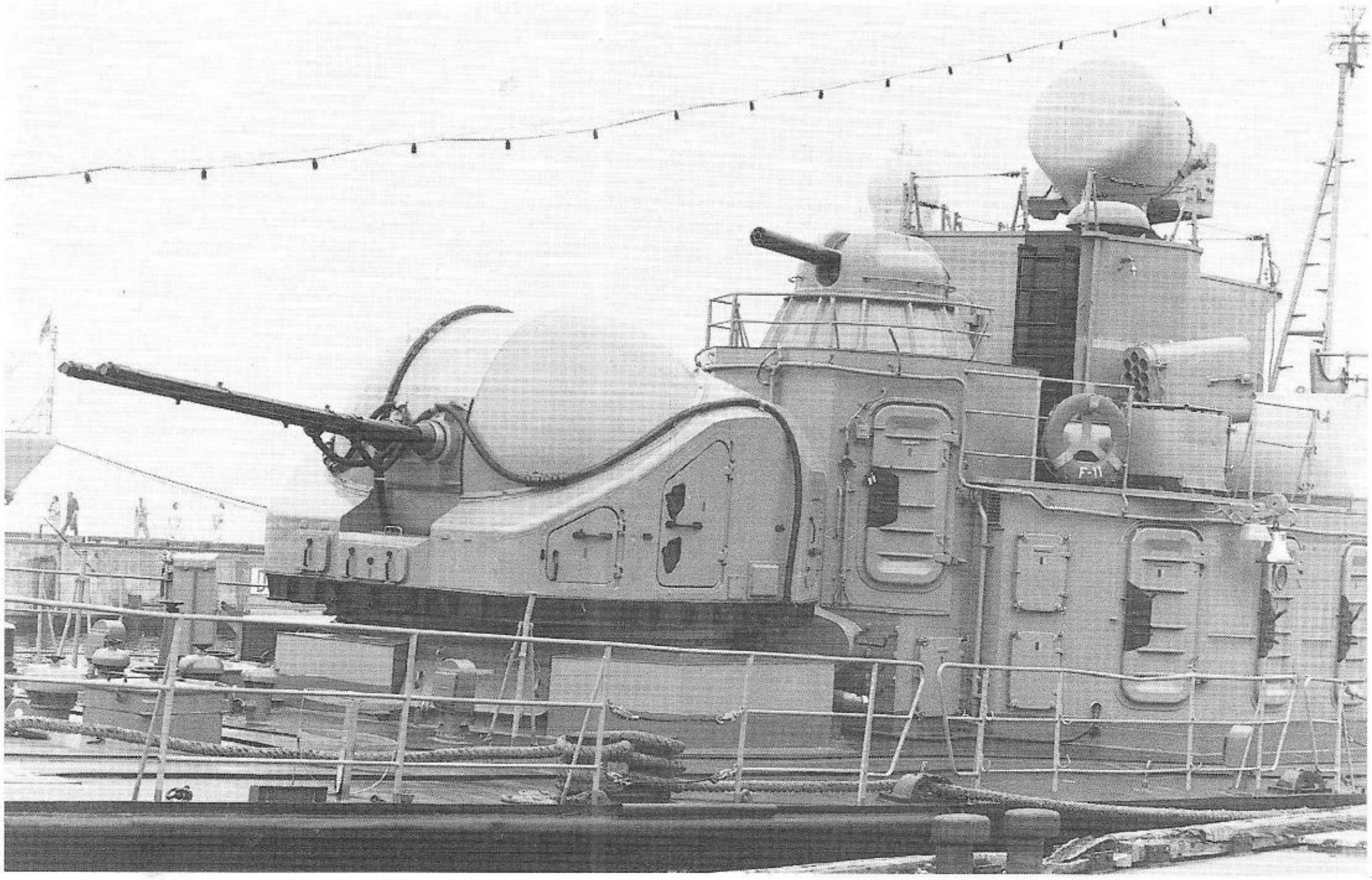
Grisha V. Early ships in the Grisha V group have Strut Pair, which consists of two Strut Curve antennas back to back, which is presumably intended to increase the data rate.

Half Plate Bravo

Grisha V. The later ships have Half Plate Bravo in place of Strut Pair. Half Plate Bravo is an E/F band set formed by taking one of the two planar arrays from the Top Plate back to back array.

Don 2

All Grishas have one Don 2, I-band, navigation radar.



Zemaitis *(F 11) in close-up showing the twin AK-725 57 mm guns, AK-630 CIWS and Bass Tilt fire-control director radar. Note also the PK-2 chaff launcher to the right of the lifebelt* (Jane's/H M Steele)

Pop Group

Grisha I, III, V. The Pop Group director is located on the bridge roof, providing the weapon control system for the SA-N-4 missile system. The director includes an acquisition radar with a long, curved antenna on top of the cab, and two target trackers. The latter two are of different size, but presumably the smaller one performs a similar function to the larger, but at higher frequencies, which would enable them to direct two different missiles against the same target. The system operates in the F/H/I band.

Muff Cob

Grisha I and II. Muff Cob is the director for the 57 mm fire-control system and is the large cylindrical radome atop the small tower overlooking the quarterdeck. The radome is supported by a trunnion yoke in a traversing mounting and is thus capable of both elevation and traverse. There is a device to the left of the radome (from the front), with a remotely controlled cover, which may be a TV camera. The F/G band radar is named Muff Cob by NATO and Bars (Wildcat) by the Russian Navy.

Bass Tilt fire-control radar

Grisha III, V only. Bass Tilt is an H/I-band fire-control radar which entered service in the mid-1970s and in the 'Grisha' class it is the fire-control system for the 76 mm gun and the 30 mm CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (3.9 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.5 ft) high and 1.45 m (4.7 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

Unidentified antenna. There is a mast at the forward end of the after deckhouse in all versions; in Grisha I, III and V this is a lattice mast, in Grisha II it is plated over. This supports a single rectangular array which has not, as yet, been identified.

IFF

Different IFF equipments can be found, including: High Pole A or B; Square Head; and Salt Pot.

SONARS

Bull Nose

The Grishas all carry the Bull Nose bow-mounted, active search and attack sonar, which operates in the 7-8 kHz frequency band.

Elk Tail

The Elk Tail dipping sonar is derived from the set used in the Hormone helicopter. It is deployed from the stern and the ship must stop to use it and recover it before moving on. It is used, in conjunction with Bull Nose, to trigger the ASW torpedoes and the RBU-6000 ASW rocket launcher.

PROPULSION

Specifications

System: Combined diesel and gas turbine (CODAG)
Main machinery: 1 gas turbine; 11 MW (15,000 hp(m)); 2 diesels; 11.8 MW (16,000 hp(m))
Shafts: 3

FURTHER INFORMATION

Ukrainian Ship

The Ukrainian ship appears to be a standard Russian Navy Grisha V.

Lithuanian Ships

The Lithuanian ships appear to be a standard Grisha III, except that they do not have the mast on the after deckhouse with the unexplained radar (see above).

KRIVAK

OVERVIEW

The 'Krivak' class is one of the major successes of the Russian shipbuilding industry. It is a very neat design, well armed and with a good balance of sensors on a moderate displacement (3,650 tonnes full load). The operational requirement was issued in 1964 and the first of class appeared in 1969, at the height of the Cold War, and was immediately recognised as impressive, capable, and for Western navies — dangerous. There was only one significant tactical deficiency, the lack of an onboard helicopter, and that was overcome in the Krivak-III. A total of 41 Krivaks has been produced which fall into four groups.

The Krivak (Project 1135) was designed at the Northern Design Bureau, headed by N Sobolev, with Chief Supervisor I Satsyura representing the navy department. The requirement was for a small escort ship, displacing no more than 2,100 tonnes, with a predominantly ASW armament and capable of being mass-produced. It was to be armed with RBU launchers, ASW torpedo tubes, an air defence missile system and two twin 76 mm guns. As is normal in all navies, however, the requirement changed, more weapons were needed and the displacement increased, resulting in the Project 1135, displacing well over 3,000 tonnes.

The propulsion units are mounted on rafts, with two-stage anti-vibration mountings and to improve economy at low speed there is a propulsion reduction gear unit, which enables one engine to drive both shafts. There is fully automatic roll and pitch stabilisation system, designated UKA-135, with twin stabilisers located on the lower hull immediately below the mast, which is claimed to reduce roll and pitch by a factor of between 3.5 and four times.

The Krivak was produced at three shipyards, with the lead ship being laid down on 21 July 1968.

Krivak I (Project 1135). The first group, with 21 commissioned between 1970 and 1982. These have four SS-N-14 anti-submarine missile launchers on the foredeck, two SA-N-4 SAM launchers and two twin 76 mm guns, both aft.

TABLE I: KRIVAK CLASS — SUMMARY

		Krivak I	Krivak I Mod	Krivak II	Krivak III
Project No		Project 1135	Project 1135.1	Project 1135M	Project 1135MP
No produced		21*	4*	11	7**
SSM			8 × SS-N-25		
SAM		2 × SA-N-4	2 × SA-N-4	2 × SA-N-4	1 × SA-N-4
ASM		4 × SS-N-14	4 × SS-N-14	4 × SS-N-14	—
Guns	76 mm 100 mm 30 mm CIWS	II × 2	II × 2	II × 1	I × 1 2 × 30 mm
Torpedo tubes		8	8	8	8
ASW mortar	RBU-6000	2	2	2	—
Mines		20	20	20	20
Radars	Air Search Surface Search	Top Plate	Top Plate	Top Plate	Head Net C Peel Cone
Fire control	SS-N-14 SA-N-4 76 mm guns 100 mm guns 30 mm CIWS	2 × Eye Bowl 2 × Pop Group Owl Screech	2 × Eye Bowl 2 × Pop Group Owl Screech	2 × Eye Bowl 2 × Pop Group Kite Screech	— 1 × Pop Group Kite Screech Bass Tilt
IFF		High Pole B	High Pole B	High Pole B	Salt Pot
Sonar	hull-mounted VDS	Bull Nose	Bull Nose Mare Tail	Bull Nose	Bull Nose

Notes
* The four Krivak I Mod are included in the original 21 Krivak I hulls
** The last two Krivak III hulls have been completed and handed over to the Ukraine

Ukrainian Navy Hetman Sagaidachny, *a Krivak III originally built for the Russian KGB Border Guard* (Jane's/H M Steele)

Krivak I Mod. Three Krivak Is were modernised between 1991 and 1994. This involved deleting the RBU-6000, adding eight SS-N-25 (Harpoonski) launchers and numerous changes to the sensor fit. This programme was ended with the completion of the third hull, purely for financial reasons.

Krivak II (Project 1135M). The second construction group, eleven were commissioned between 1975 and 1982. The major change was in the two gun mountings where two single 100 mm weapons were substituted for the two twin 76s. In addition, the gun mounting in 'X' position is raised slightly and the break to the quarterdeck is several metres further aft than in other versions.

Krivak III. The last to be produced, entering service between 1984 and 1991, this version introduced the long-awaited helicopter flight deck and hangar. This displaced the two gun mountings and the SA-N-4 launcher aft; one gun mounting was moved forward to 'A' position and the other, together with the SA-N-4 launcher, deleted. Moving the gun to the foredeck displaced the four SS-N-14 launchers, but the role of this weapon was taken over by the SS-N-15, which is launched from the torpedo tubes. The forward radar tower is plated over to a much greater extent than in earlier versions and there is a small mast on the hangar roof, which is used to support folded dipole HF communications antennas, the other end of which is suspended from the foremast. When first introduced into service, the Krivak IIIs were operated by the maritime arm of the KGB Border Service in the Far East, although whether the ships were designed for the KGB or the latter simply took them over while under construction is not clear. They have since been returned to the navy.

National designation

The national designations of these ships changed in 1977, indicating an altered perception of their primary mission:

1969-1977. *bolshoy protivolodochny korabl* (large anti-submarine ship.

1977 onwards. *storozhevoy korabl* (escort ship)

Disposals

Disposal of these ships has already started and a number of Krivak Is and Krivak IIs have already been scrapped.

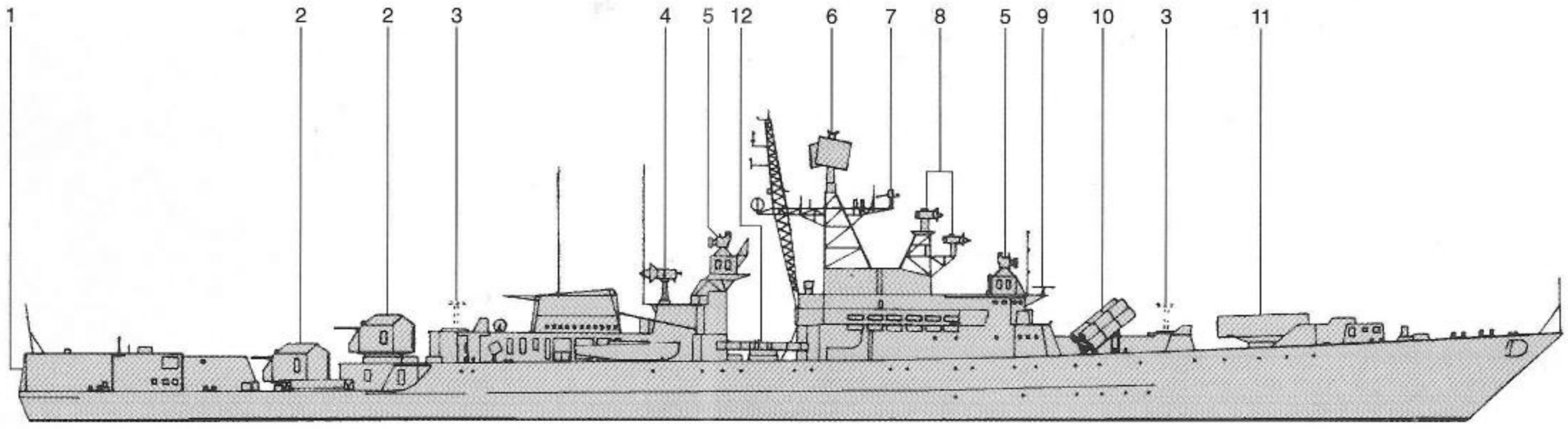
TABLE II. KRIVAK PRODUCTION

	Krivak I	Krivak II	Krivak III
Yantar Shipyard, Kaliningrad	8	11	–
Zaliv Shipyard, Kerch	7	–	7
Severnaya Verf, St Petersburg	6	–	–
TOTAL	21	11	7

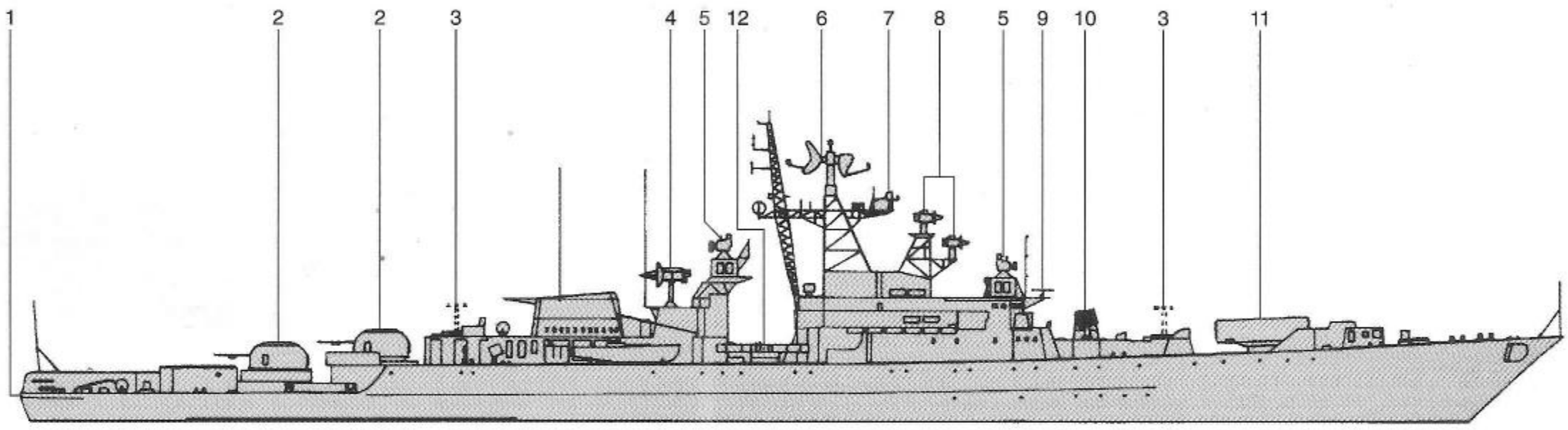
Exports

Despite the respect in which the design is held, no Krivaks have been exported, and ships at the end of their service lives are being scrapped rather than offered to friendly navies as happens with US, British and French ships. However, a new version, designated Project 1135.6 is now being marketed, which appears to be an updated Krivak III.

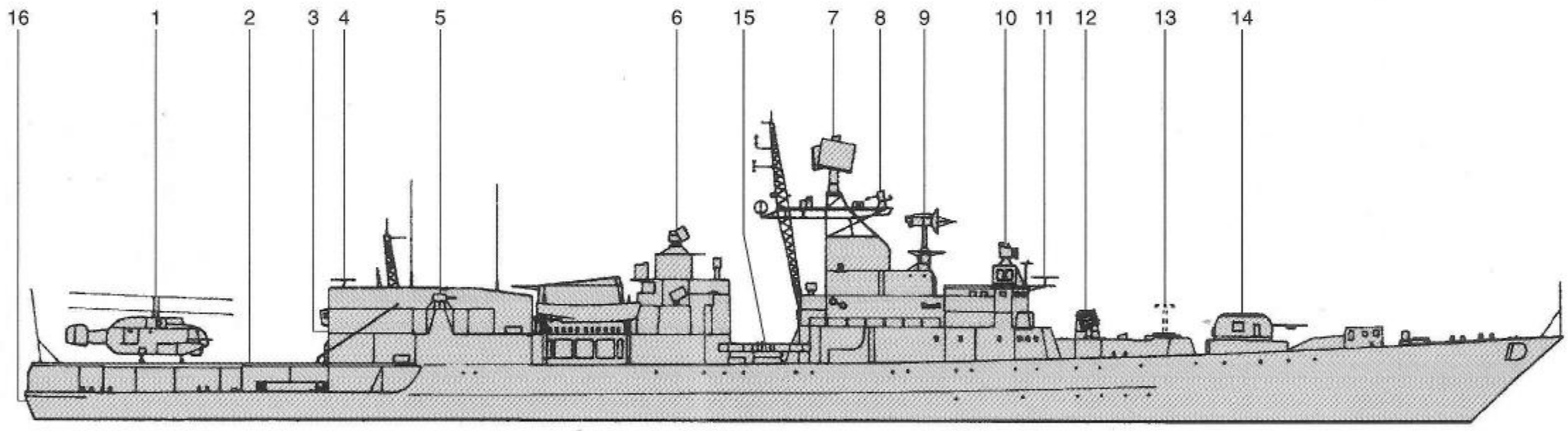
KRIVAK



Krivak I (mod) (Ian Sturton)
1 *Steer Hide variable depth sonar* **2** *Twin AK-726 76 mm (3 in)/59 guns* **3** *SA-N-4 Gecko twin arm launchers* **4** *Owl Screech gunfire control (for 76 mm guns)* **5** *Pop Group fire control (SA-N-4 missiles)* **6** *Top Plate* **7** *Surface search radar: Don Kay, or Don Kay 2, or Palm Frond, or Spin Trough* **8** *Eye Bowl fire control (SS-N-14 missiles)* **9** *Navigation radar: Palm Frond* **10** *SS-N-25 anti-ship missiles (two four-tube launchers)* **11** *SS-N-14 Silex anti-submarine missiles (four launchers)* **12** *Eight 533 mm (21 in) torpedo tubes*



Krivak II (Ian Sturton)
1 *Mare Tail variable depth sonar* **2** *100 mm (3.9 in)/59 single mounts* **3** *SA-N-4 Gecko twin-arm launchers* **4** *Kite Screech fire control (for 100 mm guns)* **5** *Pop Group fire control (for SA-N-4 missiles)* **6** *Head Net C air search radar* **7** *Surface search radar: Don Kay* **8** *Eye Bowl fire control (for SS-N-14 missiles)* **9** *Palm Frond navigation radar* **10** *RBU-6000 anti-submarine/anti-torpedo rocket launcher* **11** *SS-N-14 Silex four-tube anti-submarine missile launcher* **12** *Eight 533 mm (21 in) torpedo tubes*



Krivak III (Ian Sturton)
1 *Ka-27 Helix ASW helicopter* **2** *Flight deck* **3** *Hangar* **4** *Peel Cone carrier control approach (CCA) radar* **5** *ADG-630 30 mm/65* **6** *Bass Tilt fire control (for ADG-630)* **7** *Top Plate air search radar* **8** *Surface search radar: Don Kay, Don Kay 2, Palm Frond or Spin Trough* **9** *Kite Screech fire director (for 100 mm gun)* **10** *Pop Group fire director (for SA-N-4 SAM system)* **11** *Navigation radar: Palm Frond* **12** *RBU-6000 anti-submarine/anti-torpedo rocket launcher* **13** *SA-N-4 twin-arm SAM launcher* **14** *100 mm (3.9 in)/59 single gun* **15** *Eight 533 mm (21 in) torpedo tubes* **16** *Mare Tail variable depth sonar*

GENERAL SPECIFICATIONS

Operators: Russia, Ukraine
Type: Project 1135, 1135.1, 1135P, 1135MP

Class: KRIVAK I, Mod, II, III

Krivak I.
Built: 21
Converted to Krivak I Mod: 3
Active: 6

Krivak I Mod
Converted from Krivak I: 3
Active: 3

Krivak II
Built: 11
Active: 7

Krivak III
Built: 8
Building (Ukraine): 1
Transferred to Ukraine: 2
Russia — active: 7
Ukraine — active: 1
Ukraine — building: 1

Displacement:
standard: 2,810 t
full load: Krivak I, Krivak I Mod — 3,200 t; Krivak II — 3,330 t

Dimensions
Length: 123.0 m (403.5 ft)
Beam: 14.2 m (46.6 ft)
Draught: 4.5 m (14.76 ft)

Speed: 32 kts
Range: 4,600 n miles at 20 kts; 1,600 n miles at 30 kts

Complement: 180 (18 officers)

SHIPS

Krivak I
Bodry; Druzhny; Razumny; Retivy; Zadorny; Ladny

Krivak I Mod
Legky; Letuchy; Pylky; Bezukoriznenny

Krivak II
Bessmenny; Grozyashchy; Neukrotimy; Pytlivy; Razitelny; Rezky; Rezvy

Krivak III — Russia
Menzhinsky; Dzerzhinsky; Orel; Pskov; Anadyr; Kedrov; Vorovsky

Krivak III — Ukraine
Hetman Sagaidachny; Hetman Dorosenko (building)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

SS-N-25 (Kh 35 Uran)

Krivak III only. Krivak IIIs are armed with eight SS-N-25 launchers on the foredeck. SS-N-25 is an autonomous anti-ship missile system, which has been dubbed 'Harpoonski' in the West. The system comprises the missile, the launcher-handling system and (probably) a fire-control console. It is compatible with most surface search radars. The clipped-delta wings and slim, trapezoidal control fins are in X configuration and all fold. The missiles are housed in individual, cylindrical launcher-containers, but these are grouped together in a box-like structure, which is noticeably different from the Harpoon-like launchers in the 'Gepard' class frigate. The launchers are raised at a fixed angle of about 35°. Information in Russian sales literature suggests that the missile has a limited capability compared with Harpoon. The sea-skimming altitude is 5-10 m (16.4-32.8 ft).

Specifications

Length: 3.78 m (12.4 ft) (4.62 m (15.1 ft) with booster)
Diameter: 42 cm (16.5 in)
Wing span: 93 cm (36.6 in)
Weights:
missile: 480 kg (1,058 lb) (without booster)
booster: 120 kg (264 lb)
warhead: 145 kg (319 lb)
Guidance: Inertial and active radar
Max speed: Mach 0.9
Range: 2.5-70 n miles (5-130 km)

Manufacturer/Contractor

Zvezda Design Bureau.

Pylky, *a modified Krivak I, with the two RBU-6000 ASW rocket launchers replaced by two four-tube launchers for SS-N-25* (MoD Bonn)

SURFACE-TO-AIR MISSILES (SAM)

SA-N-4 short-range missile system

Krivak I, Krivak I Mod, Krivak II — two launchers: Krivak III — one launcher. All ships are armed with SA-N-4, but Krivak III has one launcher forward, while the others all have two launchers, one at either end of the ship. The twin-rail launcher lies beneath a hinged flat cover plate, emerging to launch its missiles and retracting to reload. This is likely to result in a low rate of fire which must be slowed even further by the need to close the magazine cover before firing. Below the launcher are four revolving drums each with five missiles while the electromechanical and hydraulic machinery is below that. On launch, the booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.5 km), following which the sustainer burns for 15 seconds. Command and control is via the Pop Group system (see below). There are 20 weapons to each launcher.

Specifications

Length: 3.1 m (10.17 ft)
Diameter: 21 cm (8.27 in)
Wing span: 64 cm (25.2 in)
Weight: 130 kg (286.6 lb)
Speed: Mach 2.5
Warhead: 50 kg (110 lb) HE
Range: 0.75-8 n miles (1.5-15 km)
Height: 9-3,000 m (30-10,000 ft)
Guidance: Semi-active radar homing

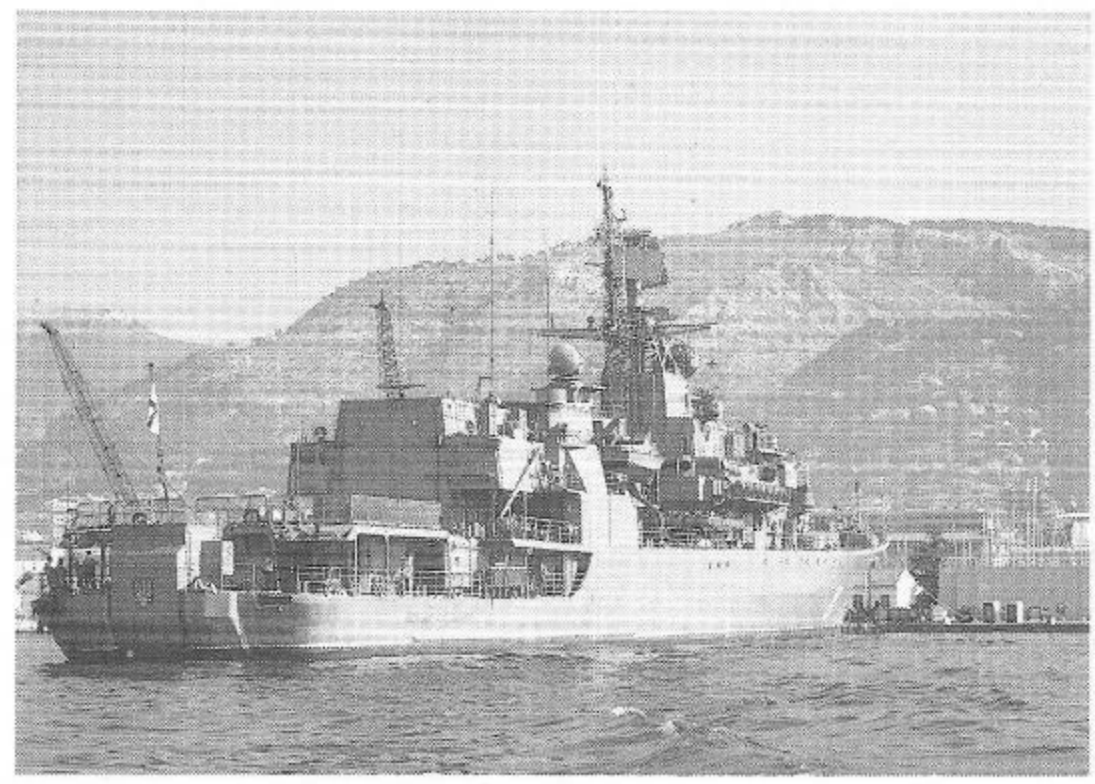
SS-N-14 'Silex' long-range anti-submarine torpedo delivery system

Krivak I, Krivak I Mod, Krivak II. There is one, quadruple SS-N-14 ('Silex') missile launcher on the foredeck. SS-N-14 is a long-range torpedo delivery system capable of operating to beyond the First Convergence Zone. The missile is powered by a solid propellant booster-sustainer and is reported to have an autopilot which can be updated in flight. Payload is either a Type 40 or a Type 53-72 torpedo, which is faired into the underside of the airframe. The ASW version of the weapon requires only 15 seconds warm-up time and cruises at a height of some 750 m (2,460 ft), being guided towards the approximate location of the target by radio command. The torpedo is ejected immediately above the submarine's estimated position and deploys its parachute which slows the descent. On entering the water the parachute is disconnected and the weapon begins a search pattern to acquire the target. The missile body includes a 500 kg (1,102 lb) warhead, enabling the weapon to be used in an anti-ship role against targets up to 19 n miles (35 km) distant. The target is initially located by sonar and the Eye Bowl F-band fire-control radar is used to guide and track the missile during flight.

Specifications

SS-N-14
Length: 7.2 m (23.62 ft)
Diameter: 0.574 m (1.88 ft) (1.35 m (4,43 ft) with torpedo)
Launch weight: 4,000 kg (8,818 lb)
Range (anti-submarine): 30 n miles (55 km)
Speed: Mach 0.95
Guidance: Autopilot and command update

The stern of Krivak II, Neukrotimy. *The two 100 mm (3.9 in) guns are characteristic of this version . The long housing accommodates the Mare Tail variable depth sonar which is deployed through the large door in the transom. The two torpedo-shaped devices resting on chocks on the deck are acoustic decoys. The sailor on the left is standing behind the cable drum for the non-buoyant decoy which is kept at a standard depth by the float strapped to the side of the VDS housing. The recesses at the outer ends of the transom are for minelaying and the minerails can be seen in the deck* (A M Garcia)



Ukrainian Krivak III. Hetman Sagaidachny, *at Toulon in 1994. The Krivak IIIs were originally built for the KGB Border Service and then taken over by the Russian Navy. One already in service was handed over to the Ukraine Navy, while the second in still under construction. There is a large hangar and flight deck, displacing the guns and SA-N-4 launcher, but the Mare Tail VDS and mine rails are still fitted. Note also the Top Plate radar which replaced Head Net C in this version and the Peel Cone carrier-controlled approach (CCA) radar on the hangar roof* (Jane's/H M Steele)

AT-2 (NATO = Type 53-72)
Range: 3,800 m (4,155 yd)
Max depth: 400 m (1,312 ft)
Homing:
Warhead: 100 kg (220 lb)
Speed: 40 kts
Length: 7.2 m (23.5 ft)
Diameter: 533 mm (21 in)

TUBES

There are two sets of quadruple 533 mm (21 in) torpedo tubes in the waist. They are normally aligned with the ship but pivot outwards at an angle of about 30° to fire.

TORPEDOES

The tubes can launch any of the wide variety of Russian 533 mm torpedoes.

GUNS

Two AK-726 twin 76 mm (3 in)/59 mountings

Krivak I only. There are two twin AK-726 turrets, both aft in 'X' and 'Y' positions. The AK-726 is a multirole weapon system designed for air defence, surface engagement and shore bombardment roles and consists of two 76 mm guns mounted in a turret with a 5 mm metal shield. The whole mounting can contain 60 rounds of which two are on the feeder rail and four are on the hoists at any one time. The prime ammunition is the UOFB-62, a fixed round which weighs 12.8 kg (28.2 lb). The projectile weighs 4.6 kg (10.1 lb) and has 400 g of A-IX-2 explosive and a VG-67 point impact fuze.

There is a five-man crew in the turret: the gun captain, two layers and two loaders. There is a further team of four loaders in the below-decks magazine.

AK-726 is associated with 'Owl Screech' radar. In addition to radar fire control there is local control through the Prisma optical sighting system, which may be used for engaging targets with speeds of up to 600 m/s (Mach 1.75).

Specifications

Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,215 ft/s)
Traverse: 360° at 36°/s
Elevation: −7 to +85° at 32°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 90 rds/min (whole mounting)
Range:
- **surface/surface:** 8.5 n miles (15.7 km)
- **AA (max):** 10,000 m (32,808 ft)
- **AA (effective):** 7,000 m (22,965 ft)

AK-100 100 mm/59 medium-calibre dual-purpose gun

Krivak II — two single mounts. Krivak III — one single mount. Krivak IIs and Krivak IIIs mount the 100 mm gun instead of the 76 mm in the Krivak I and Krivak I Mod. The AK-100 100 mm/59 calibre is a water-cooled weapon in an enclosed turret.

Specifications

Calibre: 100 mm (3.9 in)
Length of barrel: 59 calibres
Muzzle velocity: 880 m/s
Traverse: 200° at 30°/s
Elevation: −10 to +85° at 20°/s
Weight of projectile: 15.6 kg (34.4 lb)
Rate of fire: 60 rds/min
Range, surface/surface: 21.5 km

30 mm AK-630 close in weapon system

Krivak III only. There are two AK-630 close in weapon system (CIWS) turrets either side of the hangar. This multibarrel, high volume-of-fire gun system, has a separate fire-control radar and a below-deck control station with remote optical and/or electro-optical sensor. It fires five types of fire mission: against anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected shore targets. The weapon consists of six water-cooled barrels, using the Gatling principle with a fixed breech block and revolving barrels. The magazine contains 2,000 rounds of HE-I and HE-T ammunition. The gun fires bursts of up to 400 rounds, during which both the barrel and the breech block are cooled, with used cartridges and links being ejected into a bin below the elevating mass. The mounting is unusual in having an ignition system for burning off gun gases accumulating within it during firing.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Muzzle velocity: 890 m/s (2,920 ft/s)
Traverse: 360° (depending on location of turret) at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
- **radar fire control:** 4,000 m (13,123 ft)
- **electro-optic fire control:** 5,000 m (16,404 ft)

Rate of fire: 4,000-5,000 rds/min
Ammunition:
- **round:** 1.224 kg (2.7 lb)
- **projectile weight:** UOF-84: 384 g; UOR-84: 388 g

ANTI-SUBMARINE MORTARS

RBU-6000

Krivak I, II, III. There are two 12-tube RBU-6000 mortars located on the foredeck in all except Krivak I Mod, which thus becomes one of the very few Russian combat ships not to have at least one RBU-type weapon. The mounting can traverse through 360° and elevation limits are −15°/+60°. Loading is automatic from a below-deck magazine. It is estimated that the rockets weigh 110 kg (242 lb), with a 25 kg (55 lb) warhead. Pairs of tubes are fired in sequence. The RGB-60 rocket is fitted with an impact-time fuze, which detonates either on hitting a solid object (such as a submarine) or when it reaches a preset depth. Firing is usually conducted in a full salvo of 12 rockets, but it is also possible to fire single rockets, or four- or eight-rocket salvos, if the tactical situation requires it. The warhead weighs 31 kg (68 lb).

MINES

There are launch rails at the stern, enabling the ship to launch up to 20 mines.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Bell Shroud

There are two Bell Shroud systems. This is basically a Watch Dog B, but with two extra pairs of receiver antennas to cover higher frequencies in the radar spectrum. It is the standard intercept system used in Russian destroyers and frigates and is used in conjunction with Bell Squat as the standard intercept/jamming system.

Bell Squat

There are two Bell Squat jammer systems, which were derived from Top Hat, but with the frequency bands increased to cover K-band. Two types of ECM system are in use, Bell Squat A which uses barrage jamming, and Bell Squat B which employs deception jamming.

Half Cup

Some ships have been seen with a Half Cup laser warning device.

DECOYS

Chaff launchers

All ships carry chaff launchers, which are either four of the 16-tubes type or ten of the 10-tube type.

Torpedo decoy

There is a towed torpedo decoy, designation unknown.

COMMAND AND CONTROL SYSTEMS

RADARS

Head Net C (MR-310) air surveillance radar

Head Net C (Russian designation = MR-310) is used as the main air surveillance radar in Krivak I and II. It is an E-band, 3D radar, consisting of two Head Net A scanners which are positioned back to back, with one tilted at some 30° to the horizontal. This displaces the resulting fan-shaped elevation beam by the same amount from the vertical, which, in combination with the vertical beam produced by the companion scanner, provides the means for heightfinding using the 'V-beam' technique. The two beams are also separated in azimuth by 180°. In practice, the vertical beam fulfils the search function and the operator selects a target for which height data is required, and by placing a marker on this target (or similar technique) he places a range gate in the second (inclined) beam and excludes other targets. Computation to give a height readout can then be performed by analogue or digital methods. Range is some 70 n miles (128 km).

Top Plate

Top Plate (Orel and later and some Krivak I after modernisation).

Surface search/navigation

There is the usual mixture of types to be found in Russian ships, all I-band, including:

Don Kay
Palm Frond
Don 2
Spin Trough

Peel Cone

Krivak III only. One Peel Cone antenna is found on the hangar roof of the Krivak III. This suggests that it is used in a helicopter control and direction-finding role.

Eye Bowl fire-control radar

Krivak I, I Mod, II. There are two Eye Bowl fire-control radars mounted on a small tower above the bridge. Eye Bowl radar is the fire-control director for the SS-N-14 missile system. Its main role is to track and guide the outgoing SS-N-14 missile to ensure that it reaches a previously designated target position determined by another of the ship's sensors and the combat information system. The reflector dish is comparatively small and there appear to be several auxiliary (possibly electro-optical) sensors mounted immediately behind the reflector dish. Command signals to the SS-N-14 missile are probably transmitted as coded information within the radar transmissions, as no separate command antennas can be seen. Eye Bowl operates in the F-band, which tends to confirm the estimated range of the SS-N-14 system of 30 n miles.

Pop Group

Krivak I, I Mod, II — two, Krivak III — one. Pop Group is the weapon control system for the SA-N-4 missile system, with one director per launcher. In Krivak I, I Mod and II there are two launchers: one is on the bridge roof, the other on a small tower abaft the mast. The director includes an acquisition radar with a long, curved antenna on top of the cab, and two target trackers. The latter two are of different size, but presumably the

Neukrotimy, *a Krivak II. Weapons on the foredeck are SS-N-14 ASW missile launcher and two RBU-6000 ASW rocket launchers. Sensors from the bridge roof upwards are: Peel Cone (navigation radar); Pop Group (fire control, SA-N-4); two Eye Bowl (fire control, SS-N-14); Palm Frond (surface search radar); Head Net C (air search radar). Note also the Bell Shroud ESM array below the port-side bridge windows* (Jane's/HM Steele)

smaller one performs a similar function to the larger, but at higher frequencies, which would enable them to direct two different missiles against the same target. The system operates in the F/H/I band.

Owl Screech gunfire-control radar

Krivak I and Krivak I Mod only. Owl Screech is a G-band, fire-control radar distinguished by a circular dish scanner, behind which is mounted a fairly bulky housing containing transmitter and receiver, together with the turning and stabilisation gear. The 2.3 m (7.5 ft) diameter scanner has a central feed supported by a four-leg structure. Feed arrangements could incorporate a rotating dipole to provide a conical scan search pattern. The NATO designation Owl Screech is derived from signal characteristics noted in the course of ELINT monitoring. The principal function is that of gunfire director against aircraft targets, although it probably has an additional capability against surface targets, and possibly splash detection.

Kite Screech

Krivak II and III only. The radar director for the 100 mm mounts is 'Kite Screech'. This is a G/I-band radar which appears to incorporate monopulse tracking. It features a circular dish antenna, with central feed, behind which are transmitter, receiver, turning and stabilisation gear housings. All are mounted upon a pedestal which is about 2 m (6.5 ft) high. It could well be that the radar compartment for this sensor also acts as the fire-control centre.

Bass Tilt

Krivak III only. Bass Tilt is an H/I-band fire-control radar which entered service in the mid-1970s and is part of the fire-control system for the ADG-630 CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.5 ft) high and 1.45 m (4.75 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

IFF

IFFs are High Pole B in all ships, plus Salt Pot in Krivak III.

SONARS

Bull Nose

All ships are fitted with the Bull Nose bow-mounted, active search and attack sonar, which operates in the 7-8 kHz frequency band. This sonar is also found in *Neustrashimmy* and its Russian designation is MGK 335MS.

VDS

Krivak I Mod only. Part of the conversion work in the Krivak I Mod is the installation of a variable-depth sonar (VDS) in an enlarged compartment on the quarterdeck. This may be either Mare Tail or Steer Hide, both of which are medium-frequency, active search systems.

AVIATION

AVIATION FACILITIES

Specifications

Krivak III only.
Flight deck: 23 × 14 m (75 × 46 ft)

HELICOPTERS

One Ka-27PL (NATO = Helix A)

Specifications

Dimensions:
rotor diameter: 15.90 m (52.16 ft)
rotor disc area: 397 m² (4,275 sq ft)
fuselage length: 11.30 m (37.07 ft)
height to rotor head: 5.40 m (17.72 ft)
Weights:
operating weight, empty: 6,500 kg (14,330 lb)
max take-off weight: 12,600 kg (27,778 lb)
max payload: 5,000 kg (11,023 lb)
Performance:
max level speed at optimum altitude: 135 kts (250 km/h)
endurance: 4.5 h
Engines: 2 Klimov (Isotov) TV3-117V turboshafts, each 1,645 kW (2,205 shp)
Accommodation: 3 (pilot plus 2)
Sensors: Surface-search radar, sonobuoys, dipping sonar
Weapons: 2 APR-2 torpedoes, or 4 conventional depth bombs or mines

PROPULSION

Specifications

System: Combined gas turbine and gas turbine (COGAG)
Main machinery: 2 gas turbines; 40.8 MW (55,500 hp (m)); 2 gas turbines; 10 MW (13,600 hp(m))
Shafts: 2

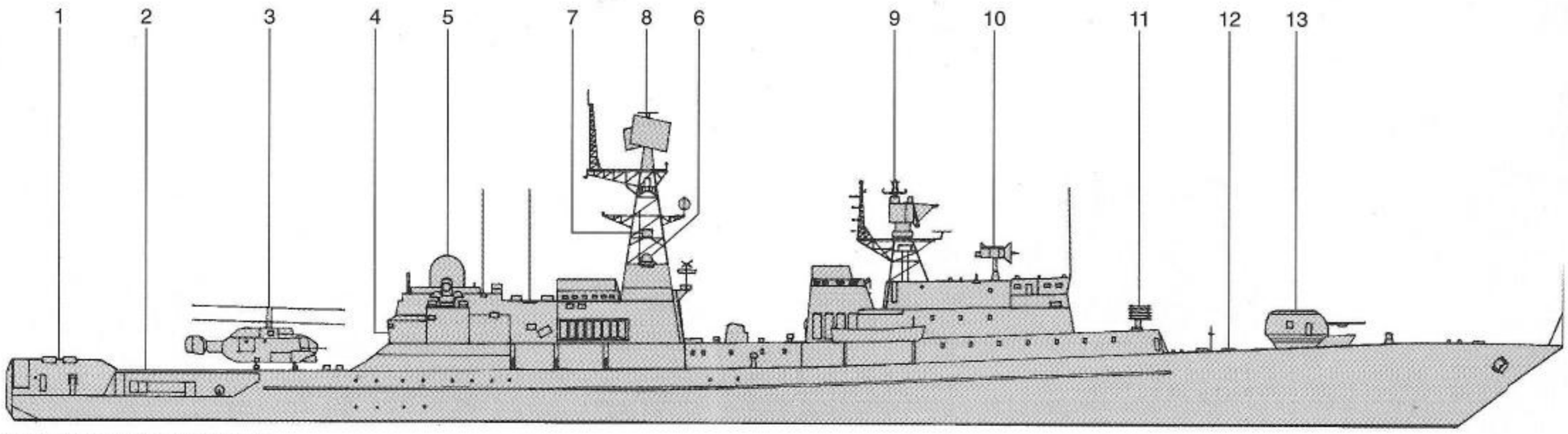
FURTHER INFORMATION

Ukrainian ships

The Ukrainian Navy has taken over the last two Krivak IIIs, which originally had been intended for the Border Guard of the former Soviet Union. The first was commissioned in 1993 and *Dorosenko* should have completed in 1995, but was held up by the refusal of the Russian authorities to release equipment. This problem has now been overcome.

Sagaidachny deployed to the Mediterranean in 1994 and to the Indian Ocean in early 1995, indicating that the Ukrainian Navy fosters 'blue water' ambitions.

NEUSTRASHIMY



Neustrashimy (Ian Sturton)
1 *Housing for Ox Tail VDS* **2** *Flight deck* **3** *Kamov Ka-27 Helix ASW helicopter* **4** *Hangar* **5** *Cross Dome (target acquisition for CADS-N-1)* **6** *Wine Glass jammer* **7** *Bell series jammer* **8** *Top Plate air search radar* **9** *Cross Sword fire control (SA-N-4)* **10** *Kite Screech fire control (gun)* **11** *RBU-6000 ASW rocket launcher* **12** *Four, six-tube SA-N-9 Gauntlet vertical launchers* **13** *100 mm (3.9 in)/59 gun* **14** *CADS-N-1 Kynshal*

GENERAL SPECIFICATIONS

Operator: Russian Federation
Type: TYPE 1154

Class: NEUSTRASHIMY (JASTREB)

Built: 1
Active: 1
Building: 2

Displacement:
standard: 3,450 t
full load: 4,100 t

Dimensions
Length: 131.2 m (430.4 ft) (oa); 123 m (403.5 ft) (wl)
Beam: 15.5 m (50.9 ft)
Draught: 4.8 m (15.7 ft)

Speed: 32 kts
Range: 4,500 n miles at 16 kts

Complement: 200

SHIPS

NEUSTRASHIMY

Builder	Yantar, Kaliningrad, Russia
Laid down	Apr 1986
Launched	May 1988
Commissioned	24 Jan 1993

YAROSLAVL MUDRY

Builder	Yantar, Kaliningrad, Russia
Laid down	May 1988
Launched	May 1991
Commissioned	Oct 1996

— (ex-*Tuman*)

Builder	Yantar, Kaliningrad, Russia
Laid down	Sep 1990
Launched	Jul 1993
Commissioned	Oct 1999

Neustrashimy *in the Kiel Canal on 19 June 1995, the centenary of the canal's opening. Note the dense pall of exhaust fumes which accompanied the ship wherever it went* (Jane's/H M Steele)

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Klinok integrated air defence system

Neustrashimy has a Klinok fully integrated air defence system consisting of a group of four vertical short-range SAM launchers and a pair of CADS-N-1 combined gun and short-range missile launchers. In addition, each Klinok includes an 8-round magazine; a command and control system; and a Cross Sword fire-control radar. The VLS complex is situated on the forecastle, with two pairs of tubes side by side. Klinok is intended for all-weather use against aircraft, missiles and small craft and is a modular system based on the 9M330 'Kynshal' missile (NATO = SA-N-9 Gauntlet).

Specifications

Klinok system
Max target speed: 700 m/s (2,297 ft/s)
Max number of simultaneous targets: 4
Max number of missiles guided simultaneously: 8
Guidance: Command guidance
Target detection range: 45 km
Target killing range:
missiles: 1.5-12 km
guns: 0.2-12 km
Response time: 0-24 s
Fuze: Pulse radio

SA-N-9 Gauntlet

The missile in the system is the SA-N-9. For launching, the allocated container is rotated into position below the hatch, whereupon the gas-ejection system forces the missile out of the cylinder, simultaneously deflecting the missile in the direction of the target. Once the missile has reached a safe height of some 18-20 m (59-66 ft) above the deck the booster-sustainer comes into operation, accelerating the missile rapidly to its maximum speed. The computer-controlled fire-control system is highly automated and apparently uses one computer for the 'Cross Sword' radar system and two to control the remainder of the Klinok system and to interface with other sensors.

The manufacturers state that up to four targets travelling at Mach 2 may be engaged simultaneously and that the system can operate up to eight missiles simultaneously. The system can be available in 15 seconds when on alert or 3 minutes from 'cold start' and the response time is 8-24 seconds depending upon the search radar's mode of operation.

Specifications

SA-N-9
Length: 3.5 m (11.5 ft)
Diameter: 23.5 cm (9.25 in)
Wing span: 75 cm (25 in)
Weight: 165 kg (364 lb)
Warhead: 15 kg (33 lb)
Speed: Mach 2.5
Range: 0.5-6.5 n miles (1.5-12 km)
Altitude: 10-6,000 m (33-19,686 ft)

Manufacturers/Contractors

Altair Research and Development Corporation, Russia (system).
Fakel Experimental Design Bureau, Kaliningrad, Russia (missile).

CADS-N-1 (Kashtan/Kortika) close in weapon system

The very short-range gun/missile element of the system is the CADS-N-1 Kashtan/Kortika combined missile/gun system, which is designed for point defence against anti-ship missiles and guided bombs at ranges up to 2 n miles (4 km). It consists of an above-deck combat module and a below-deck command module. The combat module is on a deck mounting on which it can turn 360° in azimuth. On either side of the module is a 2A38M 30 mm calibre water-cooled gun, capable of elevation only, and above it are four launcher-containers for 9M311 (NATO = SA-N-11) surface-to-air missiles. These are two-stage, solid propellant missiles with a 'fragmentation/multiple rod type' warhead and a proximity fuze, activated when the missile is within 5 m of the target.

The sensor is the 'Hot Flash' radar which features two paraboloid antennas with front horn feeds. The central one is probably a search radar, to detect and track sea-skimming missiles, while the one mounted to the right of it is probably the missile guidance radar. The transmitter and receiver electronics are mounted behind the antennas. To the left of the central radar antenna are two electro-optic sensors which are probably a laser rangefinder and a remotely operated TV camera.

Targets are designated through the ship's prime air search radar and the target is acquired through the search radar and at ranges of 1,500 to 8,000 m (4,921-26,248 ft) it will be engaged with missiles using radar or TV tracking, with the missiles probably launched in pairs for increased kill probability. Guns will engage targets at closer ranges down to 500 m (1,640 ft). According to Russian publicity material, the highly automated system can engage up to six targets per minute.

Russian sources state the 2S6M can engage targets flying at a maximum speed of 500 m/s (1,640 ft/s) with the complete system having a reaction time of 8 seconds and a similar performance may be expected from the Kashtan.

Specifications

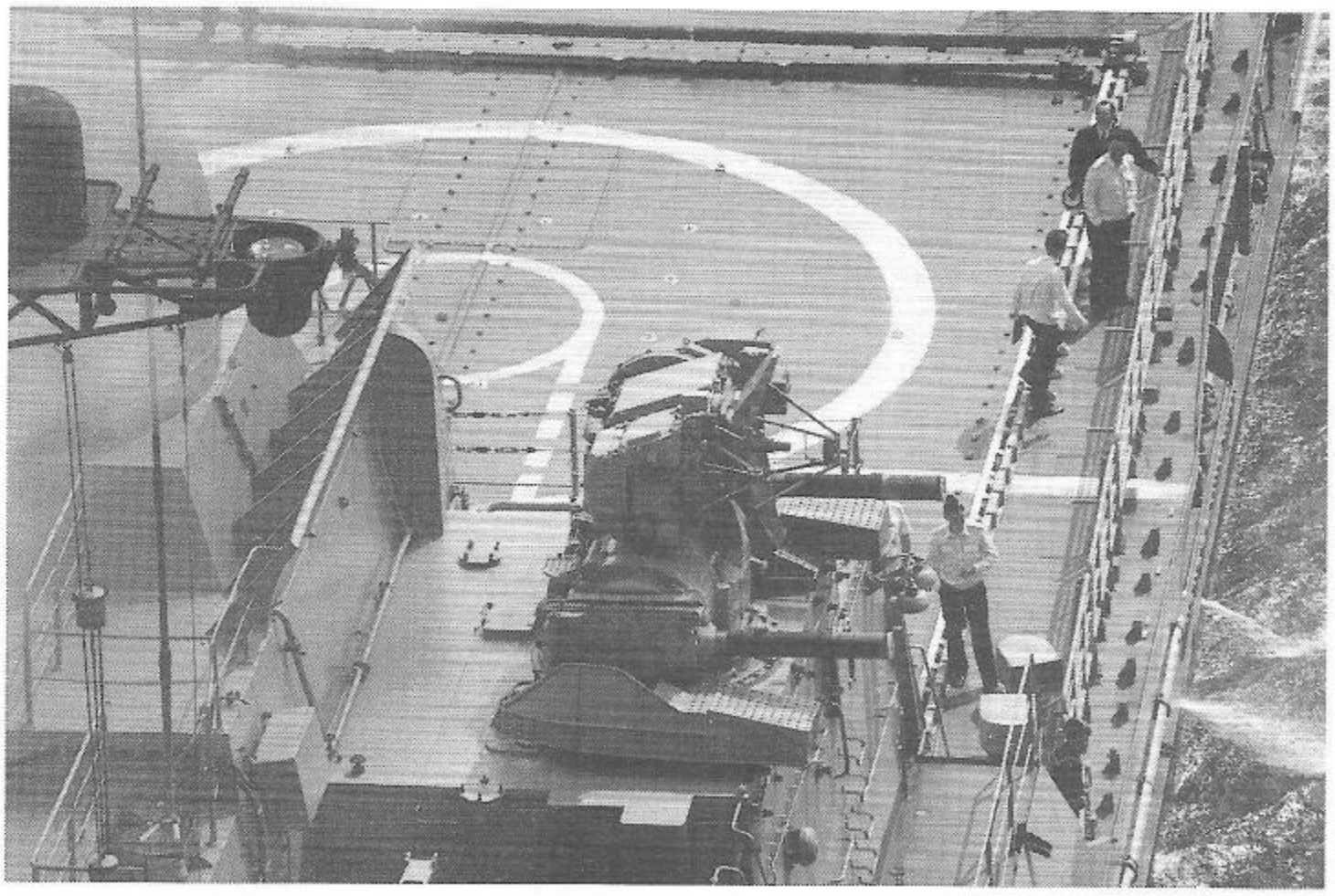
SA-N-11
Length: 2.56 m (5.8 ft)
Diameter: 17 cm (6.7 in)
Wing span: n/k
Weight: 57 kg (125.6 lb)
Speed: Mach 2.6
Range: 4.5 n miles (8 km)
Guidance: Radar to command line of sight

Specifications

2A38M gun
Calibre: 30 mm (12 in)
Number of guns: 2
Length: 3.48 m (11.4 ft)
Weight: 223 kg (491 lb)
Cyclic rate of fire: 1,950-2,500 rds/min
Muzzle velocity: 960 m/s (3,150 ft/s)
Effective range: 2 n miles (4 km)
Effective altitude: 200-2,000 m (656-6,562 ft)
Magazines: 1,900 rounds each

Manufacturers/Contractors

Ministry of Radio Industry, Moscow, Russia.
Scientific Production Corporation Phasotran, Russia.



CADS-N-1 with its two 30 mm cannon, but without the four containers for SA-N-11 SAM (H & L van Ginderen Collection)

ANTI-SUBMARINE MISSILES

Launcher

There are three 533 mm (21 in) horizontal launchers at main deck level on each side of the ship, which are angled outwards at 18° from the centreline. These tubes can launch either SS-N-15 or SS-N-16 anti-submarine missiles which dive into the water, before resurfacing and starting the usual flight profile. Normal torpedoes are also launched. These launchers are similar to those which appeared in the last three 'Kirov' class battlecruisers.

SS-N-15 (NATO = Starfish)

SS-N-15 (Starfish) long-range anti-submarine weapon system is similar in shape to SUBROC, having a long, slim cylinder with small, retractable fins and a booster rocket at the end. The weapon is loaded into a standard 533 mm (21 in) torpedo tube and is then launched in the same way as a torpedo, with the weapon travelling horizontally until it has cleared the ship's side when the rocket motor ignites and propels it upwards, where it flies to the target area and ejects the payload which descends to the sea retarded by a parachute. On entering the water, the weapon is automatically activated and begins carrying out a search and track pattern. The SS-N-15 payload is either a 200 kT nuclear depth charge or a Type 40 lightweight torpedo although it should be noted that, under current international agreements, nuclear warheads would not be carried at sea; the capability, however, remains.

Specifications

Length: 6.5 m (21.33 ft)
Diameter: 533 mm (21 in)
Wing span: n/k
Weight: 1,800 kg (3,968 lb)
Range: 24-27 n miles (45-50 km)
Speed: n/k
Guidance: Inertial

SS-N-16 (NATO = Stallion)

SS-N-16 is a long-range anti-submarine weapon system and is believed to be similar in shape to SUBROC, having a long, slim cylinder with small, retractable fins and a booster rocket at the end. It is associated with a Shark Gill bow-mounted sonar, which is integrated with a passive, towed-array sonar. The weapon is loaded into a standard 650 mm torpedo tube and is then launched in the same way as a torpedo, with the weapon travelling horizontally until it has cleared the submarine when the rocket motor ignites and drives it to the surface and on into the atmosphere where the wings deploy and it flies to the target area where it ejects the payload which descends to the sea retarded by a parachute. On entering the water, the weapon is automatically activated and begins carrying out a search and track pattern.

Payload is usually an E45-75A lightweight torpedo with a range of 8.1 n miles (15 km) at 30 knots. The torpedo has both passive and active sonar sensors and a warhead of either 100 kg (220.5 lb) high explosives (SS-N-16A Veder) or a nuclear warhead of undetermined power (SS-N-16B Vodopod). Note that under current international agreements, nuclear warheads would not be carried at sea, although the capability, of course, remains.

Specifications

Length: 6.7 m (22 ft)
Diameter: 533 mm (21 in)
Span: n/k
Weight: 1,850 kg (4,079 lb)
Range: 50 n miles (92 km)
Speed: n/k
Guidance: Inertial

GUNS

AK-100,100 mm/59 medium-calibre dual-purpose gun

There is one single AK-100,100 mm/59 calibre water-cooled mounting in an enclosed turret on the foredeck in 'A' position.

Specifications

Calibre: 100 mm (3.9 in)
Length of barrel: 59 calibres
Muzzle velocity: 880 m/s (2,887 ft/s)
Traverse: 200° at 30°/s
Elevation: −10 to +85° at 20°/s
Weight of projectile: 15.6 kg (34.4 lb)
Rate of fire: 60 rds/min
Range: anti-surface: 21.5 km

ANTI-SUBMARINE MORTARS

RBU-12000

Few details of this mounting have been published, but it has 10 launcher tubes either side of a box which presumably contains the elevation gears and is itself mounted on a steel pintle. The automatic reloading system is likely to work in the same manner as the RBU 1000/RBU 6000. It is presumably triggered by the Ox Yoke sonar.

Specifications

RBU-12000
Launch tubes: 10
Tube arrangement: Horseshoe
Calibre: 250 mm (9.8 in)
Tube length: 1.4 m (4.6 ft)
Rocket weight: 70 kg (154.3 lb)
Warhead: 80 kg (176.4 lb)
Range: 1,200 m (3,940 ft)

MINES

As in virtually every Russian surface combatant, there are two mine rails.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES ESM/ECM

Three EW systems have been identified so far:

Cage Flask. Cage series sensors are normally communications intercept systems. There are three.

Wine Glass. Wine Glass (formerly designated Foot Ball) is a jammer. It is also found on 'Sovremenny' class destroyers.

Half Hat. There are two Half Hats; Hat group devices are normally jammers.

DECOYS

Chaff launchers

There are two 10-barrelled chaff launchers.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Bell Crown

There are two Bell Crown datalinks.

Salt Pot

There are two Salt Pot IFF devices.

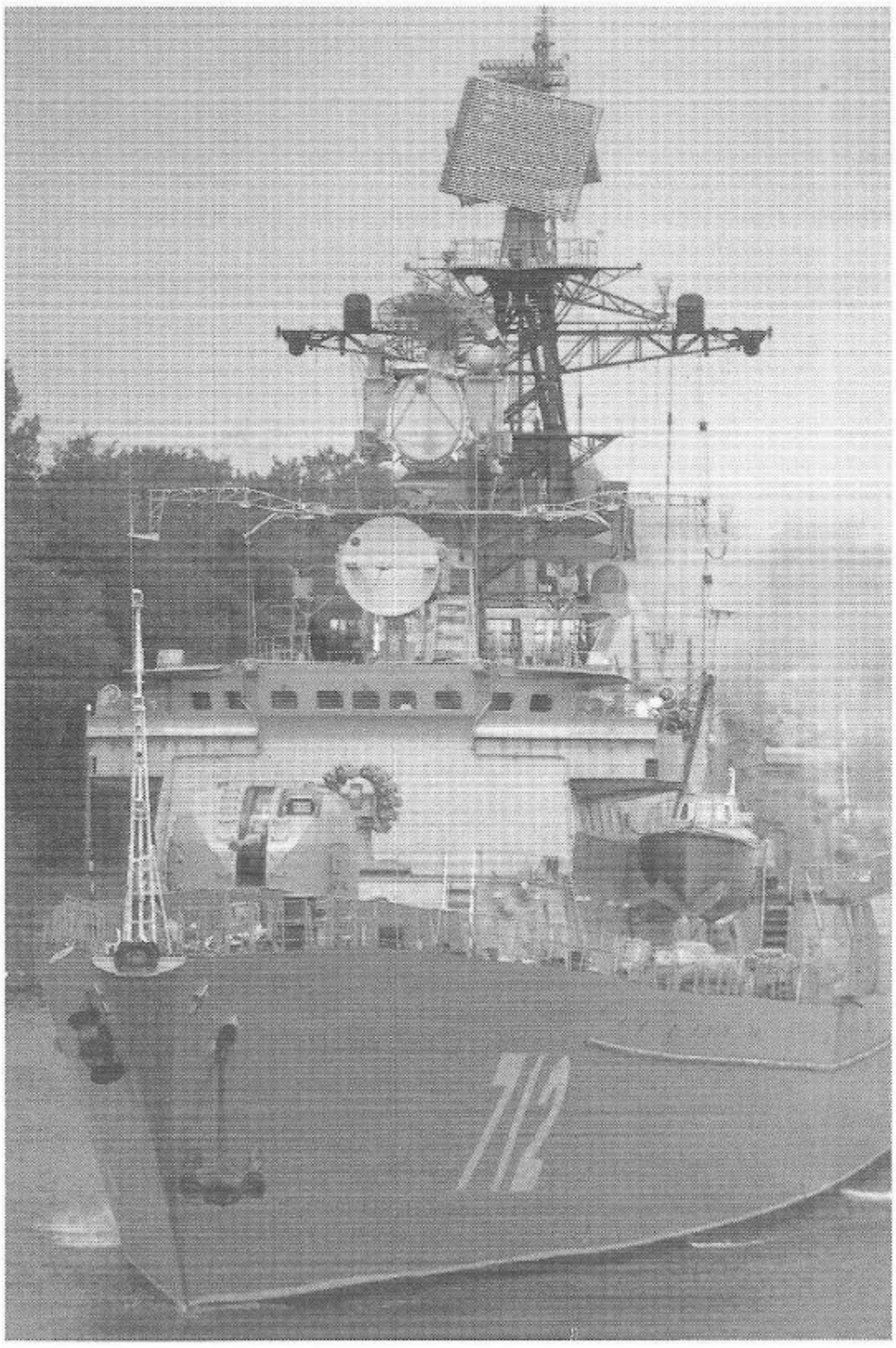
RADARS

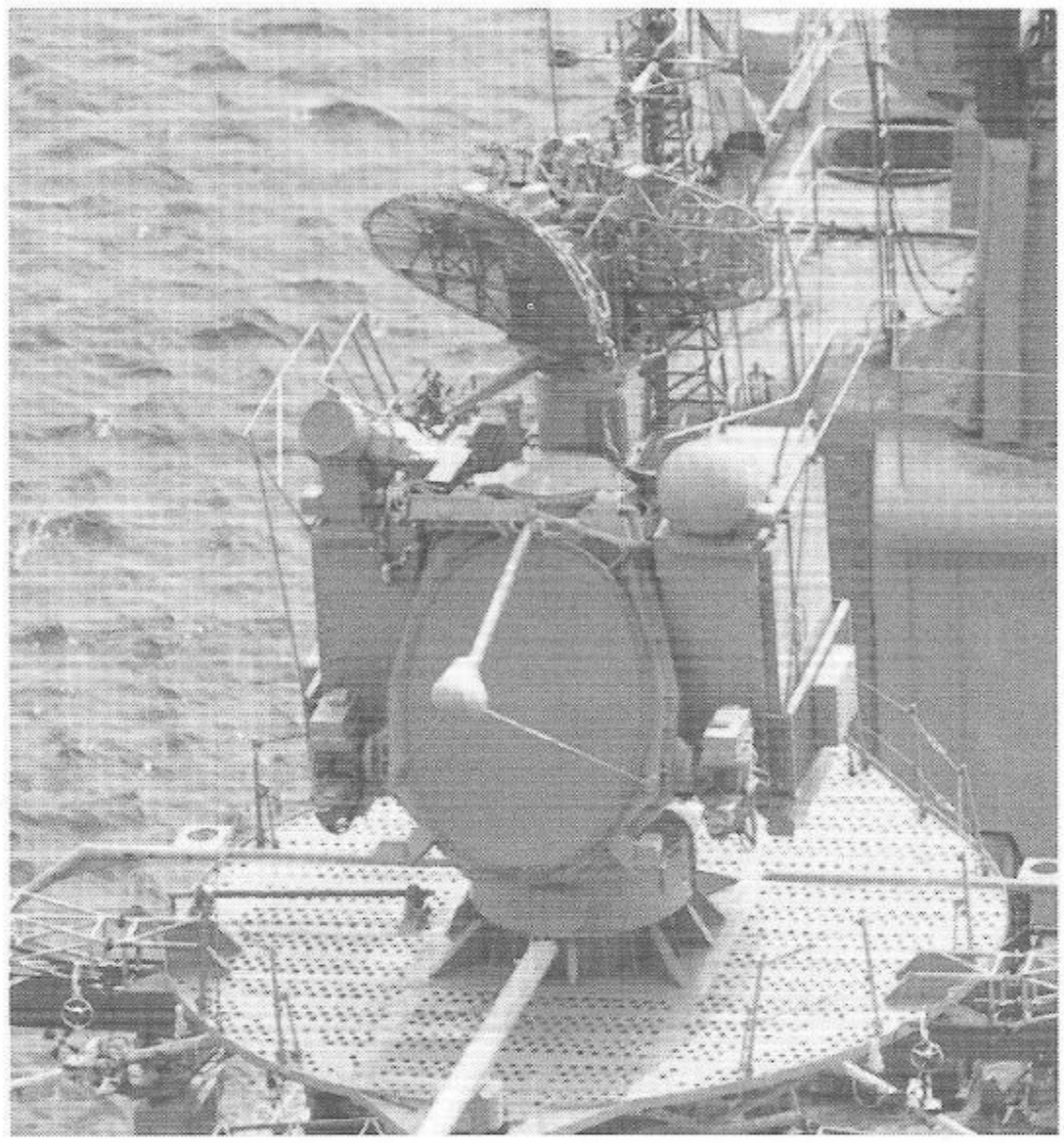
Top Plate air/surface surveillance radar

Top Plate is an air and surface surveillance 3D radar with two back to back planar arrays, operating in the D/E-bands. A version of Top Plate on offer for export as 'Fregat-Mae' has a maximum range and altitude of 150 km and 30,000 m respectively, and is accurate to 120 m (394 ft) in range. It can detect a 7 m² target flying at 5,000 m (16,405 ft) out to a range of 130 km, and a 0.05 m² missile at 30 km.

Palm Frond

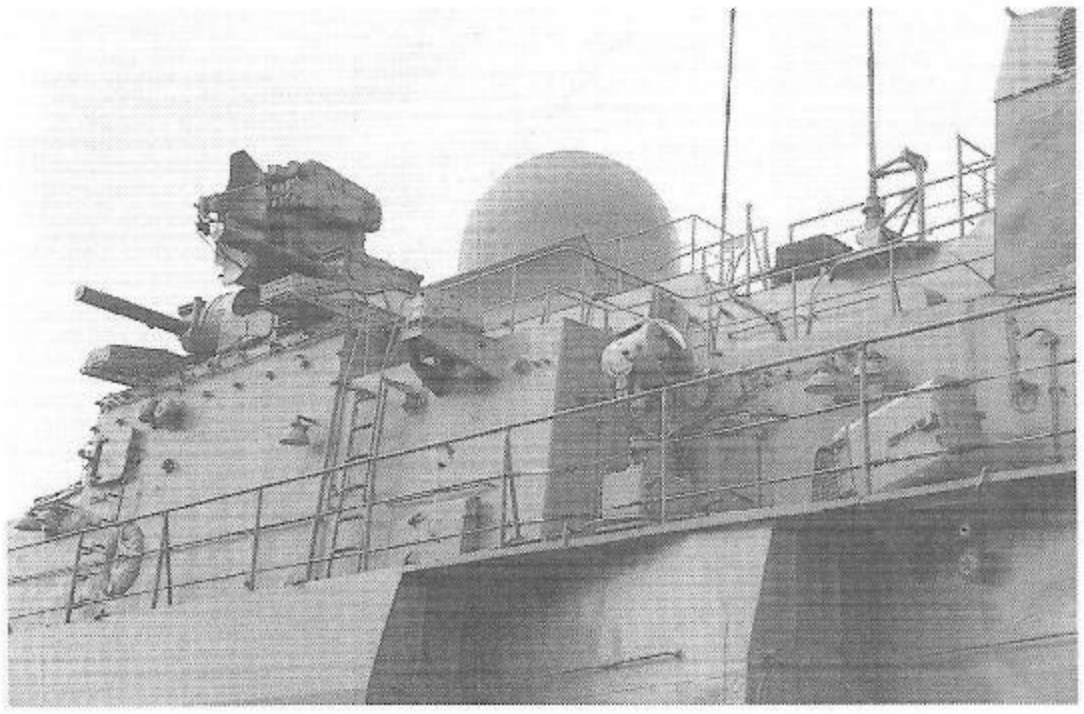
There are two Palm Frond navigational radar antennas.



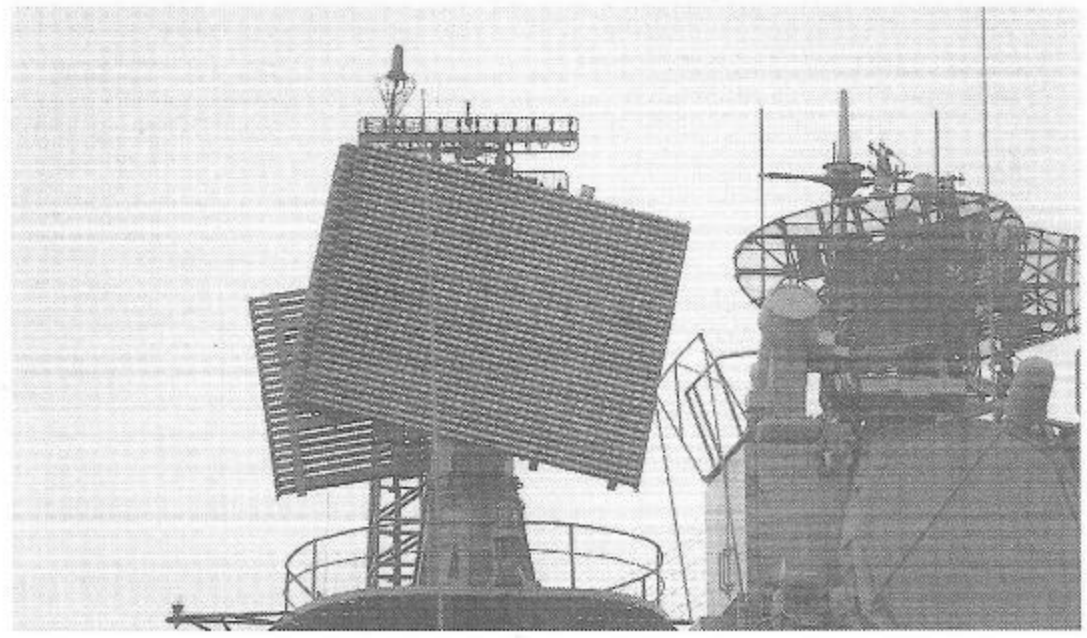


Cross Sword has four basic elements. The back to back parabolic surveillance antennas on top, the elliptical target/missile tracker below, the command transmitter (above left) and a second tracker (above right) (H & L van Ginderen Collection)

Left: Neustrashimy, *showing the usual profusion of electronic devices. On the bridge roof is Kite Screech B, with, behind it, two Palm Frond navigation radars, and behind the post Palm Frond, a Wine Glass jammer. At the next level is a Cross Sword, the fire-control director for SA-N-9; the two back to back parabolic antennas are part of Cross Sword. On the yard-arm are two Bell Crown datalinks, and at the head of the mainmast Top Plate with an IFF interrogator* (Jane's/H M Steele)



Another view of CADS-N-1 with, to its right, the top of the associated Cross Dome target acquisition radar (H & L van Ginderen Collection)



Top Plate antenna array consists of two back to back planar arrays canted at equal but opposite angles to the horizontal. One plate (the front in this picture) is wider and deeper than the other. The horizontal antenna across the top is an IFF interrogator (H & L van Ginderen Collection)

Palm Frond is one of the standard Russian navigation radars and operates in the I-band at between 9,400 and 9,600 MHz.

Cross Sword fire-control radar

Cross Sword consists of two large boxes of electronics with an oval-shaped phased-array antenna installed on the front of one at an angle of 22.5°. This is a front-feed K-band (20-40 GHz) tracking radar and above it are two drum-shaped antennas, the larger one on the right probably tracking the missile while the smaller one on the left is the uplink transmitter. On a separate pedestal on top of the boxes are two parabolic lattice antennas, mounted back to back, for the C-band (0.5-1 GHz) monopulse search radar. Two electro-optic sensors are *at the base of the tracking antenna for operating the* system in severe electronic environments.

Kite Screech gunfire control radar

Kite Screech is an I/J-band fire-control radar for the 100 mm gun. It has a range of approximately 10-12 n miles (18-22 km). It is found in 'Kirov', 'Slava', 'Sovremenny', 'Udaloy', 'Krivak II/III' and 'Neustrashimy'. It appears to use monopulse tracking instead of the conical scan tracking of earlier fire-control radars. It features a circular dish antenna with central feed, behind which are transmitter, receiver and stabilisation gear mountings. All are mounted on a pedestal about 2 m (6.56 ft) high. One such radar controls one or two guns and it is likely that the radar *compartment for this sensor also acts as the fire-control* centre.

SONARS

Bull Nose

Neustrashimy is fitted with Bull Nose bow-mounted, active search and attack sonar, which operates in the 7-8 kHz frequency band.

Ox Tail

Ox Tail VDS is installed in a bulge at the after end of the flight deck and deploys through a large stern door.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 20 × 15 m (67 × 50 ft)

HELICOPTER

1 Kamov Ka-27PL (NATO = Helix A)

Specifications

Dimensions:

rotor diameter: 15.90 m (52.16 ft)
rotor disc area: 397 m² (4,275 sq ft)
fuselage length: 11.30 m (37.07 ft)
height to rotor head: 5.40 m (17.72 ft)

Weights:

operating weight, empty: 6,500 kg (14,330 lb)
max take-off weight: 12,600 kg (27,778 lb)
max payload: 5,000 kg (11,023 lb)

Performance:

max level speed at optimum altitude: 135 kts (250 km/h)
endurance: 4.5 h

Engines: 2 Klimov (Isotov) TV3-117V turboshafts, each 1,645 kW (2,205 shp)

Accommodation: 3, (pilot plus 2)
Sensors: Surface search radar, sonobuoys, dipping sonar
Weapons: 2 APR-2 torpedoes, or 4 conventional depth bombs or mines

PROPULSION

Specifications

System: Combined gas turbine and gas turbine (COGAG)

Main machinery: 2 gas turbines; 35.72 MW (48,600 hp (m)); 2 gas turbines; 17.79 MW (24,200 hp(m))
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The first of class started sea trials in the Baltic in December 1990. Second of class is still fitting out and the third was launched in 1993 with only the hull completed but was back on the slips again by mid-1994. Little work was done on either during 1995.

DESIGN

The latest Russian frigate is slightly larger than the Krivak and has full helicopter facilities, with the helicopter flight deck extending across the full width of the ship. The after funnel is unusually flush decked but both funnels have been slightly extended after initial sea trials.

Separate SSM launchers have not been fitted so it is probable that SSM missiles can also be fired from the midships combined torpedo launchers.

Attempts have been made to incorporate stealth features and there is some form of IR suppression in the engine uptakes. Seen from above there are two rows of four pipes in the forward stack and six, of a slightly larger diameter in the after stack. Despite these, the ship, like many Russian surface ships emits dense clouds of exhaust fumes, probably due to either poor quality fuel or incomplete combustion, or a combination of the two.

The main propulsion plant is the same as in the 'Udaloy II' class.

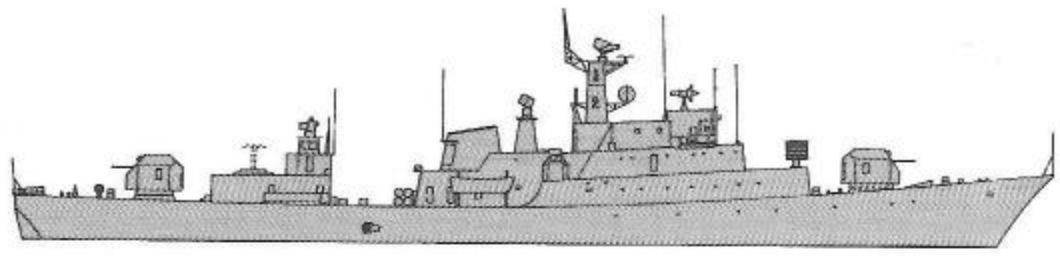
DEPLOYMENT

Neustrashimy is based in the Baltic. It has already made several visits to Western Europe, one of which was for the celebrations commemorating the 100th anniversary of the opening of the Kiel Canal.

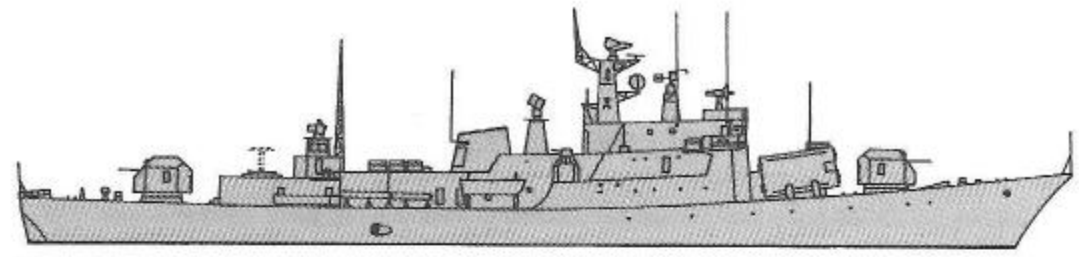
Neustrashimy (H & L van Ginderen Collection)

KONI

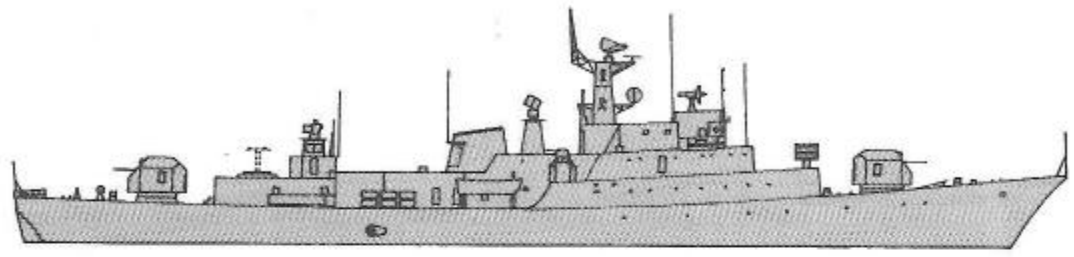
OVERVIEW



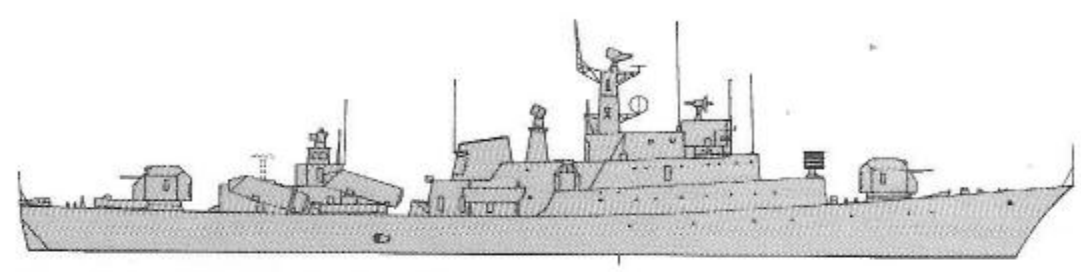
Koni Class (Algeria) (Ian Sturton)



Koni Class (Libya) (Ian Sturton)



Koni Class (Cuba) (Ian Sturton)



Koni Class (Yugoslavia) (Ian Sturton)

The 'Koni' class is relatively unusual in that it was designed and built in Russia specifically for export, with only one of the type being operated by the Russian Navy, and then only for demonstrations and crew training — and even that was sold to Bulgaria in 1990.

The Koni was in essence an enlarged version of the Grisha and was designated *'storozhevoy korabl'* (patrol ship) by the Russian Navy. Fourteen ships were built at the Zelenodolsk Shipyard on the Black Sea and a further two were built to a modified design in Yugoslavia. Another four ships — the 'Tetal' class — were built in Romania, which may (or may not) have been copies of the design (as discussed below).

There are four variations on the designs, which are generally known by their NATO designations of Koni I, II, III and IV:

- **Koni I.** This is the original version and has a distinct break in the superstructure between the stack and the after deckhouse (Bulgaria—1; East Germany—3).
- **Koni II.** This is a 'hot weather version' with a continuous deckhouse to house the air conditioning equipment. (Algeria—3; Cuba—3).
- **Koni III.** Supplied only to Libya, this has the continuous deckhouse of the Koni II, but with changes to the armament and sensors. (Libya—2).
- **Koni IV.** Supplied only to Yugoslavia this is essentially a Koni I but with SS-N-2C missiles (Yugoslavia—2)

Algeria
Algeria took delivery of its three Koni IIs between 1980 and 1985 and may be presumed to be satisfied with them as the country tried to buy the three former East German Konis in 1990 (the offer was refused by the German Government).

Bulgaria
Bulgaria operates one Koni I, which was the ship formerly used by the Russian Navy as a demonstrator and crew trainer.

Cuba
Cuba took delivery of three Koni IIs: the first in 1981, the second in 1984, and the third a considerable time later in 1988.

East Germany
Although now stricken, the three ships of the former DDR are mentioned for completeness. The Volksmarine purchased three ships from Russia, of which the first two were delivered in 1978 and 1979, which were, in fact, the first two to be exported. There was then a long gap before the third was delivered in 1986.

A fourth was ordered but the order was cancelled before delivery. On reunification in 1990 two ships spent six months in the Bundesmarine, following which they were stricken. As far as is known all three have been scrapped.

Libya
Libya took delivery of two Koni IIIs: the first in 1986 and the second in 1987. They are the most sophisticated and powerful of the Russian-made ships, with four SS-N-2C launchers

Romania
Romania built four 'Tetal' class ships between 1983 and 1987. These have certain superficial similarities with the 'Koni' class but their measurements differ, the hull form is not the same, nor is the armament, and while the Konis have a CODAG power plant, the Tetals have an all-diesel propulsion system. It appears, therefore, that even if the Romanian designers started their design work with the 'Koni', the end result is so different as to constitute a separate class altogether and they are not considered further under the 'Koni' class.

Yugoslavia
Yugoslavia took delivery of two Russian-built 'Koni I' class frigates in 1980 and 1982, and these were followed by two much-modified ships, with changes in the armament and sensor fits.

Summary
The Koni programme is summarised in the following two tables:

TABLE 1: RUSSIAN-BUILT 'KONI' CLASS FRIGATES

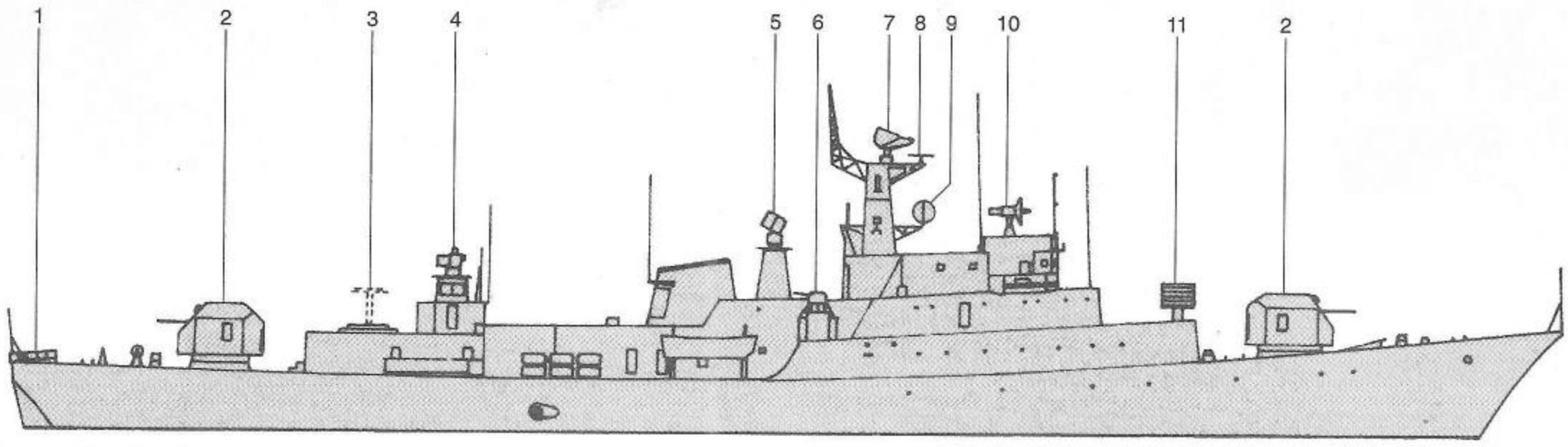
Hull Number	Commissioned	Koni Type	Name	Customer	Remarks
1	1976	I	—	Russia	1. Used for demonstrations/ training 2. Transferred to Bulgaria — see 14A below
2	Jul 1978	I	*Rostock* (141)	East Germany	Stricken 1991
3	May 1979	I	*Berlin* (142)	East Germany	Deleted 1991
4	Mar 1980	IV	*Beograd* (VPB 31)	Yugoslavia	1. Formerly named *Split* 2. In service
5	Dec 1980	II	*Murat Reis* (901)	Algeria	In Service
6	Sep 1981	II	350	Cuba	1. No name 2. In service
7	Apr 1982	II	*Rais Kellich* (902)	Algeria	In service
8	Dec 1982	IV	*Kopar* (VPB 32)	Yugoslavia	In service
9	Feb 1984	II	353	Cuba	1. No name. Now renumbered as 383 2. In service
10	Jan 1985	II	*Rais Korfou* (903)	Algeria	In service
11	Jun 1986	III	*Al Hani* (212)	Libya	In service
12	Jan 1986	I	*Halle* (143)	East Germany	Deleted 1991
13	Oct 1987	III	*Al Qirdabiyah* (213)	Libya	In service
14	Apr 1988	II	356	Cuba	1. No name 2. In service
14A	Feb 1990	I	*Smeli*	Bulgaria	1. Ex-Russian demonstrator 2. In service

TABLE II — YUGOSLAV-BUILT 'KONI' CLASS FRIGATES

Hull Number	Commissioned	Name	Customer	Remarks
15	1988	*Kotor* (VPB 33)	Yugoslavia	In service
16	1988	*Novi Sad* (VPB 34)	Yugoslavia	i. In service ii. Formerly *Pula*

Rostock *(141) was one of three 'Koni' class frigates built in Russia and exported to the (then) East Germany*

MOURAD RAIS (KONI)



Mourad Rais (Ian Sturton)
1 *Depth charge racks* **2** *AK-726 twin 76 mm/60 guns* **3** *SA-N-4 Gecko twin-arm launcher* **4** *Pop Group missile control radar (for SA-N-4)* **5** *Drum Tilt fire-control radar (for 30 mm)* **6** *Twin AK-230 30 mm cannon* **7** *Strut Curve air search radar* **8** *Don 2 surface search/navigation radar* **9** *Cross Loop DF antenna* **10** *Hawk Screech fire control (for 76 mm guns)* **11** *RBU-6000 anti-submarine rocket launchers*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Algeria
Type: Koni (Type 1159.2)

Class: MOURAD RAIS

Purchased: 3
Active: 3

Displacement:
standard: 1,440 t
full load: 1,900 t

Dimensions
Length: 96.4 m (316.3 ft)
Beam: 12.6 m (41.3 ft)
Draught: 3.5 m (11.5 ft)

Speed: 27 kts (gas turbine); 22 kts (diesel)
Range: 1,800 n miles at 14 kts

Complement: 130

SHIPS

MOURAD RAIS (901)
Builder Zelenodolsk Shipyard, Russia
Commissioned Dec 1980

RAIS KELLICH (902)
Builder Zelenodolsk Shipyard, Russia
Commissioned Apr 1982

RAIS KORFOU (903)
Builder Zelenodolsk Shipyard, Russia
Commissioned Jan 1985

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-4 short-range missile system

There is one SA-N-4 launcher aft, in the 'X' position. The twin-rail launcher lies beneath a hinged flat cover plate, emerging to launch its missiles and retracting to reload. This is likely to result in a low rate of fire which must be slowed even further by the need to close the magazine cover before firing. Below the launcher are four revolving drums each with five missiles while the electro-mechanical and hydraulic machinery is below that. On launch, the booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.5 km), following which the sustainer burns for 15 seconds. Command and control is via the Pop Group system (see below). There are 20 weapons in the magazine.

Specifications
Length: 3.1 m (10.17 ft)
Diameter: 21 cm (8.27 in)
Wing span: 64 cm (25.2 in)
Weight: 130 kg (286.6 lb)
Speed: Mach 2.5
Warhead: 50 kg (110 lb) HE
Range: 0.75-8 n miles (1.5-15 km)
Height: 9-3,000 m (30-10,000 ft)
Guidance: Semi-active radar homing

GUNS

Two AK-726 twin 76 mm (3 in)/59 mountings

There are two twin AK-726 turrets, in 'A' and 'Y' positions, respectively. The AK-726 is a multirole weapon system designed for air defence, surface engagement and shore bombardment roles and consists of two 76 mm guns mounted in a turret with a 5 mm metal shield. The whole mounting can contain 60 rounds of which two are on the feeder rail and four are on the hoists at any one time. The prime ammunition is the UOFB-62, a fixed round which weighs 12.8 kg (28.2 lb). The projectile weighs 4.6 kg (10.1 lb) and has 400 g of A-IX-2 explosive and a VG-67 point impact fuze. There is a five-man crew in the turret: the gun captain, two layers and two loaders. There is a further team of four loaders in the below-decks magazine.

In the 'Koni' class, AK-726 is associated with Hawk Screech radar. In addition to radar fire control there is local control through the Prisma optical sighting system, which may be used for engaging targets with speeds of up to 600 m/s (Mach 1.75).

Specifications
Calibre: 76 mm
Barrel length: 59 calibres
Muzzle velocity: 980 m/s (3,215 ft/s)
Traverse: 360° at 36°/s
Elevation: −7 to +85° at 32°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 90 rds/min (whole mounting)
Range:
surface/surface: 8.5 n miles (15.7 km)
AA (max): 10,000 m (32,808 ft)
AA (effective): 7,000 m (22,965 ft)

30 mm AK-630 close in weapon system

There are two AK-630 close in weapon system (CIWS) turrets amidships. This multibarrel, high volume-of-fire gun system, has a separate fire-control radar and a below-deck control station with remote optical and/or electro-optical sensor. It fires five types of fire mission: against anti-ship missiles, aircraft, small surface vessels, drifting mines, and unprotected shore targets. The weapon consists of six water-cooled barrels, using the Gatling principle with a fixed breech block and revolving barrels. The magazine contains 2,000 rounds of HE-I and HE-T ammunition. The gun fires bursts of up to 400 rounds, during which both the barrel and the breech block are cooled, with used cartridges and links being ejected into a bin below the elevating mass. The mounting is unusual in having an ignition system for burning off gun gases accumulating within it during firing.

Specifications
Calibre: 30 mm
Length of barrel: 65 calibres
Muzzle velocity: 890 m/s (2,920 ft/s)
Traverse: 360° (depending on location of turret) at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (13,123 ft)
electro-optic fire control: 5,000 m (16,404 ft)
Rate of fire: 4,000-5,000 rds/min
Ammunition:
round: 1.224 kg (2.7 lb)
projectile weight:
UOF-84: 384 g
UOR-84: 388 g

ANTI-SUBMARINE MORTARS

RBU-6000

There are two 12-tube RBU-6000 mortars located on the foredeck. The mounting can traverse through 360° and elevation limits are −15°/+60°. Loading is

automatic from a below-deck magazine. It is estimated that the rockets weigh 110 kg (242 lb), with a 25 kg (55 lb) warhead. Pairs of tubes are fired in sequence. The RGB-60 rocket is fitted with an impact-time fuze, which detonates either on hitting a solid object (such as a submarine) or when it reaches a preset depth. Firing is usually conducted in a full salvo of 12 rockets, but it is also possible to fire single rockets, or four- or eight-rocket salvos, if the tactical situation requires it. The warhead weighs 31 kg (68 lb).

MINES

There are launch rails at the stern, enabling the ship to launch up to 22 mines.

DEPTH CHARGES

There are two depth-charge racks.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC COUNTERMEASURES (ECM)

Cross Loop

Cross Loop is a simple communications direction-finding system.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar

The air search radar is the Russian MR-302 (NATO = Strut Curve) a medium-range, general purpose, F-band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m² aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Don 2

All Konis have one Don 2, I-band, navigation radar.

Hawk Screech fire-control radar

Hawk Screech is the fire-control radar for the 76 mm guns. It has a circular dish scanner, behind which are mounted the transmitter and receiver, as well as turning and stabilisation gear. The complete radar is pedestal-mounted. The 2.3 m (7.5 ft) diameter scanner has a central feed supported by a four-leg structure. Feed arrangements could incorporate a rotating dipole to provide a conical scan search pattern. Dish diameter is approximately 2 m (6.5 ft) and the operating frequency is in the H/I-band for both types. The NATO designation, Hawk Screech, is apparently derived from signal characteristics noted in the course of ELINT monitoring. The principal function is that of gunfire director against aircraft targets, although this type probably also has a certain capability against surface targets, and possibly splash detection.

Drum Tilt

There is a single 'Rys' (NATO = Drum Tilt) fire-control system for the AK-230s. This is an I/J-band system with a pedestal-mounted director whose antenna is in a weatherproof container attached to the scanner assembly and tilted at an angle of about 22°. The maximum acquisition range is approximately 22 n miles (40 km). The single radar director controls both gun mountings.

Pop Group

The Pop Group director is located aft atop a small tower. It provides the weapon control system for the SA-N-4 missile system. The director includes an acquisition radar with a long, curved antenna on top of the cab, and two target trackers. The latter two are of different size, but presumably the smaller one performs a similar function to the larger, but at higher frequencies, which would enable them to direct two different missiles against the same target. The system operates in the F/H/I band.

IFF

The ships carry one High Pole B and two Square Head.

SONAR

Herkules

Herkules (NATO = Wolf Paw) is a sonar more usually found in submarines. It is a hull-mounted, active search and attack, medium-frequency system.

PROPULSION

Specifications

System: Combined diesel and gas turbine (CODAG)
Main machinery: 1 SGW, Nikolayev, M8B gas turbine (centre shaft); 13.25 MW (18,000 hp(m)) sustained; 2 Russki B-68 diesels; 11.63 MW (15,820 hp(m)) sustained
Shafts: 3

FURTHER INFORMATION

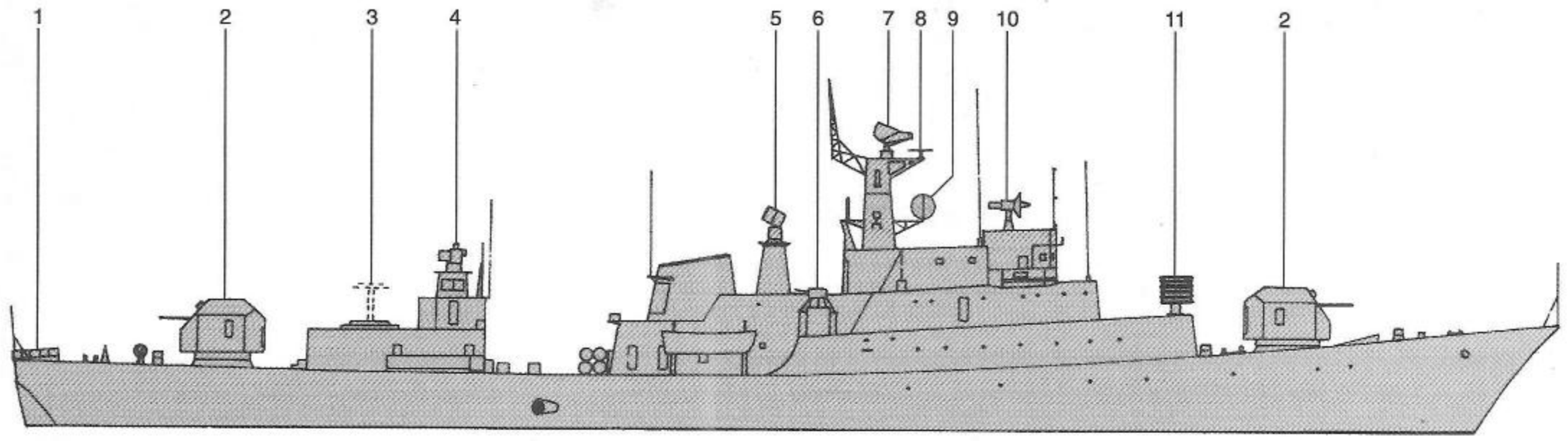
The Algerian Government expressed some interest in 1991 in purchasing the three 'Koni' class frigates formerly operated by the defunct East German Navy. The sale was, however, rejected by the German Government and the ships have since been stricken and scrapped.

The Algerian Konis do not have torpedo tubes.

These Algerian ships were fitted with new generators in 1992-94.

All the Algerian ships are currently active.

SMELI (KONI)



Smeli (Ian Sturton)
1 *Depth charge racks* **2** *AK-726 twin 76 mm/60 guns* **3** *SA-N-4 Gecko twin-arm launcher* **4** *Pop Group missile control radar (for SA-N-4)* **5** *Drum Tilt fire-control radar (for 30 mm)* **6** *Twin AK-230 30 mm cannon* **7** *Strut Curve air search radar* **8** *Don 2 surface search/navigation radar* **9** *Cross Loop DF antenna* **10** *Hawk Screech fire control (for 76 mm guns)* **11** *RBU-6000 anti-submarine rocket launchers*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Bulgaria
Type: Koni I (Type 1159.1)

Class: SMELI

Acquired: 1
Active: 1

Displacement:
standard: 1,440 t
full load: 1,900 t

Dimensions
Length: 96.4 m (316.3 ft)
Beam: 12.6 m (41.3 ft)
Draught: 3.5 m (11.5 ft)

Speed: 27 kts (gas turbine); 22 kts (diesel)
Range: 1,800 n miles at 14 kts

Complement: 110

SHIPS

SMELI (11)

Builder	Zelenodolsk Shipyard, Russia
Commissioned (Russian Navy)	1976
Sold to Bulgaria	Feb 1990

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-4 short-range missile system

There is one SA-N-4 launcher aft, in the 'X' position. The twin-rail launcher lies beneath a hinged flat cover plate, emerging to launch its missiles and retracting to reload. This is likely to result in a low rate of fire which must be slowed even further by the need to close the magazine cover before firing. Below the launcher are four revolving drums each with five missiles while the electro-mechanical and hydraulic machinery is below that. On launch, the booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.5 km), following which the sustainer burns for 15 seconds. Command and control is via the Pop Group system (see below). There are 20 weapons in the magazine.

Specifications
Length: 3.1 m (10.17 ft)
Diameter: 21 cm (8.27 in)
Wing span: 64 cm (25.2 in)
Weight: 130 kg (286.6 lb)
Speed: Mach 2.5
Warhead: 50 kg (110 lb) HE
Range: 0.75-8 n miles (1.5-15 km)
Height: 9-3,000 m (30-10,000 ft)
Guidance: Semi-active radar homing

Smeli *(11) is the former Russian Navy demonstrator and crew trainer, which was sold to Bulgaria after the last 'Koni' class export order had been met* (Giorgio Ghiglione)

GUNS

Two AK-726 twin 76 mm (3 in)/59 mountings

There are two twin AK-726 turrets, in 'A' and 'Y' positions, respectively. The AK-726 is a multirole weapon system designed for air defence, surface engagement and shore bombardment roles and consists of two 76 mm guns mounted in a turret with a 5 mm metal shield. The whole mounting can contain 60 rounds of which two are on the feeder rail and four are on the hoists at any one time. The prime ammunition is the UOFB-62, a fixed round which weighs 12.8 kg (28.2 lb). The projectile weighs 4.6 kg (10.1 lb) and has 400 g of A-IX-2 explosive and a VG-67 point impact fuze. There is a five-man crew in the turret: the gun captain, two layers and two loaders. There is a further team of four loaders in the below-decks magazine.

In the 'Koni' class, AK-726 is associated with Hawk Screech radar. In addition to radar fire control there is local control through the Prisma optical sighting system, which may be used for engaging targets with speeds of up to 600 m/s (Mach 1.75).

Specifications
Calibre: 76 mm
Barrel length: 59 calibres
Muzzle velocity: 980 m/s (3,215 ft/s)
Traverse: 360° at 36°/s
Elevation: −7 to +85° at 32°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 90 rds/min (whole mounting)
Range:
anti-surface: 8.5 n miles (15.7 km)
AA (max): 10,000 m (32,808 ft)
AA (effective): 7,000 m (22,965 ft)

30 mm L/65 AK-230 twin mounting

This ship has two twin AK-230, remotely operated, twin barrel, automatic anti-aircraft guns, which are designed to engage air targets at heights of up to 4,000 m (13,123 ft). It is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically powered mounting is 1.46 m (4.8 ft) high, 3.11 m (10.2 ft) long and 2.1 m (6.8 ft) wide, and consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system. Russian ammunition for this weapon consists of two rounds; BR-83 and OF-83D (see Specifications).

The fire-control radar is the I/J-band Rys (NATO = Drum Tilt) fire-control radar, whose maximum acquisition range is approximately 22 n miles (40 km).

Specifications

NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,445 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,123 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
type: Armour-piercing tracer
weight (complete round): 1.47 kg (3.2 lb)
weight (projectile): 0.35 kg (0.77 lb)
OF-83D:
type: High explosive
weight (complete round): 1.40 kg (3.08 lb)
projectile: 0.27 kg (0.6 lb)
explosive: 30 g (A-XI-2)

ANTI-SUBMARINE MORTARS

RBU-6000

There are two 12-tube RBU-6000 mortars located on the foredeck. The mounting can traverse through 360° and elevation limits are −15°/+60°. Loading is automatic from a below-deck magazine. It is estimated that the rockets weigh 110 kg (242 lb), with a 25 kg (55 lb) warhead. Pairs of tubes are fired in sequence. The RGB-60 rocket is fitted with an impact-time fuze, which detonates either on hitting a solid object (such as a submarine) or when it reaches a preset depth. Firing is usually conducted in a full salvo of 12 rockets, but it is also possible to fire single rockets, or four- or eight-rocket salvos, if the tactical situation requires it. The warhead weighs 31 kg (68 lb).

MINES

There are launch rails at the stern, enabling the ship to launch up to 22 mines.

DEPTH CHARGES

There are two depth-charge racks.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog

There is a single Watch Dog array. This is an intercept and radar warning system which has been in service for over 30 years. It is a wide-open system with an array consisting of four tiers of eight microwave horns, covering frequencies from D to H-band.

Cross Loop

Cross Loop is a simple communications direction-finding system. The antenna is on a small platform on the mast.

DECOYS

There are two PK-16 16-barrelled chaff launchers.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar

The air search radar is the Russian MR-302 (NATO = Strut Curve) a medium-range, general purpose, F band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m² aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Don 2

All Konis have one Don 2, I-band, navigation radar.

Hawk Screech fire-control radar

Hawk Screech is the fire-control radar for the 76 mm guns. It has a circular dish scanner, behind which are mounted the transmitter and receiver, as well as turning and stabilisation gear. The complete radar is pedestal-mounted. The 2.3 m (7.5 ft) diameter scanner has a central feed supported by a four-leg structure. Feed arrangements could incorporate a rotating dipole to provide a conical scan search pattern. Dish diameter is approximately 2 m (6.5 ft) and the operating frequency is in the H/I-band for both types. The NATO designation, Hawk Screech, is apparently derived from signal characteristics noted in the course of ELINT monitoring. The principal function is that of gunfire director against aircraft targets, although this type probably also has a certain capability against surface targets, and possibly splash detection.

Drum Tilt

There is a single 'Rys' (NATO = Drum Tilt) fire-control system for the AK-230s. This is an I/J-band system with a pedestal-mounted director whose antenna is in a weatherproof container attached to the scanner assembly and tilted at an angle of about 22°. The maximum acquisition range is approximately 22 n miles (40 km). The single radar director controls both gun mountings.

Pop Group

The Pop Group director is located aft atop a small tower. It provides the weapon control system for the SA-N-4 missile system. The director includes an acquisition radar with a long, curved antenna on top of the cab, and two target trackers. The latter two are of different size, but presumably the smaller one performs a similar function to the larger, but at higher frequencies, which would enable them to direct two different missiles against the same target. The system operates in the F/H/I band.

IFF

The ship carries one High Pole B, but does not appear to have the two Square Heads carried by some other Konis.

SONAR

Herkules

Herkules (NATO = Wolf Paw) is a sonar more usually found in submarines. It is a hull-mounted, active search and attack, medium-frequency system.

PROPULSION

Specifications

System: Combined diesel and gas turbine (CODAG)
Main machinery: 1 SGW, Nikolayev, M8B gas turbine (centre shaft); 13.25 MW (18,000 hp(m)) sustained; 2 Russki B-68 diesels; 11.63 MW (15,820 hp(m)) sustained
Shafts: 3

FURTHER INFORMATION

This particular ship was operated by the Russian Navy as a demonstrator and crew trainer for foreign customers. When these tasks were completed the ship was sold to Bulgaria in February 1990. *Smeli* is based at Varna.

Smeli *(11). Weapons include twin 76 mm guns ('A' position) and two RBU 6000 ASW rocket launchers ('B' position)*

350 (KONI)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Cuba
Type: Koni II (Type 1159.2)

Class: 350

Acquired: 3
Active: 3

Displacement:
standard: 1,440 t
full load: 1,900 t

Dimensions
Length: 96.4 m (316.3 ft)
Beam: 12.6 m (41.3 ft)
Draught: 3.5 m (11.5 ft)

Speed: 27 kts (gas turbine); 22 kts (diesel)
Range: 1,800 n miles at 14 kts

Complement: 110

SHIPS

350
356
383 (ex-*353*)

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-4 short-range missile system

There is one SA-N-4 launcher aft, in the 'X' position. The twin-rail launcher lies beneath a hinged flat cover plate, emerging to launch its missiles and retracting to reload. This is likely to result in a low rate of fire which must be slowed even further by the need to close the magazine cover before firing. Below the launcher are four revolving drums each with five missiles while the electromechanical and hydraulic machinery is below that. On launch, the booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.5 km), following which the sustainer burns for 15 seconds. Command and control is via the Pop Group system (see below). There are 20 weapons in the magazine.

Specifications
Length: 3.1 m (10.17 ft)
Diameter: 21 cm (8.27 in)
Wing span: 64 cm (25.2 in)
Weight: 130 kg (286.6 lb)
Speed: Mach 2.5
Warhead: 50 kg (110 lb) HE
Range: 0.75-8 n miles (1.5-15 km)
Height: 9-3,000 m (30-10,000 ft)
Guidance: Semi-active radar homing

GUNS

Two AK-726 twin 76 mm (3 in)/59 mountings

All. There are two twin AK-726 turrets, in 'A' and 'Y' positions, respectively. The AK-726 is a multirole weapon system designed for air defence, surface engagement and shore bombardment roles and consists of two 76 mm guns mounted in a turret with a 5 mm metal shield. The whole mounting can contain 60 rounds of which two are on the feeder rail and four are on the hoists at any one time. The prime ammunition is the UOFB-62, a fixed round which weighs 12.8 kg (28.2 lb). The projectile weighs 4.6 kg (10.1 lb) and has 400 g of A-IX-2 explosive and a VG-67 point impact fuze. There is a five-man crew in the turret: the gun captain, two layers and two loaders. There is a further team of four loaders in the below-decks magazine.

In the 'Koni' class, AK-726 is associated with 'Hawk Screech' radar. In addition to radar fire control there is local control through the Prisma optical sighting system, which may be used for engaging targets with speeds of up to 600 m/s (Mach 1.75).

Specifications
Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,215 ft/s)
Traverse: 360° at 36°/s
Elevation: −7 to +85° at 32°/s
Ammunition (total): 16 kg (35.28 lb)
Rate of fire: 90 rds/min (whole mounting)
Range:
anti-surface: 8.5 n miles (15.7 km)
anti-air (max): 10,000 m (32,808 ft)
anit-air (effective): 7,000 m (22,965 ft)

30 mm L/65 AK-230 twin mounting

356 and 380 only. These two ships have two twin AK-630, remotely operated, twin barrel, automatic anti-aircraft guns, which are designed to engage air targets at heights of up to 4,000 m (13,124 ft). It is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically powered mounting is 1.46 m (4.8 ft) high, 3.11 m (10.2 ft) long and 2.1 m (6.9 ft) wide, and consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system. Russian ammunition for this weapon consists of two rounds; BR-83 and OF-83D (see Specifications).

The fire-control radar is the I/J-band Rys (NATO = Drum Tilt), whose maximum acquisition range is approximately 22 n miles (40 km).

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,123 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
type: Armour-piercing tracer
weight (complete round): 1.47 kg (3.24 lb)
weight (projectile): 0.35 kg (0.77 lb)
OF-83D:
type: High explosive
weight (complete round): 1.40 kg (3.08 lb)
projectile: 0.27 kg (0.59 lb)
explosive: 30 g (A-XI-2)

30 mm AK-630 close in weapon system

350 only. This ship has four AK-630 close in weapon system (CIWS) turrets amidships. This multibarrel, high volume-of-fire gun system, has a separate fire-control radar and a below-deck control station with remote optical and/or electro-optical sensor. It fires five types of fire mission: against anti-ship missiles, aircraft, small surface vessels, drifting mines, and unprotected shore targets. The weapon consists of six water-cooled barrels, using the Gatling principle with a fixed breech block and revolving barrels. The magazine contains 2,000 rounds of HE-I and HE-T ammunition. The gun fires bursts of up to 400 rounds, during which both the barrel and the breech block are cooled, with used cartridges and links being ejected into a bin below the elevating mass. The mounting is unusual in having an ignition system for burning off gun gases accumulating within it during firing.

Specifications
Calibre: 30 mm
Length of barrel: 65 calibres
Muzzle velocity: 890 m/s (2,920 ft/s)
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Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (13,123 ft)
electro-optic fire control: 5,000 m (16,404 ft)
Rate of fire: 4,000-5,000 rds/min
Ammunition:
round: 1.224 kg (2.7 lb)
projectile weight:
UOF-84: 384 g
UOR-84: 388 g

ANTI-SUBMARINE MORTARS

RBU-6000

There are two 12-tube RBU-6000 mortars located on the foredeck. The mounting can traverse through 360° and elevation limits are −15°/+60°. Loading is automatic from a below-deck magazine. It is estimated that the rockets weigh 110 kg (242 lb), with a 25 kg warhead. Pairs of tubes are fired in sequence. The RGB-60 rocket is fitted with an impact-time fuze, which detonates either on hitting a solid object (such as a submarine) or when it reaches a preset depth. Firing is usually conducted in a full salvo of 12 rockets, but it is also possible to fire single rockets, or four- or eight-rocket salvos, if the tactical situation requires it. The warhead weighs 31 kg (68.3 lb).

MINES

There are launch rails at the stern, enabling the ship to launch up to 22 mines.

DEPTH CHARGES

There are two depth-charge racks.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog
There is a single Watch Dog array. This is an intercept and radar warning system which has been in service for over 30 years. It is a wide-open system with an array consisting of four tiers of eight microwave horns, covering frequencies from D to H-band.

Cross Loop
Cross Loop is a simple communications direction-finding system. The antenna is on a small platform on the mast.

DECOYS

There are two PK-16 16-barrelled chaff launchers.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar
The air search radar is the Russian MR-302 (NATO = Strut Curve) a medium-range, general purpose, F band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m² aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Don 2
All Konis have one Don 2, I-band, navigation radar.

Hawk Screech fire-control radar
Hawk Screech is the fire-control radar for the 76 mm guns. It has a circular dish scanner, behind which are mounted the transmitter and receiver, as well as turning and stabilisation gear. The complete radar is pedestal-mounted. The 2.3 m (7.5 ft) diameter scanner has a central feed supported by a four-leg structure. Feed arrangements could incorporate a rotating dipole to provide a conical scan search pattern. Dish diameter is approximately 2 m (6.5 ft) and the operating frequency is in the H/I-band for both types. The NATO designation, Hawk Screech, is apparently derived from signal characteristics noted in the course of ELINT monitoring. The principal function is that of gunfire director against aircraft targets, although this type probably also has a certain capability against surface targets, and possibly splash detection.

Drum Tilt
There is a single 'Rys' (NATO = Drum Tilt) fire-control system for the AK-230s. This is an I/J-band system with a pedestal-mounted director whose antenna is in a weatherproof container attached to the scanner assembly and tilted at an angle of about 22°. The maximum acquisition range is approximately 22 n miles (40 km). The single radar director controls both gun mountings.

Pop Group
The Pop Group director is located aft atop a small tower. It provides the weapon control system for the SA-N-4 missile system. The director includes an acquisition radar with a long, curved antenna on top of the cab, and two target trackers. The latter two are of different size, but presumably the smaller one performs a similar function to the larger, but at higher frequencies, which would enable them to direct two different missiles against the same target. The system operates in the F/H/I band.

IFF
The ship carries one High Pole A, and two Square Heads.

SONARS

Herkules
Herkules (NATO = Wolf Paw) is a sonar more usually found in submarines. It is a hull-mounted, active search and attack, medium-frequency system.

PROPULSION

Specifications
System: Combined diesel and gas turbine (CODAG)
Main machinery: 1 SGW, Nikolayev, M8B gas turbine (centre shaft); 13.25 MW (18,000 hp(m)) sustained; 2 Russki B-68 diesels; 11.63 MW (15,820 hp(m)) sustained
Shafts: 3

FURTHER INFORMATION

Names/Pennant numbers
The ships have no names and the Cuban Navy follows the Russian practice of allocating pennant numbers according to tactical missions. Thus, the ship that was designated 353 was redesignated 383 in October 1988.

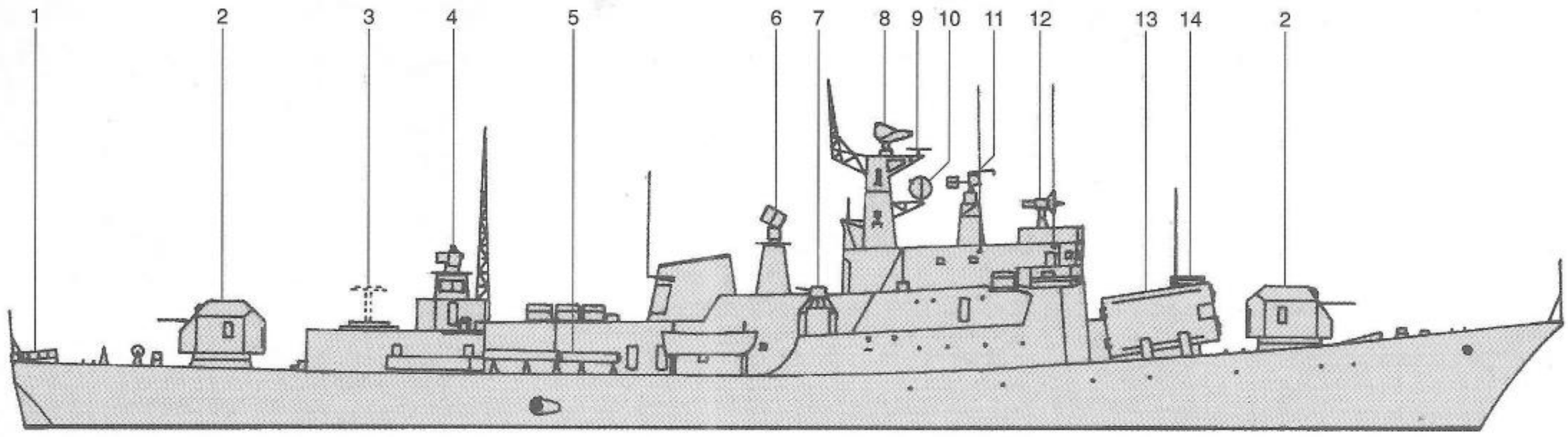
Transfers
Because of the changing pennant numbers and the fact that the ships are not named it is difficult to trace the history of each. The transfers of the three ships took place:

First ship — 24 September 1981
Second ship — 8 February 1984
Third ship — 10 April 1988

Deployment
All three ships are based at Cienfuegos.

Cuban 'Koni' class frigate. The Cubans change pennant numbers frequently, making it difficult to keep track of individual ships (Van Boeijin)

AL HANI (KONI III)



Al Hani (Ian Sturton)

1 Depth-charge racks 2 AK-726 twin 76 mm/60 guns 3 SA-N-4 twin-arm launcher 4 Pop Group missile control radar 5 Twin 406 mm torpedo tubes 6 Drum Tilt fire-control radar (for 30 mm) 7 Twin AK-230 30 mm cannon 8 Strut Curve air search radar 9 Don 2 navigation radar 10 Cross Loop DF 11 Plank Shave surface search radar 12 Hawk Screech fire control (for 76 mm gun) 13 SS-N-2C Styx twin launcher (two) 14 RBU-6000 (between SS-N-2c launchers)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Libya
Type: Koni III (Type 1159.3)

Class: AL HANI

Acquired: 2
Active: 2

Displacement:
standard: 1,440 t
full load: 1,900 t

Dimensions
Length: 96.4 m (316.3 ft)
Beam: 12.6 m (41.3 ft)
Draught: 3.5 m (11.5 ft)

Speed: 27 kts (gas turbine); 22 kts (diesel)
Range: 1,800 n miles at 14 kts

Complement: 120

SHIPS

AL HANI (F 212)
Builder Zelenodolsk Shipyard, Russia
Commissioned 28 Jun 1986

AL QIRDABIYAH (F 213)
Builder Zelenodolsk Shipyard, Russia
Commissioned 24 October 1987

WEAPONS SYSTEMS

ANTI-SHIP MISSILES

P-21 Rubezh (SS-N-2c 'Styx') medium-range anti-ship missile

The Libyan Konis are armed with four P-21 (NATO = SS-N-2c 'Styx') missiles, with two twin launch bins located either side of a large deckhouse on the foredeck. There are no reloads. This relatively large anti-ship missile is powered by a liquid-fuelled rocket motor, with a solid fuel booster attached.

Once the target is detected the ship must close with the aim of being within the optimum engagement distance, some 15-20 n miles (28-37 km). Then the ship must maintain a speed of 15 knots or less and hold its course for 20-30 seconds before launching the first salvo of two missiles. These may be followed, a minute later, by the other two.

Upon launch the missile climbs at an angle of 45° to one of five preset altitudes (100, 150, 200, 250 or 350 m), where the onboard radar searches for a target and the receiver is switched on for very short periods to receive signals from a designated range, the range gate being 1 km on either side of the target. The radar locks on only after eight returns have been received, at distances of 3.5-12 n miles (6.5-22 km), whereupon the seeker guidance system switches off the autopilot. A throw-off gyroscope takes the missile on target a few seconds before impact as it becomes too close for radar-generated homing signals. Russian Navy tacticians calculate that seven to eight missiles are required to destroy a cruiser-size target and four for a destroyer, making salvo firing a major feature of any tactical engagement scenario with SS-N-2c missiles to ensure destruction of the target.

Specifications

SS-N-2c
Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.9 ft)
Speed: Mach 0.9
Weight (without booster): 2,500 kg (5,512 lb)
Warhead: 454 kg (1,001 lb) hollow-charge
Fuzes: Impact, proximity
Range: 3-46 n miles (5.5-85 km)
Guidance: Autopilot with active radar (supplemented in some with IR)

MS-2 seeker
Frequency: I-band (8-12 GHz) (five presets)
PRF: 300-500 pps (adjustable)
Altitude control: Barometric pressure device

Manufacturer/Contractor

Raduga, Moscow, Russia.

SA-N-4 short-range missile system

There is one SA-N-4 launcher aft, in the 'X' position. The twin-rail launcher lies beneath a hinged flat cover plate, emerging to launch its missiles and retracting to reload. This is likely to result in a low rate of fire which must be slowed even further by the need to close the magazine cover before firing. Below the launcher are four revolving drums each with five missiles while the electro-mechanical and hydraulic machinery is below that. On launch, the booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.5 km), following which the sustainer burns for 15 seconds. Command and control is via the Pop Group system (see below). There are 20 weapons in the magazine.

Specifications

Length: 3.1 m (10.17 ft)
Diameter: 21 cm (8.27 in)
Wing span: 64 cm (25.2 in)
Weight: 130 kg (286.6 lb)
Speed: Mach 2.5
Warhead: 50 kg (110 lb) HE
Range: 0.75-8 n miles (1.5-15 km)
Height: 9-3,000 m (30-10,000 ft)
Guidance: Semi-active radar homing

TUBES

Unlike other Konis, the Libyan version has four single 406 mm torpedo tubes, which are located aft beneath the Pop Group radar tower. There are two tubes on each side mounted at a fixed angle of some 30° to the centreline.

TORPEDOES

The torpedoes used are USET-95, 406 mm, which use active/passive homing to 5.5 n miles (10 km) at 30 knots. They have a 100 kg (220 lb) warhead.

GUNS

Two AK-726 twin 76 mm (3 in)/59 mountings

There are two twin AK-726 turrets, in 'A' and 'Y' positions, respectively, but it should be noted that the 'A' gun has a restricted arc of fire compared to other Konis, due to the SS-N-2c launch bins. The AK-726 is a multi-role weapon system designed for air defence, surface engagement and shore bombardment roles and consists of two 76 mm guns mounted in a turret with a 5 mm metal shield. The whole mounting can contain 60 rounds of which two are on the feeder rail and four are on the hoists at any one time. The prime ammunition is the UOFB-62, a fixed round which weighs 12.8 kg (28.2 lb). The projectile weighs 4.6 kg (10.1 lb) and has 400 g of A-IX-2 explosive and a VG-67 point impact fuze.

There is a five-man crew in the turret: the gun captain, two layers and two loaders. There is a further team of four loaders in the below-decks magazine.

In the 'Koni' class, AK-726 is associated with 'Hawk Screech' radar. In addition to radar fire control there is local control through the Prisma optical sighting system, which may be used for engaging targets with speeds of up to 600 m/s (Mach 1.75).

Specifications

Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,215 ft/s)
Traverse: 360° at 36°/s
Elevation: −7 to +85° at 32°/s
Ammunition (total): 16 kg (35.28 lb)
Rate of fire: 90 rds/min (whole mounting)
Range:
anti-surface: 8.5 n miles (15.7 km)
anti-air (max): 10,000 m (32,808 ft)
anti-air (effective): 7,000 m (22,965 ft)

30 mm L/65 AK-230 twin mounting

These two ships have two twin AK-230, remotely operated, twin barrel, automatic anti-aircraft guns, which are designed to engage air targets at heights of up to 4,000 m (13,124 ft). It is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically powered mounting is 1.46 m (4.8 ft) high, 3.11 m (10.2 ft) long and 2.1 m (6.9 ft) wide, and consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system. Russian ammunition for this weapon consists of two rounds; BR-83 and OF-83D (see Specifications).

The fire-control radar is the I/J-band Rys (NATO = Drum Tilt), whose maximum acquisition range is approximately 22 n miles (40 km).

Specifications

NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,445 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,123 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s

Al Hani *(F 212) in Grand Harbour, Malta. The foredeck in this version is very crowded, with a 76 mm gun, two twin SS-N-2c launchers and an RBU-6000 ASW rocket launcher* (H & L van Ginderen Collection)

Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
type: Armour-piercing tracer
weight (complete round): 1.47 kg (3.24 lb)
weight (projectile): 0.35 kg (0.77 lb)
OF-83D:
type: High explosive
weight (complete round): 1.40 kg (3.08 lb)
projectile: 0.27 kg (0.59 lb)
explosive: 30 g (A-XI-2)

ANTI-SUBMARINE MORTARS

RBU-6000

There is only one 12-tube RBU-6000 mortar, which is located centrally on the roof of the small forecastle deckhouse between the two SS-N-2C launch boxes. The mounting can traverse through 360° and elevation limits are −15°/+60°. Loading is automatic from a below-deck magazine. It is estimated that the rockets weigh 110 kg (242.5 lb), with a 25 kg (55.12 lb) warhead. Pairs of tubes are fired in sequence. The RGB-60 rocket is fitted with an impact-time fuze, which detonates either on hitting a solid object (such as a submarine) or when it reaches a preset depth. Firing is usually conducted in a full salvo of 12 rockets, but it is also possible to fire single rockets, or four- or eight-rocket salvos, if the tactical situation requires it. The warhead weighs 31 kg (68.3 lb).

MINES

There are launch rails at the stern, enabling the ship to launch up to 22 mines.

DEPTH CHARGES

There are two depth-charge racks.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog

There are two Watch Dog arrays. This is an intercept and radar warning system which has been in service for over 30 years. It is a wide-open system with an array consisting of four tiers of eight microwave horns, covering frequencies from D to H-band.

Cross Loop

Cross Loop is a simple communications direction-finding system. The antenna is on a small platform on the mast.

DECOYS

PK-17

There are two 16-barrelled PK-17 chaff launchers.

Torpedo decoys

Unlike other Konis, the Libyan ships are equipped with Russian towed torpedo decoys.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar

The air search radar is the Russian MR-302 (NATO = Strut Curve) a medium-range, general purpose, F-band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m² aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Plank Shave

The Libyan Konis are fitted with Plank Shave atop a small tower on the bridge roof. This is an I-band set used for surface search and targeting the SS-N-2c missiles.

Don 2

All Konis have one Don 2, I-band, navigation radar.

Drum Tilt

There is a single 'Rys' (NATO = Drum Tilt) fire-control system for the AK-230s. This is an I/J-band system with a pedestal-mounted director whose antenna is in a weatherproof container attached to the scanner assembly and tilted at an angle of about 22°. The maximum acquisition range is approximately 22 n miles (40 km). The single radar director controls both gun mountings.

Hawk Screech fire-control radar

Hawk Screech fire-control radar has a circular dish scanner, behind which are mounted the transmitter and receiver, as well as turning and stabilisation gear. The complete radar is pedestal-mounted. The 2.3 m (7.5 ft) diameter scanner has a central feed supported by a four-leg structure. Feed arrangements could incorporate a rotating dipole to provide a conical scan search pattern. Dish diameter is approximately 2 m (6.5 ft) and the operating frequency is in the H/I-band for both types. The NATO designation, Hawk Screech, is apparently derived from signal characteristics noted in the course of ELINT monitoring. The principal function is that of gunfire director against aircraft targets, although this type probably also has a certain capability against surface targets, and possibly splash detection. There is one Hawk Screech to control both 76 mm guns.

Pop Group
The Pop Group director is located aft atop a small tower. It provides the weapon control system for the SA-N-4 missile system. The director includes an acquisition radar with a long, curved antenna on top of the cab, and two target trackers. The latter two are of different size, but presumably the smaller one performs a similar function to the larger, but at higher frequencies, which would enable them to direct two different missiles against the same target. The system operates in the F/H/I band.

IFF
The ship carries one High Pole B, and one Square Head.

SONAR

Herkules
Herkules (NATO = Wolf Paw) is a sonar more usually found in submarines. It is a hull-mounted, active search and attack, medium-frequency system.

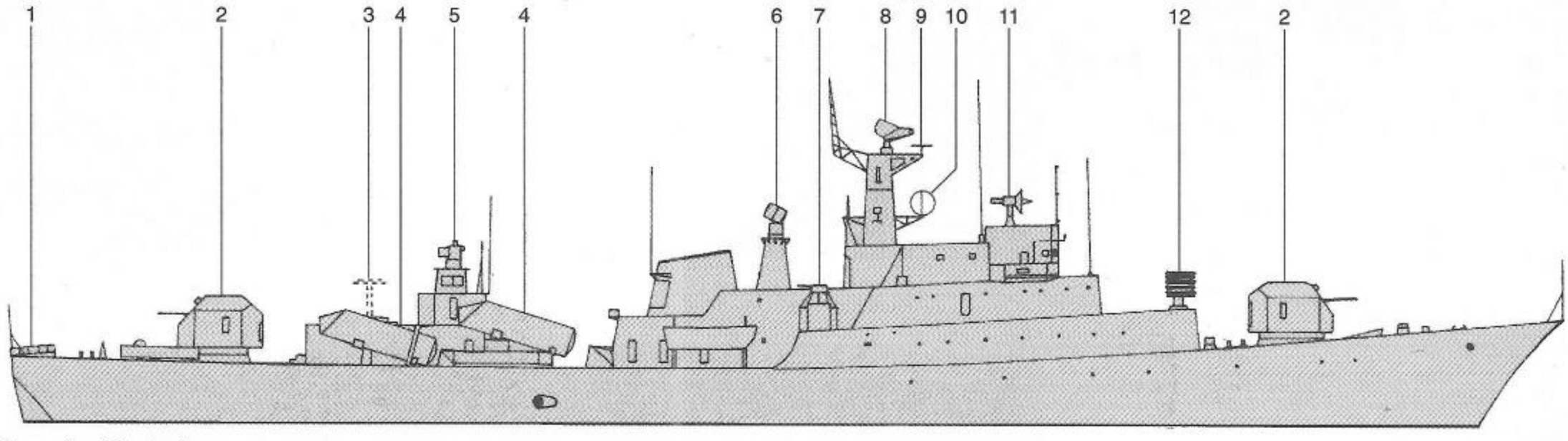
PROPULSION

Specifications
System: Combined diesel and gas turbine (CODAG)
Main machinery: 1 SGW, Nikolayev, M8B gas turbine (centre shaft); 13.25 MW (18,000 hp(m)) sustained; 2 Russki B-68 diesels; 11.63 MW (15,820 hp(m)) sustained
Shafts: 3

FURTHER INFORMATION

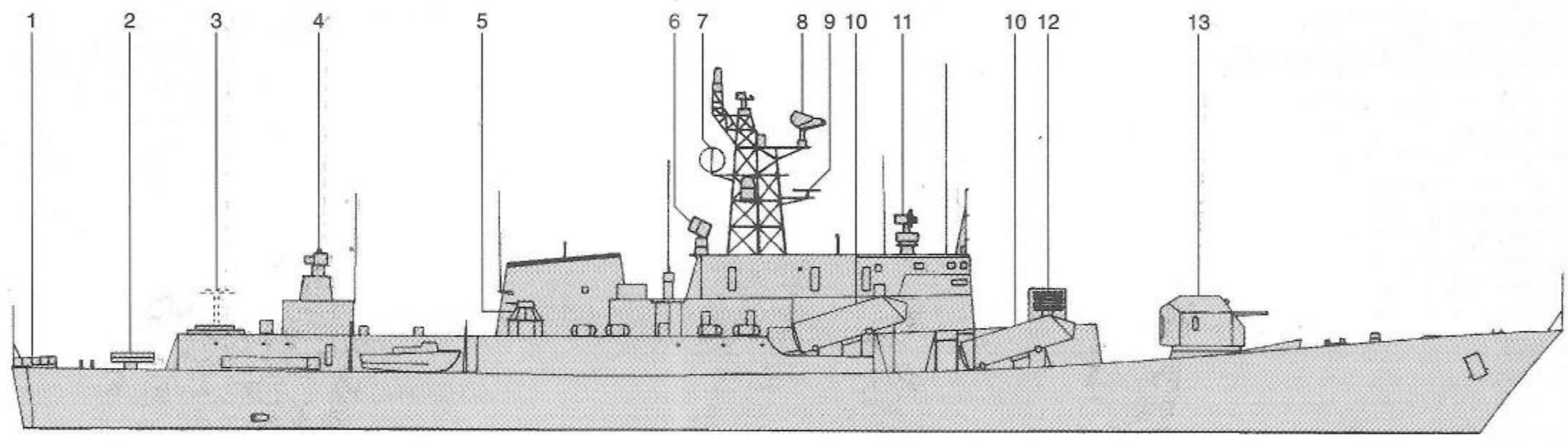
These are Type III Konis which differ substantially from earlier versions. The most important difference is that they are armed with four SS-N-2c anti-ship missiles, which are mounted on the foredeck. The forward gun is retained, but the number of RBU-6000s is reduced from two to one. This is also the only version of the Koni to have torpedo tubes: two, fixed 400 mm tubes on either beam in the waist. It also has a new small tower on the bridge roof to mount a Plank Shave surface search/target indication radar. The striped camouflage paint was applied in 1991. Both ships are reported to have been active in 1995.

BEOGRAD/KOTOR (KONI)



Kopar (Ian Sturton)

1 *Mine rails* **2** *AK-726 twin 76 mm/60 gun* **3** *SA-N-4 Gecko twin-arm launcher for SAM* **4** *SS-N-2c single launcher* **5** *Pop Group fire director (for SA-N-4)* **6** *Drum Tilt fire director (for AK-230)* **7** *AK-230 twin 30 mm cannon* **8** *Strut Curve air search radar* **9** *Don 2 navigation radar* **10** *Cross Loop DF array* **11** *Owl Screech fire control (for AK-726)* **12** *RBU-6000 ASW rocket launcher*



Kotor (Ian Sturton)

1 *Mine rails* **2** *Triple Mk 32 324 mm torpedo tubes* **3** *SA-N-4 'Geko' twin-arm launcher for SAM* **4** *Pop Group fire director (for SA-N-4)* **5** *AK-230 twin 30 mm cannon* **6** *Drum Tilt fire director radar (for AK-230)* **7** *Cross Loop DF array* **8** *Strut Curve air search radar* **9** *Palm Frond navigation radar* **10** *SS-N-2c single launcher* **11** *Owl Screech fire control (for AK-726)* **12** *RBU-6000 ASW rocket launcher* **13** *AK-726 twin 76 mm (3 in) gun*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Yugoslavia
Type: Koni IV/Koni Mod (Type 1159)
National designation: *veliki patrolni brod* (VPB)

Class: BEOGRAD/KOTOR

Purchased: 2
Built: 2
Active: 3

Displacement:
standard: 1,440 t
full load: 1,900 t

Dimensions
Length: 96.7 m (317.2 ft)
Beam: 12.8 m (42.0 ft)
Draught: 4.2 m (13.8 ft)

Speed: 27 kts (gas turbine); 22 kts (diesel)
Range: 1,800 n miles at 14 kts

Complement: 110

SHIPS

BEOGRAD (VPB 31)
Builder Zelenodolsk Shipyard, Russia
Launched 1978
Commissioned 10 Mar 1980

KOPAR (VPB 32)
Builder Zelenodolsk Shipyard, Russia
Launched 1981
Commissioned 5 Dec 1982

KOTOR (VPB 33)
Builder Tito Shipyard, Kraljevica, Yugoslavia
Launched 21 May 1985
Commissioned Jan 1987

NOVI SAD (VPB 34)
Builder Tito Shipyard, Kraljevica, Yugoslavia
Launched 18 Dec 1986
Commissioned Nov 1988

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

P-21 Rubezh (SS-N-2c 'Styx') medium-range anti-ship missile

The Yugoslav ships are all armed with four SS-N-2c anti-ship missiles, but the fits vary. In the two Russian-built ships the missiles are in single launcher-containers which are abaft the stack and facing towards the stern. In the two Yugoslav-built ships, however, the launcher-containers are located foward and face the bows.

Once the target is detected the ship must close with the aim of being within the optimum engagement distance, some 15-20 n miles (28-37 km). Then the ship must maintain a speed of 15 knots or less and hold its course for 20-30 seconds before launching the first salvo of two missiles. These may be followed, a minute later, by the other two.

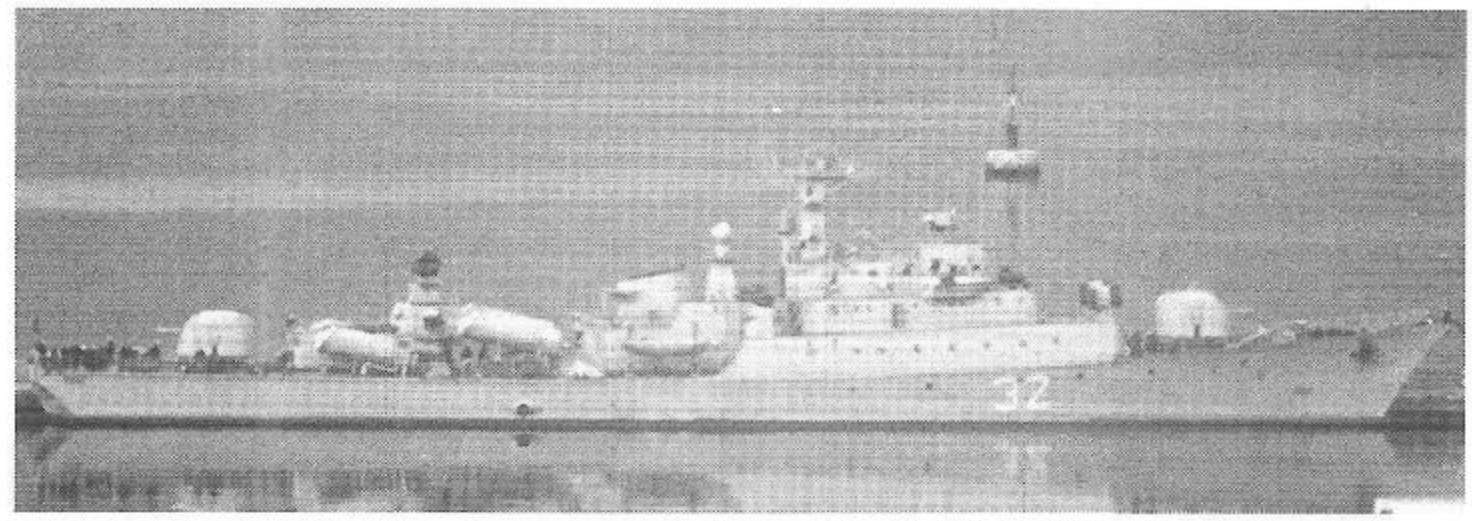
Upon launch, the missile climbs at an angle of 45° to one of five preset altitudes (100, 150, 200, 250 or 350 m), where the onboard radar searches for a target and the receiver is switched on for very short periods to receive signals from a designated range, the range gate being 1 km on either side of the target. The radar locks on only after eight returns have been received, at distances of 3.5-12 n miles (6.5-22 km), whereupon the seeker guidance system switches off the autopilot. A throw-off gyroscope takes the missile on target a few seconds before impact as it becomes too close for radar-generated homing signals. Russian Navy tacticians calculate that seven to eight missiles are required to destroy a cruiser-size target and four for a destroyer, making salvo firing a major feature of any

tactical engagement scenario with SS-N-2c missiles to ensure destruction of the target.

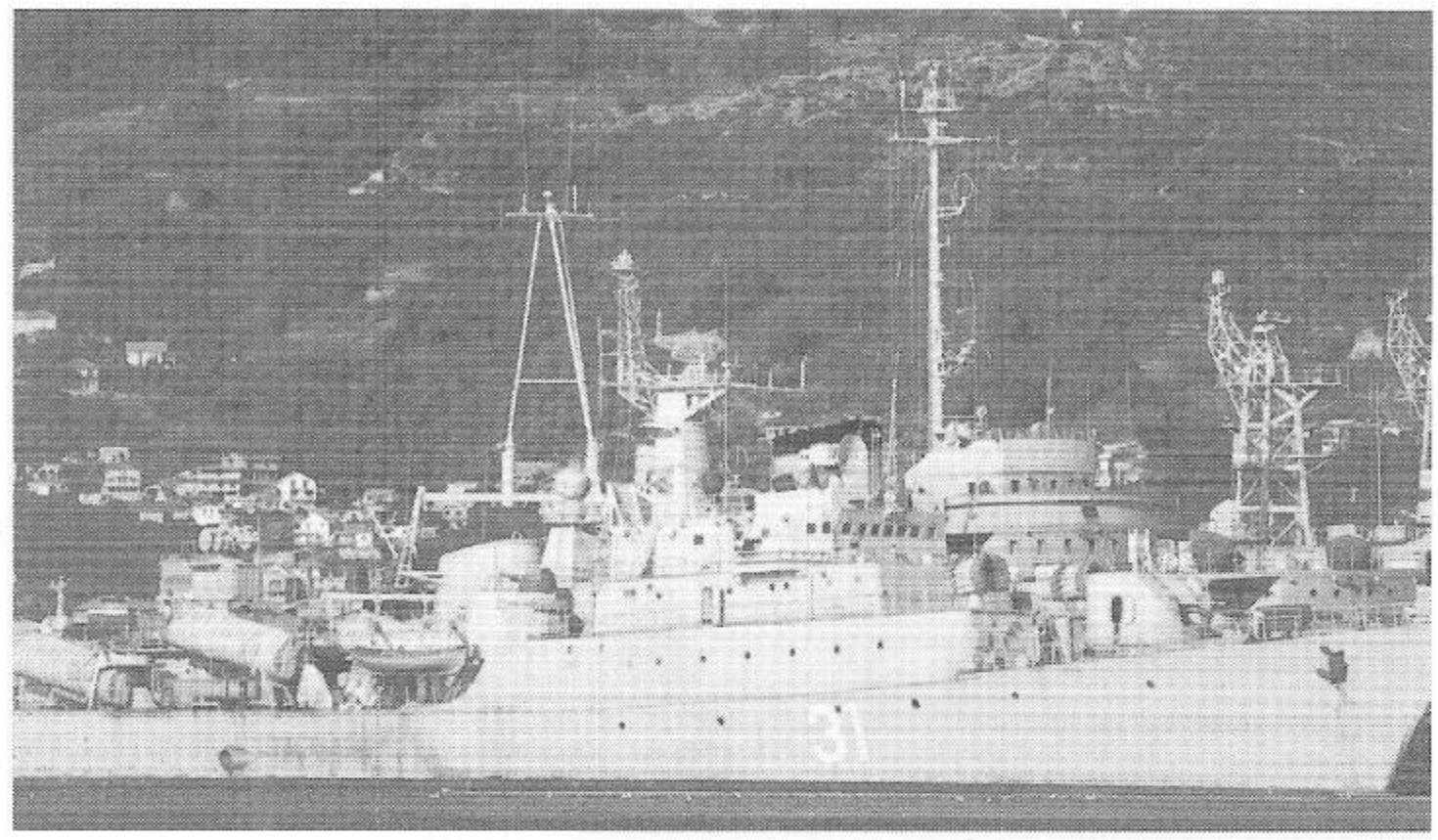
Specifications
SS-N-2c
Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.9 ft)
Speed: Mach 0.9
Weight (without booster): 2,500 kg (5.512 lb)
Warhead: 454 kg hollow-charge
Fuzes: Impact, proximity
Range: 3-46 n miles (5.5-85 km)
Guidance: Autopilot with active radar (supplemented in some with IR)

MS-2 seeker
Frequency: I-band (8-12 GHz) (four presets)
PRF: 300-500 pps (adjustable)
Altitude control: Barometric pressure device

Manufacturer/Contractor
Raduga, Moscow, Russia



Kopar *(32) the second of the two Koni IVs built in Russia for the Yugoslav Navy. They have the gap in the superstructure of the Koni II, but with four SS-N-2c anti-ship missiles which are fired over the ship's stern*



Beograd, *first of the Russian Koni IV, with SS-N-2cs pointing over the stern*

SURFACE-TO-AIR MISSILES (SAM)

SA-N-4 short-range missile system
There is one SA-N-4 launcher aft. The launcher is atop the deckhouse in the 'X' position in the two Russian-built ships, but on the quarterdeck, displacing the 76 mm mounting in the Yugoslav-built ships. In both cases, the twin-rail launcher lies beneath a hinged flat cover plate, emerging to launch its missiles and retracting to reload. This is likely to result in a low rate of fire which must be slowed even further by the need to close the magazine cover before firing. Below the launcher are four revolving drums each with five missiles while the electromechanical and hydraulic machinery is below that. On launch, the booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.5 km), following which the sustainer burns for 15 seconds. Command and control is via the Pop Group system (see below). There are 20 weapons in the magazine.

Specifications
Length: 3.1 m (10.17 ft)
Diameter: 21 cm (8.27 in)
Wing span: 64 cm (25.2 in)
Weight: 130 kg (286.6 lb)
Speed: Mach 2.5
Warhead: 50 kg (110 lb) HE
Range: 0.75-8 n miles (1.5-15 km)
Height: 9-3,000 m (30-10,000 ft)
Guidance: Semi-active radar homing

TORPEDOES

Kotor (VPB 33) and *Novi Sad* (VPB 34) only. These two Yugoslav-built ships have two triple 324 mm tubes on the quarterdeck, displacing the aft twin 76 mm mounting. They are used to launch Whitehead A 244 anti-submarine torpedoes, which use active/passive homing to a range of 3,3 n miles (6 km) at 30 knots. There is, however, some doubt as to whether these tubes are still fitted.

GUNS

Two AK-726 twin 76 mm (3 in)/59 mountings
In *Beograd* and *Kopar* there are two twin AK-726 turrets, in 'A' and 'Y' positions, respectively, but in *Kotor* and *Novi Sad* there is only one gun, in 'A' position. The AK-726 is a multirole weapon system designed for air defence, surface engagement and shore bombardment roles and consists of two 76 mm guns mounted in a turret with a 5 mm metal shield. The whole mounting can contain 60 rounds of which two are on the feeder rail and four are on the hoists at any one time. The prime ammunition is the UOFB-62, a fixed round which weighs 12.8 kg (28.2 lb). The projectile weighs 4.6 kg (10.1 lb) and has 400 g of A-IX-2 explosive and a VG-67 point impact fuze. There is a five-man crew in the turret: the gun captain, two layers and two loaders. There is a further team of four loaders in the below-decks magazine.

In the 'Koni' class, AK-726 is associated with 'Hawk Screech' radar. In addition to radar fire control there is local control through the Prisma optical sighting system, which may be used for engaging targets with speeds of up to 600 m/s (Mach 1.75).

Specifications
Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,215 ft/s)
Traverse: 360° at 36°/s
Elevation: −7 to +85° at 32°/s
Ammunition (total): 16 kg (35.28 lb)
Rate of fire: 90 rds/min (whole mounting)
Range:
anti-surface: 8.5 n miles (15.7 km)
anti-air (max): 10,000 m (32,808 ft)
anti-air (effective): 7,000 m (22,965 ft)

30 mm L/65 AK-230 twin mounting
All four ships have two twin AK-230, remotely operated, twin barrel, automatic anti-aircraft guns, which are designed to engage air targets at heights of up to 4,000 m (13,123 ft). It is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically powered mounting is 1.46 m (4.8 ft) high, 3.11 m (10.2 ft) long and 2.1 m (6.9 ft) wide, and consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system. Russian ammunition for this weapon consists of two rounds; BR-83 and OF-83D (see Specifications).

The fire-control radar is the I/J-band Rys (NATO = Drum Tilt), whose maximum acquisition range is approximately 22 n miles (40 km).

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,445 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,123 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
type: Armour-piercing tracer
weight (complete round): 1.47 kg (3.24 lb)
weight (projectile): 0.35 kg (0.77 lb)
OF-83D:
type: High explosive
weight (complete round): 1.40 kg (3.08 lb)
projectile: 0.27 kg (0.59 lb)
explosive: 30 g (A-XI-2)

ANTI-SUBMARINE MORTARS

RBU-6000
There are two 12-tube RBU-6000 mortars located on the foredeck. The mounting can traverse through 360° and elevation limits are −15°/+60°. Loading is automatic from a below-deck magazine. It is estimated that the rockets weigh 110 kg (242.5 lb), with a 25 kg (55.12 lb) warhead. Pairs of tubes are fired in sequence. The RGB-60 rocket is fitted with an impact-time fuze, which detonates either on hitting a solid object (such as a submarine) or when it reaches a pre-set depth. Firing is usually conducted in a full salvo of 12 rockets, but it is also possible to fire single rockets, or four- or eight-rocket salvos, if the tactical situation requires it. The warhead weighs 31 kg (68.3 lb).

MINES

There are launch rails at the stern, enabling the ship to launch up to 22 mines. (As far as is known, none of these ships is fitted with depth-charge rails or carries depth charges.)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

The fitting of specific ESM equipment cannot be confirmed, although it seems very unlikely that these ships should not be fitted with any ESM devices at all. At the very least the Russian Watch Dog and Cross Loop are probably fitted, although it is also possible that Western equipment could be installed.

DECOYS

ML Aviation Barricade countermeasures system

All four ships are fitted with two Barricade decoy launchers. Barricade (British Navy designation = Outfit DLK) provides ships with means of deploying chaff and infra-red (IR) decoys to counter missile attacks, using a layered defence against the various types of anti-ship missile. The system uses a 57 mm rocket with a 900 rpm spin, which combines stabilisation with rapid chaff blooming. There are two types of rocket: Stockade — long range; and Pallisade — short range. The system is integrated into the tactical data handling and command/weapon control system's electronic warfare suite.

Each launcher consists of six sets of triple cells, the outer three sets being angled 60° from the next in bearing so that the launchers provide all-round coverage. The inner three sets are preset to point to the same bearing, as required, but in different elevations. The inner three sets fire short-range Pallisade rockets in centroid mode, while the outer barrels fire medium- and long-range Stockade rockets in dump, distraction and confusion modes.

There are four decoy modes: confusion, distraction, dump and centroid.

Specifications

Stockade
Dimensions: 375 × 57 mm
Weight: 1.89 kg (4.2 lb) (chaff); 1.77 kg (3.9 lb) (IR)
Payload: 0.4 kg (0.88 lb)
Range: 400-2,000 m (1,312-6,561 ft) at 30°
Rocket burn: 0.6 s
Recommended range:
confusion mode: 2,000 m (6,561 ft)
dilution mode: 800 m (2,624 ft)
Chaff frequency range: 2-20 GHz
IR payload: 550 W/steradian in 8-13 µm band

Pallisade
Dimensions: 360 × 57 mm
Weight: 2.1 kg (4.6 lb)
Payload: 0.6 kg (1.3 lb)
Rocket burn: 0.6 s
Chaff frequency coverage: 8-35 GHz
IR payload: 3-14 µm band for 20 s

Manufacturer/Contractor

ML Wallop Defence Systems, Andover, Hampshire, UK.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar

The air search radar is the Russian MR-302 (NATO = Strut Curve) a medium-range, general purpose, F band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m² aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Don 2

VPB 31 and VPB 32 only. One Don 2, I-band, navigation radar.

Palm Frond

VPB 33 and VPB 34 only. One Palm Frond, I-band, navigation radar.

Owl Screech gunfire-control radar

VPB 31 and 32 only. Owl Screech is a fire-control radar of conventional design, widely used in many classes of vessels, distinguished by a circular dish scanner, behind which is mounted a fairly bulky housing which is assumed to contain transmitter and receiver, and probably turning and stabilisation gear. The complete radar is pedestal-mounted. The 2.3 m (7.5 ft) diameter scanner has a central feed supported by a four-leg structure. Feed arrangements could incorporate a rotating dipole to provide a conical scan search pattern. Dish diameter is approximately 2 m (6.5 ft) and the operating frequency is in the H/I-band.

The NATO designation Owl Screech is derived from signal characteristics noted in the course of ELINT monitoring.

The principal function is that of gunfire director against aircraft targets, although this type probably also has a certain capability against surface targets, and possibly splash detection.

CelsiusTech 9LV200 Mk 2 fire-control radar

VPB 33 and 34 only. 9LV200 Mk 2 is a J-band, frequency-agile naval fire-control radar which in these ships acts as a stand-alone fire controller for the 76 mm guns and SS-N-2c missiles. The radar is a monopulse equipment with stabilised antenna and a cassegrain scanner system. The radar mounting can also carry TV, IR camera and laser rangefinder for autonomous electro-optical tracking. A feature of the mounting is a new type of direct drive hydraulic motor capable of a slewing speed of 85°/s, and an initial acceleration of 500°/s².

Specifications

Type: J-band frequency-agile MTI monopulse
Frequency range: Random pulse-to-pulse in J-band
Transmitter: CelsiusTech Electronics YJ1321 magnetron (Mk 2); helix TWT (Mk 3)
Peak power: 65 kW (Mk 2); 1.5 kW (Mk 3)
Receiver noise: 11 dB (Mk 2); 10 dB (Mk 3)

Antenna
Diameter: 1 m (3.28 ft)
Beamwidth (at 3 dB): 1.3°
Gain: 40 dB (Mk 2); 41 dB (Mk 3)

Manufacturer/Contractor

CelsiusTech Electronics, Järfälla, Sweden.

Drum Tilt

There is a single *'Rys'* (NATO = Drum Tilt) fire-control system for the AK-230s. This is mounted on a small tower forward of the stack in *Beograd* and *Kopar*, and at the after end of the forward superstructure in *Kotor* and *Novi Sad*. It is an I/J-band system with a pedestal-mounted director whose antenna is in a weatherproof container attached to the scanner assembly and tilted at an angle of about 22°. The maximum acquisition range is approximately 22 n miles (40 km). The single radar director controls both gun mountings.

Pop Group

The Pop Group director is located aft atop a small tower. It provides the weapon control system for the SA-N-4 missile system. The director includes an acquisition radar with a long, curved antenna on top of the cab, and two target trackers. The latter two are of different size, but presumably the smaller one performs a similar function to the larger, but at higher frequencies, which would enable them to direct two different missiles against the same target. The system operates in the F/H/I band.

IFF

The ships carry one High Pole and two Square Heads.

SONARS

Herkules

VPB 31 and VPB 32.

Bull Nose

VPB 33 and VPB 34. Hull-mounted; active search and attack; medium frequency.

PROPULSION

Specifications

System: Combined diesel and gas turbine (CODAG)
Main machinery VPB 31, VPB 32: 2 Russki B-68 diesels; 11.63 MW (15,820 hp(m)) sustained; 1 SGW Nikolayev gas turbine; 13.2 MW (18,000 hp(m))
Main machinery VPB 33, VPB 34: 2 SEMT-Pielstick 12 PA6 V 280 diesels; 7.1 MW (9,600 hp(m)) sustained; 1 SGW Nikolayev gas turbine; 13.2 MW (18,000 hp(m))
Shafts: 3

FURTHER INFORMATION

PROGRAMME

The first two, Koni IV, were purchased from the (then) Soviet Union in 1978 and 1981, respectively, while the second two, Koni Mod, were built in Yugoslavia under licence.

DESIGN

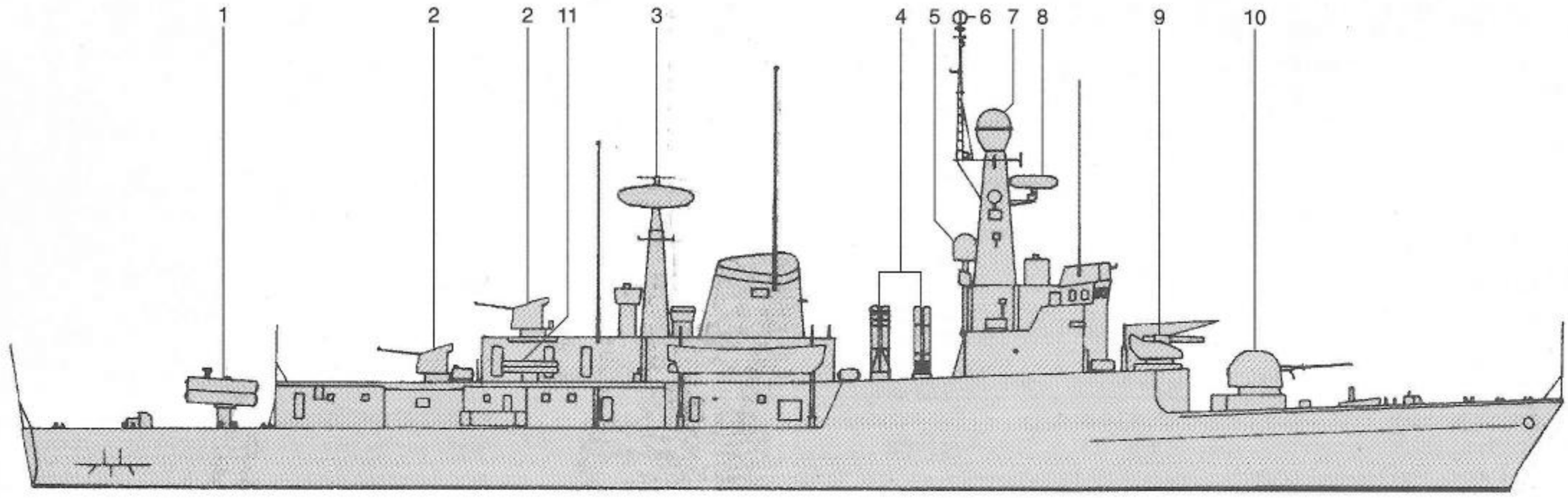
Although the hulls are identical to the 'Koni' class there are some equipment, and considerable structural differences between the Russian- and Yugoslav-built ships. The two Russian-built ships, for example, have the SS-N-2c missiles aft of midships and facing aft, while the Yugoslav-built ships have the same missiles and launchers, but level with the forward end of the bridge and facing forward. In addition, two triple torpedo tubes replace the after 76 mm gun mounting. The Yugoslav-built ships probably have the same gas-turbine engines as the other pair but there are different diesels.

There is also a different arrangement of the bridge superstructure and stack.

DEPLOYMENT

Three of the four are operational. One of the class was damaged by fire in 1991, and this may have been *Beograd* (VPB 31) which is now being cannibalised for spares. All are based at Tivat.

DESCUBIERTA



Descubierta (Ian Sturton)
1 *Selenia Albatros eight-cell launcher for Aspide SAM* **2** *Bofors 40 mm/70 in single mounts* **3** *Signaal DA05 air/surface search* **4** *McDonnell Douglas Harpoon anti-ship missiles (four)* **5** *Saturn Satcom* **6** *Elsag Mk 1000 ESM array* **7** *Signaal WM25 fire control* **8** *Signaal ZW06 navigation radar* **9** *Bofors 375 mm two-barrel anti-submarine mortar* **10** *OTOBREDA 76 mm/62 Compact gun* **11** *US Navy 324 mm Mk 32 triple torpedo tubes*

GENERAL SPECIFICATIONS

Operator: Spain

Class: DESCUBIERTA

Built: 6
Active: 6

Displacement:
standard: 1,233 t
full load: 1,666 t

Dimensions
Length: 88.88 m (291.60 ft) (oa); 85.00 m (278.87 ft) (pp)
Beam: 10.40 m (34.12 ft)
Draught: 3.8 m (12.5 ft)

Speed: 25 kts
Range: 4,000 n miles at 18 kts; 7,500 n miles at 12 kts

Complement: 118 (10 officers) plus 30 marines

SHIPS

DESCUBIERTA (F 31)
Builder Bazan, Cartagena, Spain
Laid down 16 Nov 1974
Launched 8 Jul 1975
Commissioned 18 Nov 1978

DIANA (F 32)
Builder Bazan, Cartagena, Spain
Laid down 8 Jul 1975
Launched 26 Jan 1976
Commissioned 30 Jun 1979

INFANTA ELENA (F 33)
Builder Bazan, Cartagena, Spain
Laid down 26 Jan 1976
Launched 14 Sep 1976
Commissioned 12 Apr 1980

INFANTA CRISTINA (F 34)
Builder Bazan, Cartagena, Spain
Laid down 11 Sep 1976
Launched 25 Apr 1977
Commissioned 24 Nov 1980

CAZADORA (F 35)
Builder Bazan, Ferrol, Spain
Laid down 14 Dec 1977
Launched 17 Oct 1978
Commissioned 20 Jul 1982

VENCEDORA (F 36)
Builder Bazan, Ferrol, Spain
Laid down 1 Jun 1978
Launched 27 Apr 1979
Commissioned 18 Mar 1983

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84B Harpoon

There are eight Harpoon launcher-containers at the 01 deck level, between the bridge structure and the stacks (only four are normally carried in peacetime). This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns, and for the terminal phase can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

Alenia Elsag Albatros Mk 2 Mod 9 point air defence system

The Albatros Mk 2 Mod 9 system comprises two elements:
Riva-Calzoni launcher
Aspide missile

Riva-Calzoni Albatros launcher

The single, eight-cell Albatros launcher is located on the quarterdeck. Produced by Riva-Calzoni, it has eight launch cells, four on each side of the mounting, each with a frangible front and rear cover. Each cell contains a loading guide to which the launching rail of the missile is electrically and mechanically connected. Sixteen reload missiles are stored horizontally in a hydraulically operated store and reload system in the deckhouse forward of the launcher; they are in four rows of four missiles each, their location corresponding to that of the launcher cells, and each storage cell has an autonomous missile travel device.

Selenia Aspide missile

The system uses the Selenia (now Alenia) Aspide SAM, a missile developed by Selenia from the US Sparrow. Targets are detected by the ship's primary search radar and then allocated to the fire-control system. The target is acquired by the fire-control system radar and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews in the target's direction. The missile control system selects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds. When the decision is made to engage the target with missiles the reversible prelaunch commands are

issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode. In the latter, two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch, the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at once may be controlled by the tracker, according to the manufacturer who also claims the system can engage horizontal targets at up to 8 n miles (15 km), vertical ones at 2.73 n miles (5 km) and lateral ones at 4.4 n miles (8 km). A short reaction time gives the system the ability to destroy anti-ship missiles even when detection is late.

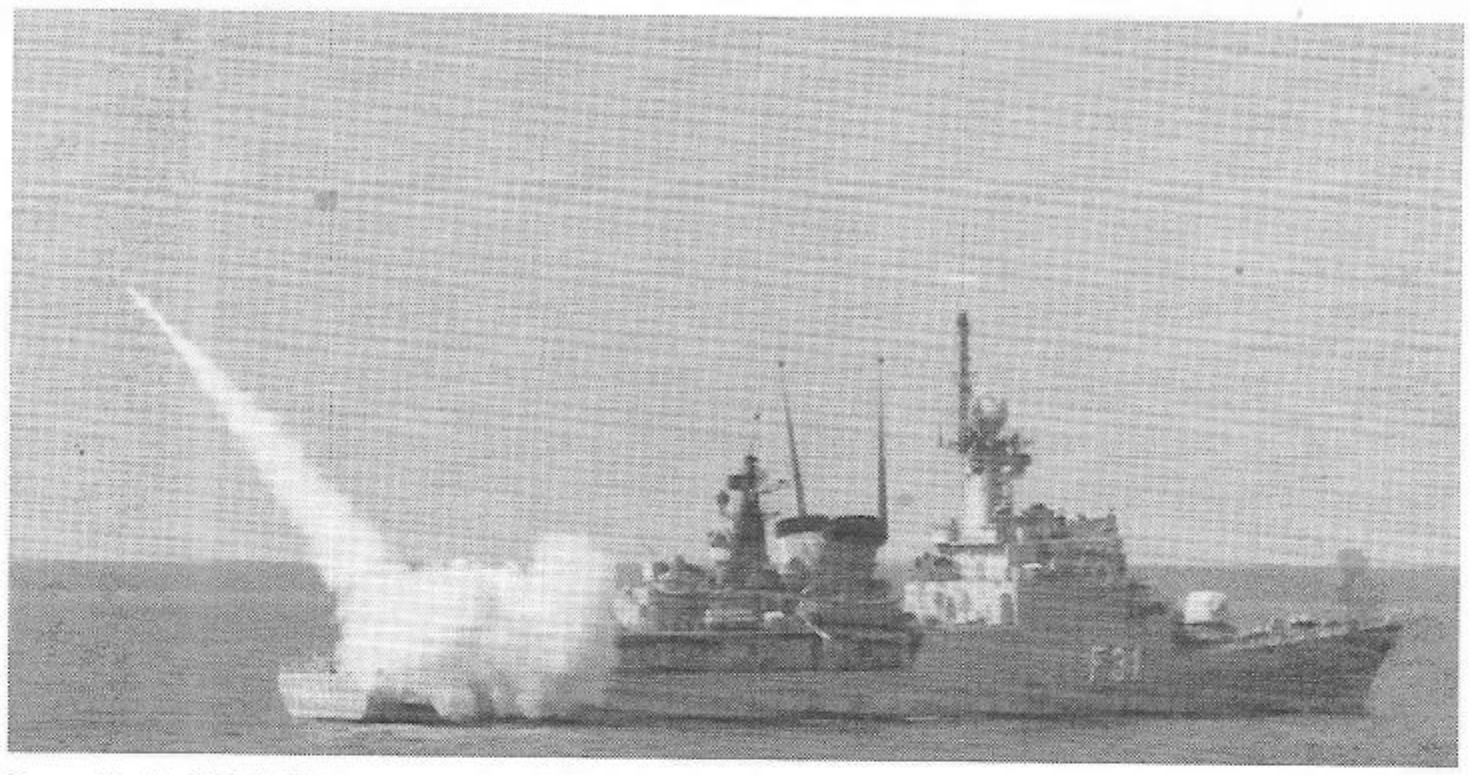
Specifications

Albatros launcher
Height: 2.98 m (9.77 ft)
Width: 3.82 m (12.53 ft)
Length: 3.82 m (12.53 ft)
Weight (loaded): 8.5 t
Traverse: 360° at 45°/s
Elevation: −5 to +80° at 25°/s

Aspide missile
Length: 3.7 m (12.14 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 80 cm (31.5 in)
Weight: 220 kg (485 lb)
Speed: Mach 2.5
Range:
anti-surface: 7 n miles (13 km)
anti-air: 15-5,000 m (50-16,000 ft)
Warhead: 33 kg (72.75 lb)
Guidance: Semi-active radar

Manufacturers/Contractors

Alenia Elsag Sistemi Navali, Rome, Italy (system/missile).
Riva-Calzoni, Bologna, Italy (launcher).



Descubierta *(F 31) firing an Aspide SAM* (Bazan)

Diana *(F 32). Note the Albatros launcher on the quarterdeck and the two Bofors 40 mm. Only one Harpoon missile launcher can been seen, but the satellite radome is fitted* (Diego Quevedo)

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited in the waist.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications

Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

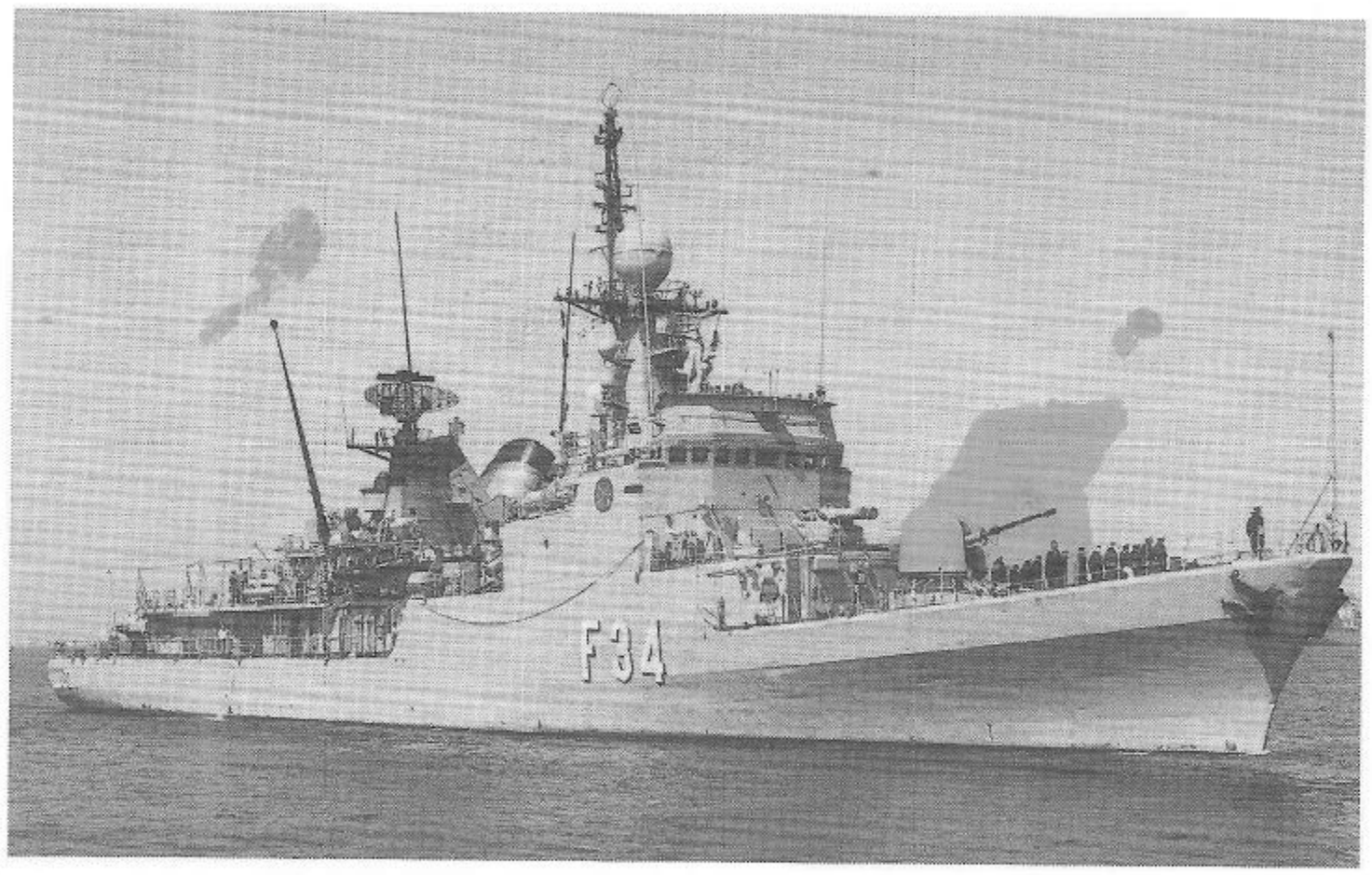
GUNS

OTOBREDA 76 mm (3 in)/62 Compact

There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications

Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s



Infanta Christina *(F 34). The Armament on the foredeck comprises an OTOBREDA 76 mm/62 Compact and a twin-barrel Bofors 375 mm ASW mortar* (Robert Pabst)

Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

Bofors 40 mm/60

There are two single Bofors 40 mm mounts located on the after superstructure.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −3 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Manufacturer/Contractor
Bofors, Sweden.

ANTI-SUBMARINE MORTARS

Bofors 375 mm ASW rocket system
There is a single, Bofors twin-tube, 375 mm ASW rocket launcher located in the 'B' gun position. The system consists of a rocket launcher, a handling system, the ship sonar and a fire-control system. The two launch tubes are mounted on trunnions with an automatic contact device to connect the rockets with the fire-control system. The hydraulic laying machinery is in the front of the mounting and a flame deflector in the rear; there is also an automatic electrohydraulic handling system. 48 rounds are stored vertically beneath the mounting and selected by an operator. The rate of fire is one round a second and rockets may be fired singly or in a salvo. There are two types of rocket, both with Hexotonal filling. The Type E (Erika) rocket has Stidar time and impact fuzes, while the Type N (Nelli) uses the Zambo proximity and impact fuzes.

Specifications
Launcher
Tubes: 4
Traverse: 260° at 18°/s
Elevation: −15 to +90° at 18°/s
Crew: 4

Rockets

	Type E	Type N
Weight	250 kg (551 lb)	230 kg (507 lb)
Muzzle velocity	130 m/s (427 ft/s)	205 m/s (673 ft/s)
Explosive weight	107 kg (236 lb)	80 kg (176 lb)
Range	0.35-0.87 n miles (0.65-1.63 km)	0.85-2.11 n miles (1.58-3.62 km)
Sinking speed	10.7 m/s (35.1 ft/s)	9.2 m/s (30.2 ft/s)

Manufacturer/Contractor
Bofors, Sweden.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

ENSA Deneb
ENSA Deneb is the ESM part of the new EW package for the 'Descubierta' class, replacing the previous radar intercept and warning elements (ELT/114 and ELT/116). It covers the frequencies 2-18 GHz.

Manufacturer/Contractor
ENSA, Spain.

Ceselsa Canopus
Canopus is the upgraded jammer suite for the 'Descubierta' class, where it has replaced both the manually operated Elettronica ELT/311 noise jammer and the ELT/511 deception jammer.

Manufacturer/Contractor
Ceselsa, Spain.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher
There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

Prairie noise suppression systems
The ships are fitted with the Prairie radiated noise suppression system in which air is passed down the propeller shaft and ejected from a groove in the leading edge of the blade, thus delaying the onset of cavitation.

AN/SLQ-25 Nixie noisemaker
One AN/SLQ-25 Nixie (Phase 1), solid-state, modular design electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom or in a partially or totally enclosed location on the main deck. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm (3.10 ft) long, 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SEWACO data handling and weapon control system
The sensor, weapon and command system in these ships is the Signaal SEWACO (SEWACO = SEnsoren WApens und COmmandosystem), at the heart of which is the DAISY-1 (DAISY = Digital Action Information SYstem), consisting of a computer and a display system. The system has been designed to fulfil the functions of anti-submarine warfare, self-defence against air attack and anti-surface warfare. The sensors contributing to the system are:

Signaal DA-05 air and surface warning radar
Signaal WM22/41 or WM25/41 combined air and surface warning and fire control, track-while-scan radar.
Signaal ZW-06 navigation and surface search radar
Ceselsa Deneb EW system
Raytheon DE-1160B sonar
External inputs received via Link 11.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11.
Satcom: Saturn

WEAPONS CONTROL

Signaal WM25 fire-control system
The Spanish ships currently have WM25 fire-control systems.

This system was designed for frigates and destroyers and requires a crew of four or five. It is capable of controlling up to two light or medium calibre guns and the Aspide point defence, semi-active homing, surface-to-air missile system. It can track simultaneously either one air and two surface targets or alternatively an air, a surface and a shore target. The configuration differs substantially from other members of the M20/WM20 family. The radar includes MTI and circular polarisation facilities for searches and pulse Doppler tracking. Peripherals include an SF-6 gas container unit for fires and a radar test set. The weapon control console is supplemented by a missile status and control panel, a bombardment corrector unit and a television console. The system receives inputs from the radar, a television director and two target designation sights. The system uses a mainframe architecture, with the prefix 'W' denoting that the SMR-S1 computer is reprogrammable. Programming is done using the Assembler software language

The prime sensor is the search and target tracking radar which shares the designation of the fire-control system. The radar features helical or horizontal scanning modes for search, monopulse tracking for air targets and track-while-scan for surface targets. The radar antennas are housed in a distinctive, egg-shaped radome, with a stabilisation system which enables them to operate at roll angles of ±30° and pitch angles of ±10°. The upper cassegrain antenna is used for searching as well as for automatic tracking of surface targets for weapon control, while the lower parabolic antenna is used for tracking air targets and for controlling air defence weapons. The antennas are fed from a common I/J-band transmitter but during surveillance all the transmitter output is channelled to the search antenna.

The search radar has a range of approximately 30-32 km against surface targets and 7,600 m against air targets, while the tracker has a range of about 29 km.

The tracker is capable of monitoring the movement of aircraft with a 1 m² cross-section at velocities up to

Cazadora *(F 35). Under the yard-arm are two spherical and two cylindrical radomes, which are part of the Elettronica Beta ESM/ECM system. The cylinders house rotating DF antennas, while the spheres are probably the jammers. These are in the process of being replaced by Spanish EW equipment* (Jane's/H M Steele)

900 m/s (2,952 m/s) and similar size objects moving at or near the surface at maximum velocities of between 34 (111 ft/s) and 55 m/s (180 ft/s).

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

SONAR

Raytheon DE-1160B (AN/SQS-53B) sonar

DE-1160B is the export version of the Raytheon AN/SQS-53B.

This is an active/passive sonar with a cylindrical array 1.6 m (5.25 ft) high and 4.8 m (15.75 ft) in diameter with 576 transducers. The sonar has a power requirement of about 65 kW, a reported active transmitting frequency of about 3 kHz and a peak frequency of 192 kHz. It operates in three active modes; surface duct, bottom bounce and convergence zone, and ranges are believed to be about 10 n miles (18.5 km) in surface duct mode and up to 34.5 n miles (64 km) in convergence zone mode. There are 37 cabinets of signal processing, transmitting and display equipment, the latter having digital display subsystems, and the system includes an AN/UYK-44 Military Reconfigurable Processor (MRP).

Manufacturer/Contractor

Raytheon, USA.

RADARS

Type	DA 05/02	ZW 06	WM25
Maker	Signaal	Signaal	Signaal
Role	Air/surface search	Navigation	Fire control
Band	E/F	I	I/J
Beam	1.5 × 8°	0.9 × 19°	Search: 1.5 × 4/7° Track: 2.4°
Peak Power	1,200 kW	60 kW	200 kW
Gain	32.2 dB	32 dB	33.5 dB
Pulsewidth	1.3/2.6 µs	0.06/0.6 µs	0.22/4.5 µs
PRF	1,000/500 pps	4,000/2,000 pps	3,600/1,800 pps
Scan rate	10.20 rpm	24 rpm	60 rpm
Typical range	75 n miles (137 km) for 2 m² target	14 n miles (25.6 km) for 10 m² target	25 n miles (46 km)

PROPULSION

Specifications

System: Diesel

Main machinery: 4 Bazan-MTU 16V 956 TB91 turbocharged diesels; 11 MW (15,000 hp(m)) sustained

Shafts: 2

Propellers: 2 Escher-Wyss, cp, 3 m (9.84 ft) diameter; 250 rpm (nominal).

FURTHER INFORMATION

PROGRAMME

The first batch of four ships was ordered on 7 December 1973, followed by the order for the second batch of four on 25 May 1976. The last ships of the second batch (F 37 and F 38) were, however, sold to Egypt before completion, and were not replaced. These ships are rated as corvettes in the Spanish Navy, although they carry 'F' pennant numbers.

DESIGN

The design of these ships originates with a Spanish Navy staff requirement issued in late 1971 for a new class of frigates:

- A high degree of national participation (83 per cent was eventually achieved).
- Cruising speed of 18 knots.
- Endurance of 4,000 n miles.
- Maximum continuous speed in excess of 25 knots.
- An integrated weapons system to include: medium-calibre guns; four light-calibre guns; SSMs; ASW torpedoes.
- Good habitability.
- Accommodation for 30 troops.

The main design was prepared by Bazan under contract to the Spanish Navy, but an outside subcontractor, expert in the ASW field (believed to be Blohm + Voss), evaluated the design as an ASW platform and a number of its recommendations (but not all) were implemented:

- Adoption of the Prairie system.
- Move the sonar dome.
- Damping numerous items of equipment, particularly near the sonar dome.
- Installation of a gas turbine high in the ship to be used during passive sonar operations.

The eventual design was based on the Portuguese 'João Coutinho' by Comodoro de Oliveira of the Portuguese Navy and final modifications by Bazan prior to construction. The Descubierta design packs a great deal into a relatively small hull (1,482 t full load displacement). Below the main deck there are two levels extending the full length of the ship, with the second deck inevitably interrupted by the machinery spaces. There is a double-bottom deck and below it most of the ship's tanks (fuel oil, lubricating oil, ballast and fresh water). The transverse bulkheads have been arranged so that the flooding of two adjacent compartments will not result in the loss of the ship.

The main longitudinal structure of the shell and decks is of HT steel, which was chosen for its combination of strength and light weight, with all transverse structures, frames, bulkheads and the secondary structure made of mild steel to Lloyd's Register Class A standards. All superstructure, deckhouses and masts, except in certain parts of the hull and weapon carrying areas are of aluminium alloy. A Y-shaped stack was adopted to minimise corrosion and obscuration effects.

Propulsion is provided by four high-speed, non-reversible diesels, two on each shaft, with the engines split between two engine rooms to enhance survivability. Manoeuvrability is enhanced by the use of two rudders abaft the propellers but slightly inboard to avoid corrosion and to permit the shaft to be removed without having first to remove the rudder.

The weapons system comprises one 76 mm gun, two 40 mm cannon, as well as eight Harpoon anti-ship missiles and an eight-cell launcher for NATO Sea Sparrow SAM, with 16 reloads. ASW capability is rather more limited, with one 375 mm mortar and two triple 324 mm torpedo tubes.

Fully stabilised. Automatic computerised engine and alternator control; two independent engine rooms; normal running on two diesels.

NAMES

Infanta Elena and *Infanta Cristina* are the daughters of King Juan Carlos. The frigate *Diana* is the tenth Spanish warship to hold that name, the line extending back to the galley *Diana* of 1570.

MODERNISATION

The original design included space and weight allowances for a VDS, but this has never been fitted, and it seems that the plan has been dropped. Similarly, it was planned at one time to replace the 40 mm gun immediately aft of the mainmast with a Meroka with associated fire-control radars but this update may also be shelved. In-service updates which have taken place include fitting two SRBOC chaff launchers and complete replacement of the Italian EW suite by a Spanish system. Link 11 has also been installed.

The WM25 fire-control system may be updated in four of the class in due course.

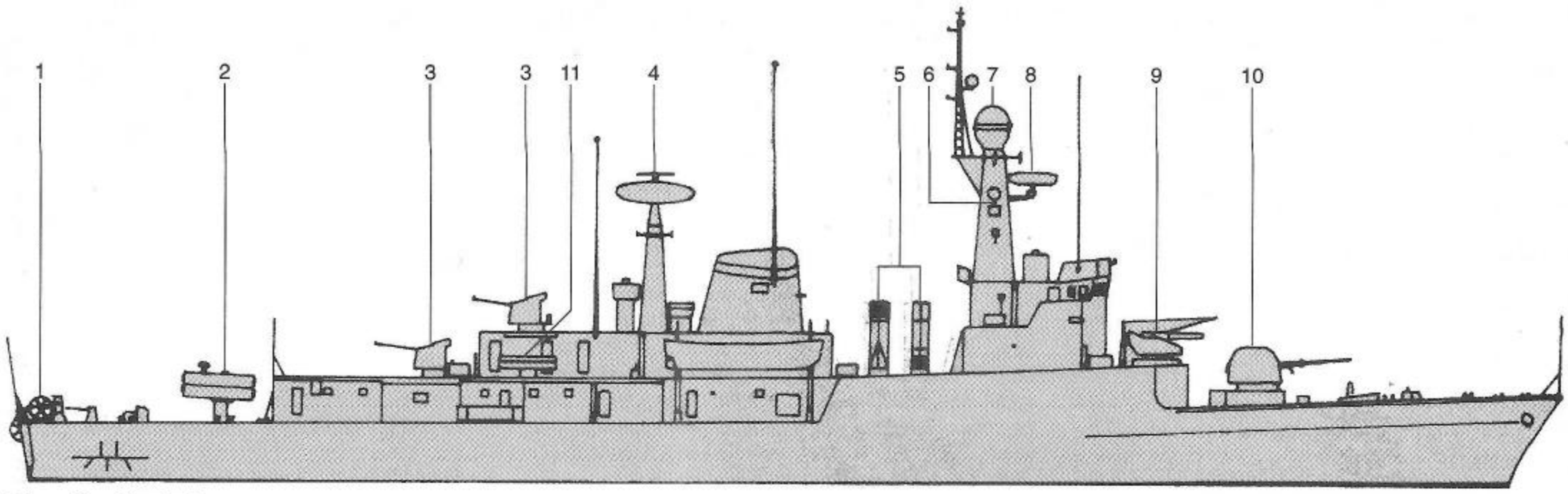
DEPLOYMENT

All are based at Cartagena, where they form the 21st Squadron.

SALES

Two were sold to Egypt in 1982 and one to Morocco in 1983.

ABU QIR (DESCUBIERTA)



El Suez (Ian Sturton)
1 *Raytheon 1167 VDS* **2** *Selenia Albatros eight-cell launcher for Aspide SAM* **3** *Bofors 40 mm/70 AA* **4** *Signaal DA05 air/surface search* **5** *McDonnell Douglas Harpoon anti-ship missiles (four)* **6** *Elettronica BETA ESM/ECM arrays* **7** *Signaal WM25 fire director* **8** *Signaal ZW06 navigation radar* **9** *Bofors 375 mm twin-tube HSW mortar* **10** *OTOBREDA 76 mm (3 in)/62 Compact gun* **11** *US 324 mm torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Spain
Operator: Egypt
Type: Descubierta

Class: ABU QIR

Purchased: 2
Active: 2

Displacement:
standard: 1,233 t
full load: 1,479 t

Dimensions
Length: 88 m (291.3 ft)
Beam: 10.4 m (34.12 ft)
Draught: 3.8 m (12.5 ft)

Speed: 25.5 kts; 28 kts trials
Range: 4,000 n miles at 18 kts

Complement: 116

SHIPS

ABU QIR (ex-*Serviola*) (F 946)

Builder	Bazan, Ferrol
Laid down	28 Feb 1979
Launched	20 Dec 1979
Completed	31 Jul 1984
Commissioned	27 Oct 1984

EL SUEZ (ex-*Centinela*) (F 941)

Builder	Bazan, Ferrol
Laid down	31 Oct 1978
Launched	6 Oct 1979
Completed	28 Feb 1984
Commissioned	21 May 1984

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84B Harpoon

There are eight Harpoon launcher-containers at the 01 deck level, between the bridge structure and the stacks (only four are normally carried in peacetime). This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns and, for the terminal phase, can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

Abu Qir *(F 946). Unlike the Spanish and Moroccan ships, the Egyptian Descubiertas are equipped with the Raytheon 1167 variable depth sonar (VDS) which can be seen on the stern. The 324 mm Mk 32 torpedo tubes can be seen abaft the ship's boat and the full complement of eight Harpoons is embarked*

SURFACE-TO-AIR MISSILES (SAM)

Alenia Elsag Albatros Mk 2 Mod 9 point air defence system

The Albatros Mk 2 Mod 9 system comprises two elements:
Riva-Calzoni launcher
Aspide missile

Riva-Calzoni Albatros launcher

The single, eight-cell Albatros launcher is located on the quarterdeck. Produced by Riva-Calzoni, it has eight launch cells, four on each side of the mounting, each with a frangible front and rear cover. Each cell contains a loading guide to which the launching rail of the missile is electrically and mechanically connected. Sixteen reload missiles are stored horizontally in a hydraulically operated store and reload system in the deckhouse forward of the launcher; they are in four rows of four missiles each, their location corresponding to that of the launcher cells, and each storage cell has an autonomous missile travel device.

Selenia Aspide missile

The system uses the Selenia (now Alenia) Aspide SAM, a missile developed by Selenia from the US Sparrow. Targets are detected by the ship's primary search radar and then allocated to the fire-control system. The target is acquired by the fire-control system radar and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews in the target's direction. The missile control system selects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds. When the decision is made to engage the target with missiles the reversible prelaunch commands are issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode. In the latter, two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch, the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at once may be controlled by the tracker, according to the manufacturer who also claims the system can engage horizontal targets at up to 8 n miles (15 km), vertical ones at 2.73 n miles (5 km) and lateral ones at 4.4 n miles (8 km). A short reaction time gives the system the ability to destroy anti-ship missiles even when detection is late.

Specifications

Albatros launcher
Height: 2.98 m (9.77 ft)
Width: 3.82 m (12.53 ft)
Length: 3.82 m (12.53 ft)
Weight (loaded): 8.5 t
Traverse: 360° at 45°/s
Elevation: -5 to +80° at 25°/s

Aspide missile
Length: 3.7 m (12.14 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 80 cm (31.5 in)
Weight: 220 kg (485 lb)
Speed: Mach 2.5
Range:
anti-surface: 7 n miles (13 km)
anti-air: 15-5,000 m (50-16,000 ft)
Warhead: 33 kg (72.75 lb)
Guidance: Semi-active radar

Manufacturers/Contractors

Alenia Elsag Sistemi Navali, Rome, Italy (system/missile).
Riva-Calzoni, Bologna, Italy (launcher).

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited in the waist.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Sting Ray lightweight anti-submarine weapon

Unlike the Spanish ships, the Egyptian Descubiertas use British Sting Ray lightweight ASW torpedo. This torpedo can be employed in deep or shallow waters, using its multiband, multibeam sonar. The narrowband capability gives good Doppler discrimination against slow or quiet targets, while the broadband capability provides target discrimination, range and bearing resolution. The acoustic beam sweeps the whole volume of the water from the surface to the maximum operating depth. The computer can be reprogrammed 'through the skin' whenever updated software is required, with the programs adapting themselves to the tactical and environmental conditions in which the torpedo operates. The computer also controls the signals, beam form, speed and trajectory of the weapon.

On entering the water the torpedo sets up a programmed search pattern designed to maximise the chances of target detection. On acquiring the target, the computer and active sonar sensors make it almost impossible for the target to evade attack. The software of the guidance/homing system enables it to filter out background noise and decoys, and to intercept the target rather than perform a conventional tailchase attack. Maximum speed is about 45 knots with an estimated endurance of some 8 minutes at that speed.

Specifications

Length: 2.59 m (8.5 ft)
Diameter: 324 mm (12.75 in)
Weight: 267 kg (in air) (589 lb)
Warhead: 35 kg (77 lb)
Speed: 45 knots (estimated)
Range: 6 n miles (11 km) (estimated)
Endurance: Approximately 8 minutes
Depth: 750 m (246 ft)

Manufacturer/Contractor

GEC-Marconi Underwater Weapons Systems Ltd.

GUNS

OTOBREDA 76 mm (3 in)/62 Compact

There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications

Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: -15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

Bofors 40 mm/60

There are two single Bofors 40 mm mounts located on the after superstructure.

Specifications

Traverse: 360° (nominal) at 90°/s
Elevation: -3 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

ANTI-SUBMARINE MORTARS

Bofors 375 mm ASW rocket system

There is a single, Bofors twin-tube, 375 mm ASW rocket launcher located in the 'B' gun position. The system consists of a rocket launcher, a handling system, the ship sonar and a fire-control system. The two launch tubes are mounted on trunnions with an automatic contact device to connect the rockets with the fire-control system. The hydraulic laying machinery is in the front of the mounting and a flame deflector in the rear; there is also an automatic electrohydraulic handling system. 48 rounds are stored vertically beneath the mounting and selected by an operator. The rate of fire is one round a second and rockets may be fired singly or in a salvo. There are two types of rocket, both with Hexotonal filling. The Type E (Erika) rocket has Stidar time and impact fuzes, while the Type N (Nelli) uses the Zambo proximity and impact fuzes.

Specifications

Launcher
Tubes: 4
Traverse: 260° at 18°/s
Elevation: -15 to +90° at 18°/s
Crew: 4

Rockets

	Type E	Type N
Weight	250 kg (551 lb)	230 kg (507 lb)
Muzzle velocity	130 m/s (427 ft/s)	205 m/s (673 ft/s)
Explosive weight	107 kg (236 lb)	80 kg (176 lb)
Range	0.35-0.87 n miles (0.65-1.63 km)	0.85-2.11 n miles (1.58-3.62 km)
Sinking speed	10.7 m/s (35.1 ft/s)	9.2 m/s (30.2 ft/s)

Manufacturer/Contractor

Bofors, Sweden.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Elettronica BETA ESM/ECM suite

The Egyptian ships are fitted with the same Elettronica EW suite as was fitted in the Spanish ships before their modernisation. The antennas are located in two sets of radomes below the yard-arm on either side of the foremast; the upper pair are globes, the lower pair a flat-topped cylinder, similar in appearance to the Russian Top Hat. The BETA suite comprises:

ELT/114 and ELT/116. Radar intercept and warning sets covering the frequencies 2-18 GHz.
ELT/311 and ELT/511. These are manually operated noise and deception jammers, respectively.

El Suez *(F 941). The EW radomes of the Elettronica BETA system show up prominently on the side of the mast*

Telegon

A Telegon communications electronics support measures (CESM) direction-finding set is installed in both ships.

Prairie noise suppression systems

The ships are fitted with the Prairie radiated noise suppression system in which air is passed down the propeller shaft and ejected from a groove in the leading edge of the blade, thus delaying the onset of cavitation. (As these two ships were originally constructed for the Spanish Navy, whose ships have only the Prairie and not the Masker system, as well, it seems unlikely that the Egyptian ships have Masker.)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SEWACO data handling and weapon control system

The sensor, weapon and command system in these ships is the same Signaal SEWACO (SEWACO = SEnsoren WApens und COmmandosystem) as that fitted originally in the Spanish ships. At the heart of this system is the DAISY-1 (DAISY = Digital Action Information SYstem), consisting of a computer and a display system. The system has been designed to fulfil the functions of anti-submarine warfare, self-defence against air attack and anti-surface warfare. The sensors contributing to the system are:

- Signaal DA05 air and surface warning radar.
- Signaal WM25 combined air and surface warning and fire-control, track-while-scan radar.
- Signaal ZW-06 navigation and surface search radar.
- Raytheon DE-1160B sonar.
- External inputs received via Link Y (see below).

(Note that the Elettronica BETA EW suite is a stand-alone system and cannot be interfaced with an automated system such as SEWACO.)

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

Type	DA 05	ZW 06	WM25
Maker	Signaal	Signaal	Signaal
Role	Air/surface search	Navigation	Fire control
Band	E/F	I	I/J
Beam	1.5 × 8°	0.9 × 19°	Search: 1.5 × 4/7° Track: 2.4°
Peak Power	1,200 kW	60 kW	200 kW
Gain	32.2 dB	32 dB	33.5 dB
Pulsewidth	1.3/2.6 µs	0.06/0.6 µs	0.22/4.5 µs
PRF	1,000/500 pps	4,000/2,000 pps	3,600/1,800 pps
Scan rate	10.20 rpm	24 rpm	60 rpm
Typical range	75 n miles (137 km) for 2 m² target	14 n miles (7.6 km) for 10 m² target	25 n miles (46 km)

COMMUNICATIONS AND DATALINKS

Link YE

The Egyptian Navy purchased the Signaal version of Link Y, which was developed in the UK by Ferranti as a digital link suitable for sale to non-NATO countries for naval and aircraft use. Different users have versions tailored to their own needs; Link YE, for example, is exclusive to the Egyptian Navy.

Link Y, generally, uses a standard message format of two 24-bit words and a transmission speed of 300-1,200 bits/s.

SONAR

Raytheon DE1167LF/VDS sonar

The Egyptian ships have been retrofitted with the DE 1167, which includes both a hull-mounted 7.5 kHz hull-mounted 36-stave transducer array and a 12 kHz VDS. This system uses digital electronics and an advanced control and display system. Outboard units consist of a transducer array and a 4.17 m (13.7 ft) long dome and the VDS winch, overboarding assembly, control station, hydraulic power supply, 200 m faired cable and towed body for the 12 kHz variable depth subsystem.

The basic hull-mounted DE1167 is an active/passive, preformed beam, omni and directional transmission sonar which uses three non-interfering 600 Hz wide FM transmission bands centred at 7.5 kHz and has a spatial Polarity Coincidence Correlation (PCC) receiver. The passive mode, which is selected automatically when transmissions are stopped, is primarily useful for torpedo detection. Optional items in production include a performance prediction subsystem, an auxiliary half-frequency passive receiver, an auxiliary display, a remote display and a training/test target remote-control unit. Signal reception and beamforming are accomplished by broadband analogue circuitry followed by clipper amplifiers for perfect data normalisation.

Specifications

Centre frequency: VDS—12 kHz; hull-mounted—7.5 kHz

Source level: TRDT 227 dB (HM), omni 217 dB

Pulse type: 600, 2,000 Hz FM sweep; 100, 200, 50, 6 ms pulse lengths
Receiver type: Spatial polarity coincidence correlator (PCC) between 36 pairs of half-beams
Beam characteristics: 36 sets of right and left half-beams for active and passive detection. Selectable 10°H × 13°V sum beam for audio listening. 1.25° bearing interpolation for fine search display

Track displays: Sector scan indicator (1,000 yd × 10°) and target Doppler indicator (1,000 yd × ±60 knots)
Target data: Range: 6.1 m (24 ft) resolution. Bearing 1.25° resolution plus active search display −0.1° and 3 m (9.84 ft) on SSI display. ±60 kts of Doppler at 1 kt steps on the TDI
Data format: Standard: NTDS ANEW (digital). Optional: NTDS slow, Fast Serial D/S synchro converters

Manufacturer/Contractor

Raytheon Company Submarine Signal Division, Portsmouth, Rhode Island, USA.

PROPULSION

Specifications

System: Diesel
Main machinery: 4 Bazan-MTU 16V 956 TB91 turbocharged diesels; 11 MW (15,000 hp(m)) sustained

Shafts: 2
Propellers: 2 Escher-Wyss, cp, 3 m (9.84 ft) diameter; 250 rpm (nominal).

FURTHER INFORMATION

PROGRAMME

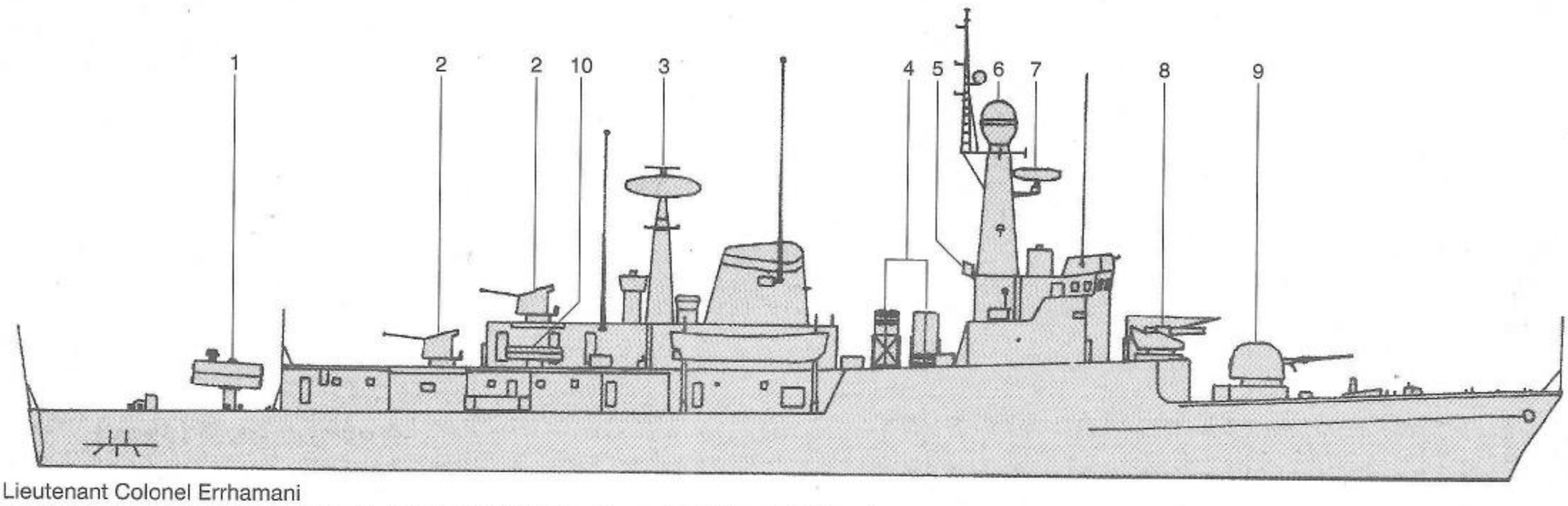
These two ships were ordered from Bazan, Spain in September 1982 and were allocated from the batch already under construction for the Spanish Navy. The two ships concerned were *Centinela* (F 37) and *Serviola* (F 38) and they were completed at Ferrol as *El Abu Qir* and *El Suez,* respectively and then moved to Cartagena for modification before transfer.

MODERNISATION

The combat data system and air search radar were updated in 1995.

El Suez *(F 941). The two ships for Egypt were taken from the Spanish production order, but were not replaced* (Bazan)

ERRHAMANI (MODIFIED DESCUBIERTA)



Lieutenant Colonel Errhamani

1 *Selenia Albatros launcher for Aspide SAM* **2** *OTOBREDA 40 mm/70* **3** *Signaal DA05 air search radar* **4** *Aerospatiale MM38 Exocet anti-ship missiles* **5** *Satellite communications antenna* **6** *Signaal WM25/41 fire control* **7** *Signaal ZW06 navigation radar* **8** *Bofors 375 mm twin tube ASW mortar* **9** *OTOBREDA 76 mm (3 in)/62 Compact* **10** *US Mk 32 324 mm triple ASW torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Spain
Operator: Morocco
Type: Modified Descubierta

Class: ERRHAMANI

Purchased: 1
Active: 1

Displacement:
standard: 1,233 t
full load: 1,479 t

Dimensions
Length: 88.8 m (291.3 ft)
Beam: 10.4 m (34 ft)
Draught: 3.8 m (12.5 ft)

Speed: 25.5 kts
Range: 4,000 n miles at 18 kts (one engine)

Complement: 100

SHIPS

LIEUTENANT COLONEL ERRHAMANI (501)

Builder	Bazan, Cartagena
Laid down	20 Mar 1979
Launched	26 Feb 1982
Commissioned	28 Mar 1983

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 38 medium-range anti-ship missile

Unlike the Spanish and Egyptian ships which have eight Harpoon SSMs, the Moroccan Descubierta is armed with four MM 38 Exocets, although these are mounted in the same place between the bridge superstructure and the twin stacks. The missiles are carried in two twin launcher-containers pointing across the centreline at the opposite beam. These launcher-containers are inclined at an angle of 12° to the horizontal. In addition to the launcher installations there is a control console and there is a co-ordinate converter to interface the missile with the ship's sensors.

Targets are acquired by the ship's search radar and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence. This involves turning on the thermal battery, releasing the mechanical safety locks, igniting the booster, and, finally, breaking the umbilical cord; the total process takes some 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change of course during its flight.

The attack consists of two phases:

Cruise phase. The cruise phase starts as the missile clears the container and the missile, powered by the sustainer motor, flies towards the general location of the target at a height of about 100 m (328 ft) which is low enough to reduce the chance of detection but adequate for target acquisition. This phase can be as long as 22 km and ends when the seeker acquires the target. This seeker is a Dassault Electronique ADAC (Auto Directeur Anti-Clutter) active monopulse radar, working in the I-band (8-10 GHz), which has a typical range of 13 n miles (24 km) against FACs.

Approach phase. On detecting the target the missile descends to 9-15 m (30-50 ft) in the approach phase.

Terminal phase. During this final phase the missile descends to 8 m (2-5 m in a calm sea) (26 ft (6.5-16.4 ft)) for a sea-skimming run in to the target.

A salvo may be fired in 12-20 seconds.

Specifications

MM 38
Length: 5.21 m (17.1 ft)
Diameter: 35 cm (13.8 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s
Booster: SNPE Epervier boost motor; burn time of 2.4 s
Warhead: Luchaire 165 kg (364 lb) fragmentation warhead
Fuzes: Delayed impact fuze and autopilot-controlled proximity fuze.

Manufacturer/Contractor

Aerospatiale Missiles, Paris, France.

SURFACE-TO-AIR MISSILES (SAM)

Alenia Elsag Albatros Mk 2 Mod 9 point air defence system

The Albatros Mk 2 Mod 9 system comprises two elements:

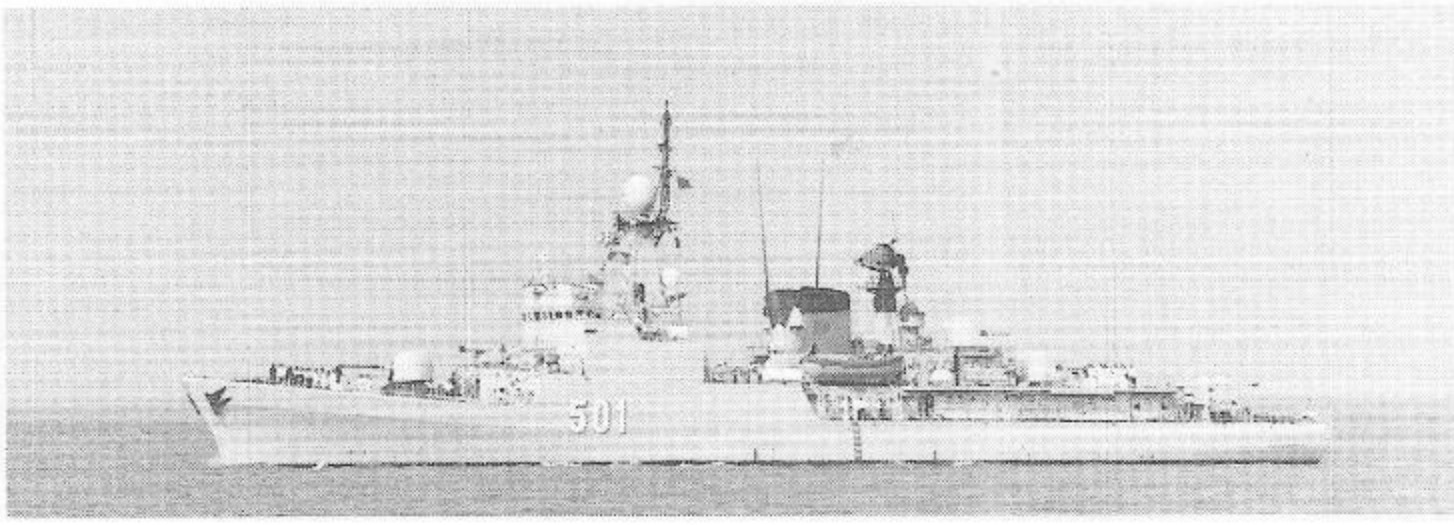
Riva-Calzoni launcher
Aspide missile

Riva-Calzoni Albatros launcher

The single, eight-cell Albatros launcher is located on the quarterdeck. Produced by Riva-Calzoni, it has eight launch cells, four on each side of the mounting, each with a frangible front and rear cover. Each cell contains a loading guide to which the launching rail of the missile is electrically and mechanically connected. Sixteen reload missiles are stored horizontally in a hydraulically operated store and reload system in the deckhouse forward of the launcher; they are in four rows of four missiles each, their location corresponding to that of the launcher cells, and each storage cell has an autonomous missile travel device.

Selenia Aspide missile

The system uses the Selenia (now Alenia) Aspide SAM, a missile developed by Selenia from the US Sparrow. Targets are detected by the ship's primary search radar and then allocated to the Signaal WM25 fire-control system. The target is acquired by the fire-control system radar and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews in the target's direction. The missile control system sel-



Lieutenant Colonel Errhamani *(F 501), flagship of the Moroccan Navy. Note that the Moroccan ship has turret-mounted OTOBREDA 40 mm, whereas all other 'Descubierta' class have simple, open mounts. It is also the only Descubierta to be armed with Exocet anti-ship missiles, although it is rarely seen with the launch tubes actually mounted* (Jane's/H M Steele)

ects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds. When the decision is made to engage the target with missiles the reversible pre-launch commands are issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode. In the latter, two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at once may be controlled by the tracker, according to the manufacturer who also claims the system can engage horizontal targets at up to 8 n miles (15 km), vertical ones at 2.73 n miles (5 km) and lateral ones at 4.4 n miles (8 km). A short reaction time gives the system the ability to destroy anti-ship missiles even when detection is late.

Specifications
Albatros launcher
Height: 2.98 m (9.77 ft)
Width: 3.82 m (12.53 ft)
Length: 3.82 m (12.53 ft)
Weight (loaded): 8.5 t
Traverse: 360° at 45°/s
Elevation: -5 to +80° at 25°/s

Aspide missile
Length: 3.7 m (12.14 ft)
Diameter: 20.3 cm (8.0 in)
Wing span: 80 cm (31.5 in)
Weight: 220 kg (485 lb)
Speed: Mach 2.5
Range:
anti-surface: 7 n miles (13 km)
anti-air: 15-5,000 m (50-16,000 ft)
Warhead: 33 kg (72.75 lb)
Guidance: Semi-active radar

Manufacturers/Contractors
Alenia Elsag Sistemi Navali, Rome, Italy (system/missile).
Riva-Calzoni, Bologna, Italy (launcher).

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited in the waist.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 1 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Compact
There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications
Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: -15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm/70 Type 564
There are two single OTOBREDA Type 564 40 mm/70 mounts located on the after superstructure. These have a glass-reinforced plastic (GRP) gunshield, an electrically powered automatic feed device, and a digital servo system.

Specifications
Traverse: 360° (nominal) at 85°/s
Elevation: -9 to +83° at 45°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,000 m/s (3,297 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ANTI-SUBMARINE MORTARS

Bofors 375 mm ASW rocket system
There is a single, Bofors twin-tube, 375 mm ASW rocket launcher located in the 'B' gun position. The system consists of a rocket launcher, a handling system, the ship sonar and a fire-control system. The two launch tubes are mounted on trunnions with an automatic contact device to connect the rockets with the fire-control system. The hydraulic laying machinery is in the front of the mounting and a flame deflector in the rear; there is also an automatic electrohydraulic handling system. 48 rounds are stored vertically beneath the mounting and selected by an operator. The rate of fire is one round a second and rockets may be fired singly or in a salvo. There are two types of rocket, both with Hexotonal filling. The Type E (Erika) rocket has Stidar time and impact fuzes, while the Type N (Nelli) uses the Zambo proximity and impact fuzes.

Specifications
Launcher
Tubes: 4
Traverse: 260° at 18°/s
Elevation: -15 to +90° at 18°/s
Crew: 4

Rockets

	Type E	Type N
Weight	250 kg (551 lb)	230 kg (507 lb)
Muzzle velocity	130 m/s (427 ft/s)	205 m/s (673 ft/s)
Explosive weight	107 kg (236 lb)	80 kg (176 lb)
Range	0.35-0.87 n miles (0.65-1.63 km)	0.85-2.11 n miles (1.58-3.62 km)
Sinking speed	10.7 m/s (35.1 ft/s)	9.2 m/s (30.2 ft/s)

Manufacturer/Contractor
Bofors, Sweden.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Elettronica ELT 715
This ship is fitted with the Elettronica ELT 715 intercept and jamming system, which appears to have been specially developed for this application.

DECOYS

DAGAIE countermeasures system
There are two DAGAIE ten-barrelled, trainable launchers mounted on top of the bridge structure, just forward of the DRBC-32E director, which can be loaded with either IR or chaff rockets. The firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, windspeed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate between them and thus collocation of

both decoys is achieved. The installation is a double mounting and comprises two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either 3-5 and 8-14 µm IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised glass fibre chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 µm bands.

Specifications

Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)

Manufacturer/Contractor

CSEE Défense, Paris, France.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SEWACO-MR data handling and weapon control system

The sensor, weapon and command system in these ships is designated Signaal SEWACO-MR (SEWACO = SEnsoren WApens und COmmandosystem) (MR = Morocco) and is similar to that fitted originally in the Spanish ships. At the heart of this system is the DAISY-1 (DAISY = Digital Action Information SYstem), consisting of a computer and a display system. The system has been designed to fulfil the functions of anti-submarine warfare, self-defence against air attack and anti-surface warfare. The senors contributing to the system are:

- Signaal DA05 air and surface warning radar.
- Signaal WM25/41 combined air and surface warning and fire control, track-while-scan radar.
- Signaal ZW-06 navigation and surface search radar.
- Raytheon DE-1160B sonar.

(Note that the Elettronica ELT 715 EW suite is a stand-alone system and cannot be interfaced with an automated system such as SEWACO).

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Lieutenant Colonel Errhamani *(F 501). This ship does not have the same EW fit as the Spanish and Egyptian ships and thus has no small radomes on the side of the mast* (Jane's/H M Steele)

SONAR

Raytheon DE-1160B (AN/SQS-53B) sonar

DE-1160B is the export version of the Raytheon AN/SQS-53B.

This is an active/passive sonar with a cylindrical array 1.6 m (5.2 ft) high and 4.8 m (15.7 ft) in diameter with 576 transducers. The sonar has a power requirement of about 65 kW, a reported active transmitting frequency of about 3 kHz and a peak frequency of 192 kHz. It operates in three active modes; surface duct, bottom bounce and convergence zone, and ranges are believed to be about 10 n miles (18.5 km) in surface duct mode and up to 34.5 n miles (64 km) in convergence zone mode. There are 37 cabinets of signal processing, transmitting and display equipment, the latter having digital display subsystems, and the system includes an AN/UYK-44 Military Reconfigurable Processor (MRP).

Manufacturer/Contractor

Raytheon, USA.

RADARS

Type	DA 05	ZW 06	WM25/41
Maker	Signaal	Signaal	Signaal
Role	Air/surface search	Navigation	Fire control
Band	E/F	I	I/J
Beam	1.5 × 8°	0.9 × 19°	Search: 1.5 × 4/7° Track: 2.4°
Peak Power	1,200 kW	60 kW	200 kW
Gain	32.2 dB	32 dB	33.5 dB
Pulsewidth	1.3/2.6 µs	0.06/0.6 µs	0.22/4.5 µs
PRF	1,000/500 pps	4,000/2,000 pps	3,600/1,800 pps
Scan rate	10.20 rpm	24 rpm	60 rpm
Typical range	75 n miles (137 km) for 2 m² target	14 n miles (7.6 km) for 10 m² target	25 n miles (46 km)

PROPULSION

Specifications

System: Diesel
Main machinery: 4 Bazan-MTU 16V 956 TB91 turbocharged diesels; 11 MW (15,000 hp(m)) sustained
Shafts: 2
Propellers: 2 Escher-Wyss, cp, 3 m (9.84 ft) diameter; 250 rpm (nominal).

FURTHER INFORMATION

PROGRAMME

This ship was ordered on 7 June 1977 and delivered, after delays due to a strike, in March 1983.

DESIGN

This ship has a number of differences from the original Spanish ships, of which the most noticeable is that it is armed with Exocet SSMs instead of Harpoons. These missiles are, however, rarely mounted in the ships.

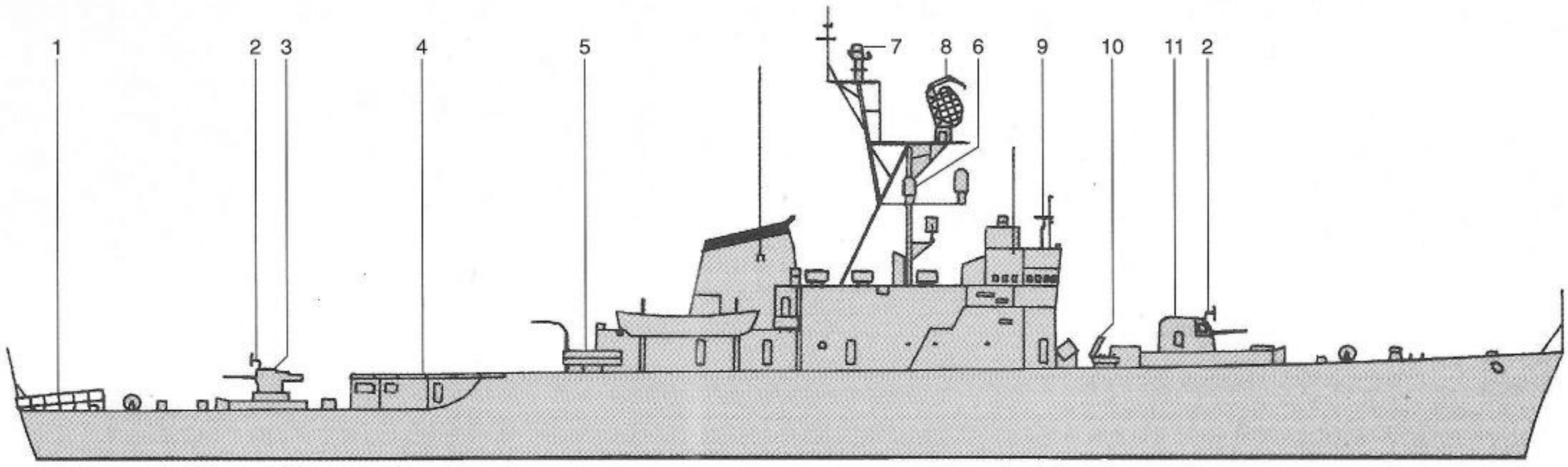
MODERNISATION

The new OTOBREDA 40 mm mounts were fitted in 1995, replacing two manual 40 mm mounts.

THE FUTURE

This is the largest unit in the Moroccan Navy and efforts to find the funds for another ship of similar size have not been successful. Morocco was one of the countries offered a 'Knox' class frigate on lease in 1994, but declined the offer, although the concurrent offer of the grant transfer of a 'Newport' class LST was accepted.

BERK



Berk
1 *Depth charge rack* **2** *Western Electric Mk 34 fire-control radar* **3** *US Navy twin 76 mm (3 in)/50 in open mount* **4** *Flight deck* **5** *US Navy triple Mk 32 324 mm torpedo tubes* **6** *AN/WLR-1 radar warning* **7** *Raytheon AN/SPS-10 surface search radar* **8** *Lockheed AN/SPS-40 air search radar* **9** *Racal-Decca TM 1226 navigation radar* **10** *Mk 11 hedgehog 24-rocket ASW launcher (two)* **11** *US Navy twin 76 mm (3 in)/50 in closed mount*

GENERAL SPECIFICATIONS

Country of origin: USA/Turkey
Operator: Turkey

Class: BERK

Built: 2
Active: 2

Displacement:
standard: 1,450 t
full load: 1,950 t

Dimensions
Length: 95 m (311.7 ft)
Beam: 11.8 m (38.7 ft)
Draught: 5.5 m (18.1 ft)

Speed: 25 kts

Complement: 164 (14 officers)

SHIPS

BERK (D 358)	
Builder	Golcük Naval Yard, Golcük, Turkey
Laid down	9 Mar 1967
Launched	25 Jun 1971
Commissioned	12 Oct 1973

PEYK (D 359)	
Builder	Golcük Naval Yard, Golcük, Turkey
Laid down	18 Jan 1968
Launched	7 Jun 1972
Commissioned	15 Apr 1976

WEAPONS SYSTEMS

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited at the forward end of the flight deck.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5, 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

US Navy 76 mm (3 in) L/50 Mk 34 gun mounting

There are two twin 76 mm (3 in) mounts. The mount in 'A' position is in a closed gunhouse, while that in 'Y' position is in an open mount, which is the same arrangement as in the 'Claud Jones' class, as built.

Berk *(D 358) in 1995. Note that the forward twin 76 mm mount is enclosed and the after mount open, a feature found on several US Navy frigate designs in the 1960s* (Selim San)

Specifications
Calibre: 76.2 mm
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (new gun, nominal); 808 m/s (mid-life)
Range: 7 n miles (13 km)
Altitude: 8,951 m (29,368 ft)
Ammunition: 10.9 kg (24 lb)

Mk 34
Traverse: 360°
Elevation: −14/15 to +85°
Traverse rate: 30°/s
Elevation rate: 24°/s
Rate of fire: 50 rds/min

ANTI-SUBMARINE MORTARS

Projector Mk 11 (Hedgehog)

Despite their age, two Hedgehog Mk 11 anti-submarine spigot mortars are retained. The bombs are fired into a circular pattern with a 41 m (134.5 ft) radius at a range of 230-250 m (755-820 ft).

Specifications
Projectile
Diameter: 177.8 mm (7 in)
Weight: 29.5 kg (65 lb)
Fuze: Impact
Explosive weight: 13.6 kg (30 lb)
Sinking speed: 7.6 m/s (25 ft/s)

DEPTH CHARGES

One rack.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

AN/WLR-1
AN/WLR-1 is a US-manufactured, manually operated, radar warning system covering frequencies from 50 MHz to 10.75 GHz, employing a number of separate antennas.

WEAPONS CONTROL

Mk 63 GFCS
There are two Mk 63 GFCS associated with the two 76 mm gun mounts, which are a combination of the Mk 51 sight and an SPG-34 radar (see below).

SONAR

AN/SQS 29
The sonar is one of the AN/SQS-29/-31 series. All are similar, being hull-mounted, active search and attack sonars, operating at high frequency. The design was based on the SQS-4 Mod 1, but with a passive search capability.

Specifications
Frequency: 8 kHz
Pulse length: 2, 7, 30, or 120 ms
Nominal range: 6,900 m (7,500 yd)

RADARS

Set	AN/SPS-40	AN/SPS-10	TM 1226	AN/SPG-34 (two)
Company	Lockheed	Raytheon	Racal-Decca	Western Electric
Role	Surface search	Surface search	Navigation	Mk 63 GFCS (guns)
Band	E/F	G	I	I
Beam	11 × 19°	1.5 × 16°	1.2°	2.5°
Peak power	200 kW	500 kW	25 kW	50 kW
Gain	21 dB	30 dB	30dB	36 dB
Pulsewidth	60 µs	0.25/1.3 µs	0.05/0.25/1 µs	0.3 µs pps
PRF	300 pps	625-650 pps		1,800 pps
Scan rate	7.5/15 rpm	15 rpm	28 rpm	28 rpm
Range	175 n miles (320 km)			

AVIATION

AVIATION FACILITIES

There is no hangar. The flight deck will accommodate an Agusta-Bell AB 212ASW

Specifications
Flight deck: 13.6 × 11.8 m (44 × 38 ft)
Helicopter: There are landing/take-off facilities only.

PROPULSION

Specifications
System: Diesel
Main machinery: 4 Fiat-Tosi Type 3-016-RSS diesels; 17.7 MW (24000 hp(m))
Shaft: 1

FURTHER INFORMATION

PROGRAMME

These were the first major warships to be designed and built in Turkey. Two were ordered and built between 1967 and 1975.

DESIGN

The design was based on that of the US Navy's 'Claud Jones' (now the Indonesian 'Samadikun' class). However, the hull design was altered slightly and the Turkish ships have a more powerful and better balanced armament.

The Turkish ships are powered by four Fiat-Tosi diesels driving a single screw, compared to the American ships' four Fairbanks-Morse diesels driving two propellers. As a result, the Turkish ships have a top speed of 25 knots, compared to 21.5 knots for the 'Claud Jones' class.

The Turkish ships also have a flight deck which will accept an Agusta-Bell AB 212ASW, although there is no hangar.

Berk *(D 358) was the first major warship to be built in Turkey. The design was based on that of the US Navy's 'Claud Jones' but with modifications to overcome the deficiencies of that unpopular class* (Selim San)

NAMES

Both ships are named after famous ships of the former Ottoman Navy.

VOSPER THORNYCROFT FAST FRIGATES

OVERVIEW

The British company Vosper (later Vosper Thornycroft) has marketed a series of 'fast frigate' designs and corvettes, which, while not identical, have followed the same general pattern of appearance, design philosophy and weapons systems. Of 25 built, 15 remain in service. They are summarised below:

TABLE I: VOSPER THORNYCROFT FAST FRIGATE DESIGNS

Designation	Customer	Number built	Displacement	Propulsion	Launched	Main weapons	Current status
Mk 1	Ghana	2	500 t	2 × diesel	1963-65	1 × 4 in 1 × 40 mm 1 × Squid	Stricken — 2
Mk 3	Nigeria	2	650 t	2 × diesel	1970-71	2 × 4 in/45 2 × 40 mm 2 × 20 mm	Stricken — 2
Mk 5	Iran	4	1,540 t	2 × GT 2 × diesel	1968-69	1 × SSM 1 × SAM 1 × 114 mm 2 × 35 mm 2 × 30 mm 1 × Limbo	Sunk — 1 Active — 3
Mk 7	Libya	1	1,625 t	2 × GT 2 × diesel	1969	2 × SAM 1 × 114 mm 2 × 40 mm 2 × 35 mm 1 × Limbo	Stricken — 2
Mk 9	Nigeria	2	850 t	4 × diesel	1977-78	1 × 76 mm 1 × 40 mm 2 × 20 mm 1 × Seacat 2 × ASW RL	Unserviceable — 2
Mk 10 ASW	Brazil	4	3,800 t	2 × GT 4 × diesels	1974-76	2 × SAM 1 × ASW 1 × 114 mm 2 × 40 mm 1 × ASW RL 6 × TT 1 × DC 1 × hel	Active — 4
Mk 10 GP	Brazil	2	3,800 t	2 × GT 4 × diesels	1974-75	4 × SSM 2 × SAM 2 × 114 mm 2 × 40 mm 1 × ASW RL 6 × TT 1 × DC 1 × hel	Active — 2
Type 21	UK	8	3,600 t	2 × GT (boost) 2 × GT (cruise)	1971-75	4 × SSM 1 × SAM 1 × 114 mm 2 × 20 mm 6 × TT	Sunk — 2 To Pakistan — 6

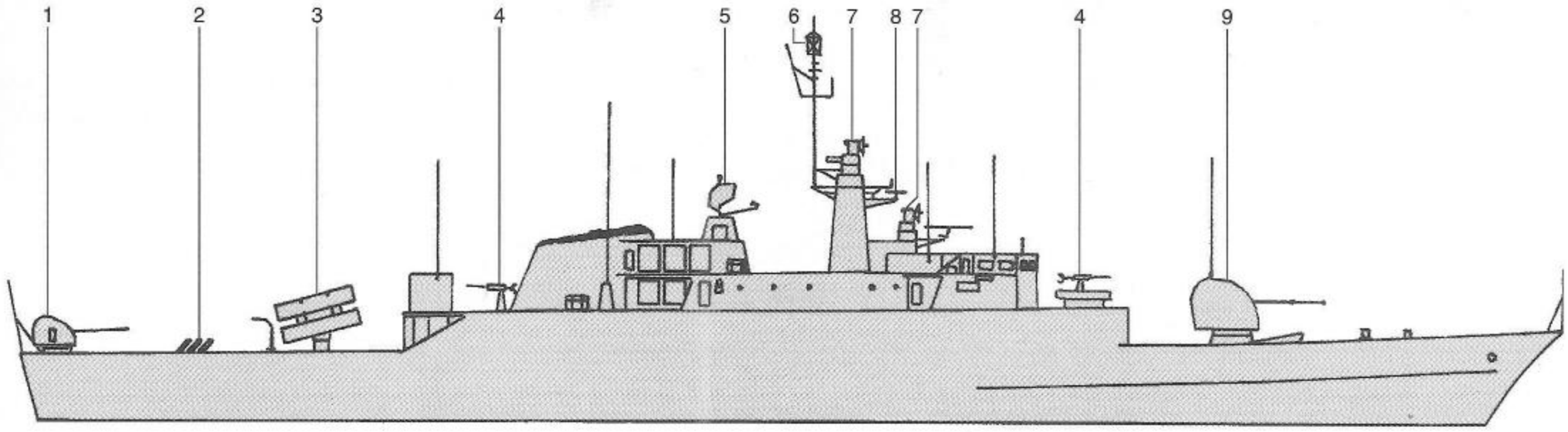
Mk 1 of the Ghana Navy (Vosper Thornycroft)

Mk 3 of the Nigerian Navy (Vosper Thornycroft)

Mk 7, Dat Assawari, *of the Libyan Navy*
(Vosper Thornycroft)

Mk 9 of the Nigerian Navy (Vosper Thornycroft)

ALVAND (VOSPER Mk 5)



Alvand (Ian Sturton)

1 *Oerlikon 35 mm/90 twin* **2** *UK Mk 10 Limbo three-tube ASW mortar* **3** *Sistel Sea Killer II fire-cell launcher with BM-21 multiple rocket launcher replacing top row* **4** *GAM-BO1 20 mm cannon* **5** *Plessey AWS 1 air/surface search radar* **6** *Racal-Decca FH-5 HF/DF* **7** *Contraves Sea Hunter fire control* **8** *Racal-Decca 1226 navigation radar* **9** *VSEL 114 mm (4.5 in)/55 Mk 8*

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: Iran
Type: Vosper Mk 5

Class: ALVAND

Purchased: 4
Active: 3

Displacement:
standard: 1,100 t
full load: 1,540 t

Dimensions
Length: 94.5 m (310 ft)
Beam: 11.1 m (36.4 ft)
Draught: 7.6 m (24.9 ft)

Speed: 39 kts (gas turbine); 18 kts (diesel)
Range: 3,650 n miles at 18 kts; 550 n miles at 36 kts

Complement: 125 (accommodation for 146)

SHIPS

ALVAND (71)

Builder	Vosper Thornycroft, Woolston, UK
Laid down	22 May 1967
Launched	25 Jul 1968
Commissioned	20 May 1971

ALBORZ (72)

Builder	Vickers, Barrow-in-Furness, Cumbria, UK
Laid down	3 Mar 1968
Launched	4 Mar 1969
Commissioned	1 Mar 1971

SABALAN (73)

Builder	Vickers, Newcastle-upon-Tyne and Barrow-in-Furness, UK
Laid down	10 Dec 1967
Launched	4 Mar 1969
Commissioned	Jun 1972

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

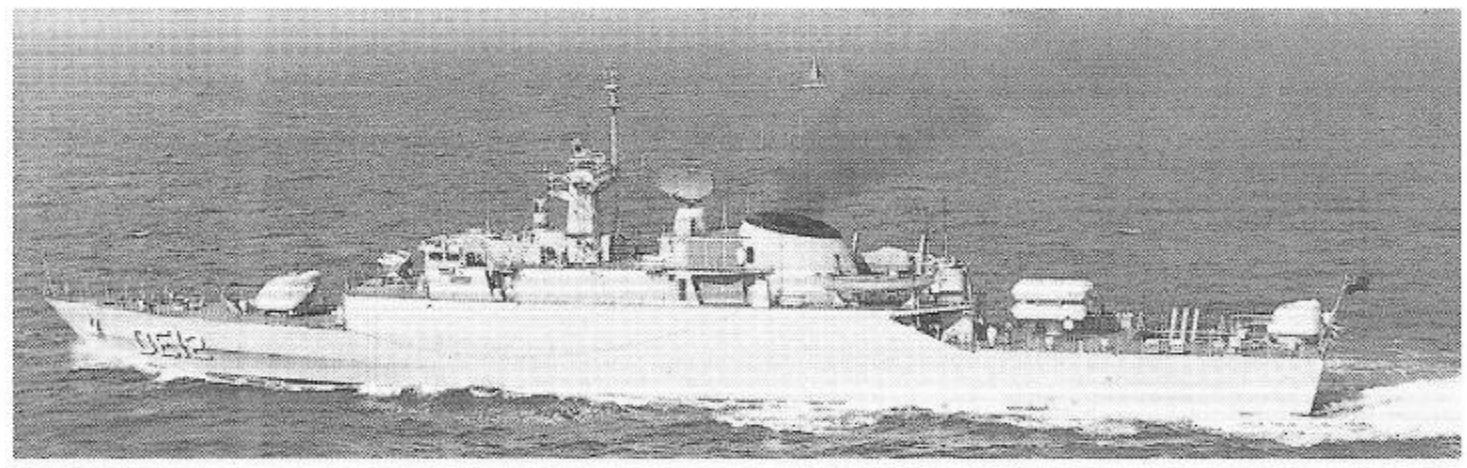
SISTEL Sea Killer Mk 2 missile system

There is one SISTEL Sea Killer Mk 2 SAM/SSM launcher on the afterdeck. This system, which predated Exocet and Harpoon was, for its time, an extremely advanced concept. It comprises three elements:

Sea Killer Mk 2 missile
Mariner launcher system
Sea Hunter 4 fire-control system

The Sea Killer Mk 2 missile is a two-stage Mach 1.9 missile with a rocket booster and rocket sustainer. The launcher system consists of a pedestal and five launcher-containers each with a frangible cover. It weighs approximately 5 tonnes, can traverse 360° at a speed of 30°/s and has an elevation of −15 to +30° at a speed of 20°/s. When a target is acquired and designated by the Sea Hunter 4 system the control console is used to assign weapons by means of an MMI using dedicated push-buttons on the weapon assignment panel. The panel also indicates weapon status and provides an override weapon control facility. For surface engagements the target is assigned to the dedicated console which uses the director search radar to acquire it. The launcher system is slaved to the director and data is provided either from track radar data or from the automatic track-while-scan prediction system.

When the predicted impact point is within the missile's fire range a lamp is illuminated and the missile may then be launched. It is carried clear of the ship by the booster which burns for approximately 1.7 seconds and is then jettisoned. The sustainer is then ignited and at this point the missile is gathered into the search radar beam which provides azimuth control, the tracker monitoring the flight and providing data to the fire-control system. If the missile deviates from the beam, guidance commands can be generated through the command transmitter. Vertical control is provided by the radio altimeter which is controlled from the ship to adjust missile height. In severe radar jamming conditions the missile is tracked by the television camera and it is guided by radio commands.



Vosper Mk 5 frigate as built for Iran as Saam *(DE 12). Following the overthrow of the Shah it became* Alvand *(71). Note the two rows of missile tubes on the Sea Killer missile launcher. The top row has since been removed and replaced by a launcher for BM-21 rockets* (Vosper Thornycroft)

Approximately 120 Sea Killer missiles and four launchers were sold to Iran for the Vosper Mk 5 frigates, the only navy to purchase the system. The system remains in service but is no longer produced and the stock of missiles may have been reduced by 50 per cent through operational use.

Specifications

Length: 4.7 m (15.4 lb)
Diameter: 20.6 cm (8.1 in)
Span: 97.8 cm (38.5 in)
Launch weight: 300 kg (661 lb)
Speed: Mach 0.9
Range: 13.5 n miles (25 km)
Guidance: Inertial and active radar beam riding
Fuze: Impact fuze
Warhead: 70 kg (154 lb) (semi-armour-piercing)

Manufacturer/Contractor

Sistel SpA, Italy.
(This consortium has been dissolved.)

BM-21 rocket launcher

It is reported that the Mariner launcher of the Sea Killer missile system may have been modified to enable it to fire BM-21 rockets in addition to the Sea Killer missiles. The BM-21 is a Russian-designed, free-flight artillery rocket normally used in land battles. It is reasonably accurate (although possibly less so when fired from a naval platform) and has a variety of warheads including chemical.

Specifications

Length: 2.74 m (8.99 ft)
Diameter: 122 mm (4.8 in)
Weight: 45.9 kg (101 lb)
Range: 8.1 n miles (15,000 m)

GUNS

Vickers 114 mm (4.5 in) Mk 8 multipurpose gun

There is one 114 mm (4.5 in) Mk 8 gun in 'A' position. The gun provides quick reaction short-range air defence, engages surface targets including fast attack craft, and provides gunfire support to ground forces. The barrel is 6.22 m (20.40 ft) long, is fitted with a muzzle brake and fume extractor, and has a life of 3,300 rounds EFC. The mounting is completely enclosed in a glass fibre shield which protects it against the environment, blast and shrapnel. The loading system is hydraulically operated, with an autoloader which is manually fed by two loaders and has a capacity of six rounds. The hoist transfers them in two stages to the turret from where they are raised by a pivoting loading arm to the breech where they are inserted by a power rammer. After the shell is fired the case is extracted automatically and ejected through a chute in the front of the mounting.

Alvand *(71) in Gulf waters in 1994. The Seacat SAM launchers have been replaced by Oerlikon 20 mm cannon*

Specifications

Calibre: 113 mm
Length of barrel: 55 calibres
Traverse: 340° at 40°/s
Elevation: −10 to +55° at 40°/s
Muzzle velocity: 868.7 m/s (2,850 ft/s)
Weight of projectile: 21 kg (46.3 lb)
Rate of fire: 25 rds/min
Range:
anti-surface: 11.9 n miles (22 km)
Crew: 4 (gun captain (CIC), loading supervisor, 2 loaders)

Manufacturer/Contractor

Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

Oerlikon 35 mm/90

There is one turret-mounted, twin Oerlikon 35 mm/90 mounting on the stern.

Specifications

Gun
Calibre: 35 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,175 m/s (3,855 ft/s)
Rate of fire: 550 rds/min/barrel
Ammunition: 1.56 kg (3.4 lb)
Range:
anti-surface: 5 km (2.7 n miles)
anti-air: 4,500 m (14,764 ft)

Mounting (GDM-C)
Traverse: 360°
Elevation: −15 to +85°
Training speed: 120°/s
Elevation speed: 100°/s
Crew: 3 (1 gunner; 2 loaders)

Oerlikon GAM-BO1 20 mm/85

Three GAM-BO1 mountings are located one before the bridge and two either side of the after end of the stack. GAM-BO1 uses a swivel fork with the sidewalls having the trunnion bearings. The cradle is made of light alloy and the weapon's working parts are enclosed in a protective case whose top opens to ease maintenance and installation. The sight, shoulder rests and back support strap are all attached to the sight bracket which is adjustable for height. Usually these mountings have an optical ring sight but they can also be fitted with a lead computing sight. The ammunition box with 200 rounds is attached to the front of the mounting and the belt is fed from the right side of the gun, with spent cartridge cases being ejected between the sidewalls of the cradle into a separate compartment, while the links are collected in a bag on the other side of the mounting.

Specifications

KAA gun
Calibre: 85 mm
Muzzle velocity: 1,050-1,150 m/s (3,445-3,773 ft/s)
Effective range:
anti-surface: 1.3 n miles (2.5 km)
fast jets: 1,200 m (3,937 ft)
helicopters: 2,000 m (6,562 ft)
Rate of fire: 900 rds/min
Round weight: 320-345 g
Projectile: 110-125 g

Manufacturer/Contractor

Royal Ordnance, Medium Calibre Gun Division (mounting).
Oerlikon Contraves AG, Defence (cannon).

M2HB 12.7 mm (0.50 in) machine guns

Two M2HB 12.7 mm machine guns are carried and can be mounted on flexible mounts.

Specifications

Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rds/min
Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-air: 1,380 m (4,500 ft)

ANTI-SUBMARINE MORTARS

Anti-Submarine Mortar Mk 10 Limbo

There is one Mk 10 Limbo mortar set in a well in the after deck. It has been suggested that this has been removed but there is photographic evidence that it was still there in 1994. This weapon has three 304.8 mm barrels installed in line on a massive metal mounting with a metadyne system for stabilising it in pitch and roll. The projectiles are loaded automatically from magazines alongside the mounting, the mortar tubes being laid horizontally with a pneumatic system moving rounds down the barrel. Fuze settings are set automatically through relays and uniselectors. The magazine has a capacity of 51 rounds. Training of the mortar is carried out automatically from the combat information centre using data from the ship's sonar system. The Limbo system fires its projectiles in a three-dimensional pattern. The projectiles can be set to explode at various depths using hydrostatic or impact fuzes and are identical to those used in Squid. Limbo has a crew of seven.

Limbo is controlled by the MCS (Mortar Control System) Mk 10. The original system used vacuum-tube technology and during the 1960s systems in British service were updated with new solid-state electronics in the computer and sonar display system. The sonar is the Type 170 with square transducer and a frequency of 15 kHz.

Specifications

Calibre: 304.8 mm (12 in)
Weight: 35 t
Range: 900 m (2,953 ft)
Projectile: 177 kg (390 lb)
Explosive: 94 kg (207 lb)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Decca RDL-2AC

The Decca RDL-2AC is fitted. This is an ESM system designed to detect hostile radar systems and covers the frequency band 1-18 GHz.

Manufacturer/Contractor

Racal-Decca, London, UK.

Racal FH 5-HF/DF

The FH-5 is a communications direction-finding system, recognisable by the masthead cage antenna array.

Manufacturer/Contractor

Racal-Decca, London, UK.

DECOYS

Mk 5 rocket flare launchers

There are two launchers for the British Mk 5 chaff system.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Contraves Sea Hunter 4

The Sea Hunter 4 fire-control system conducts surface and air defence engagements using both missiles and guns. It consists of two I/J-band radars with separate antennas sharing the same four-axis stabilised director, which is mounted at the mastheead. The fire-control system consists of a simple console linked to the Sea Hunter system, where radar data acquired from the directors is combined with data from the AWS 1 air/surface search radar and the Racal-Decca 1226 surface search radar. There is also an optical tracker on the bridge.

Manufacturer/Contractor

Contraves, Switzerland.

SONARS

Graseby Type 174 sonar

The Type 174 is a hull-mounted, medium-frequency, active search sonar, which operates in conjunction with the Type 170 attack sonar.

Manufacturer/Contractor

Graseby Marine (Graseby Dynamics), Luton, UK.

Type 170 sonar

Type 170 is the sonar used to control the Squid ASW mortar. The transducer operates at high frequency (15-25 kHz) and operating limits are about 1,800 m (6,000 ft) in range and about 400 m (1,300 ft) in depth. Accuracy is about 0.5° in bearing and about 5 m (16 ft) in range.

RADARS

Set	AWS-1	Type 1226	Model 629	Sea Hunter 4
Company	Plessey	Racal-Decca	Racal-Decca	Contraves
Role	Air search	Surface search	Navigaion	Fire control
Band	E/F	I	I	H/I
Range	60 n miles (110 km)	48 n miles (81 km)		Search: 24 n miles (45 km) Track: 21.6 n miles (40 km)
Beam	1.5 × 40°	1.2°	1.2°	Search: 1 × 30° Track: 2.2°
Peak Power	750 kW	25 kW	25 kW	180 kW
Gain	32 dB	30 dB	30 dB	—
Pulsewidth	0.35/1.5 µs	0.05/0.25/1.0 µs	0.05/0.25/1.0 µs	Search: 0.27/0.5 µs Track: 0.27 µs
PRF	1,000/400 pps	—	—	2,000 pps
Scan rate	10/20 rpm	28 rpm	28 rpm	

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 Rolls-Royce Olympus TM2A gas turbines; 29.8 MW (40,000 hp) sustained; 2 Paxman 16YJCM diesels; 2.83 MW (3,800 hp) sustained

Shafts: 2
Propellers: KaMeWa, five-bladed, cp

FURTHER INFORMATION

PROGRAMME

It was announced on 25 August 1966 that Vosper Ltd, Portsmouth, had received an order for four Mk 5 frigates for the Iranian Navy, two of which were to be built by Vickers. *Sabalan* was towed to Barrow for completion.

DESIGN

The Iranian requirement called for a ship with a primary ASW mission, armed with modern weapons systems and sensors, but with a strong emphasis on speed; indeed, a maximum of 40 knots was demanded — a very high speed for a ship of this size. Vosper's designers were able to work without the constraints imposed by Western governmental departments and produced a ship on time and well within budget.

The hull is constructed of all-welded steel, with transverse frames and longitudinal stiffening to achieve the required strength, while the superstructure is of aluminium, a material whose strengths and weaknesses were very well understood. There is a high freeboard and a knuckle in the bow to keep the foredeck dry. Roll dampers are fitted to ensure that the ship provides a stable firing platform. The sonar dome retracts at high speed. The ships are air conditioned throughout.

The propulsion system is a twin CODOG system, with each of the controllable-pitch propellers being driven by either the gas turbine or the diesel. The propellers are quite small and fast-turning in order to keep the gearbox light in weight and relatively simple. The first of class actually achieved 40.34 knots during trials.

Faramaz *(DE 18) in dry-dock showing the Vosper Thornycroft roll damping fin. This ship became* Sahand *(74) and was later sunk by US Navy forces in the Gulf on 18 April 1988*

NAMES

The ships were delivered with names which subsequently proved unacceptable to the new Iranian Government and the names were changed in 1985:

Original Name	New name
Saam (DE 12)	*Alvand* (71)
Zaal (DE 14)	*Alborz* (72)
Rostam (DE 16)	*Sabalan* (73)
Faramarz (DE 18)	*Sahand* (74)

MODERNISATION

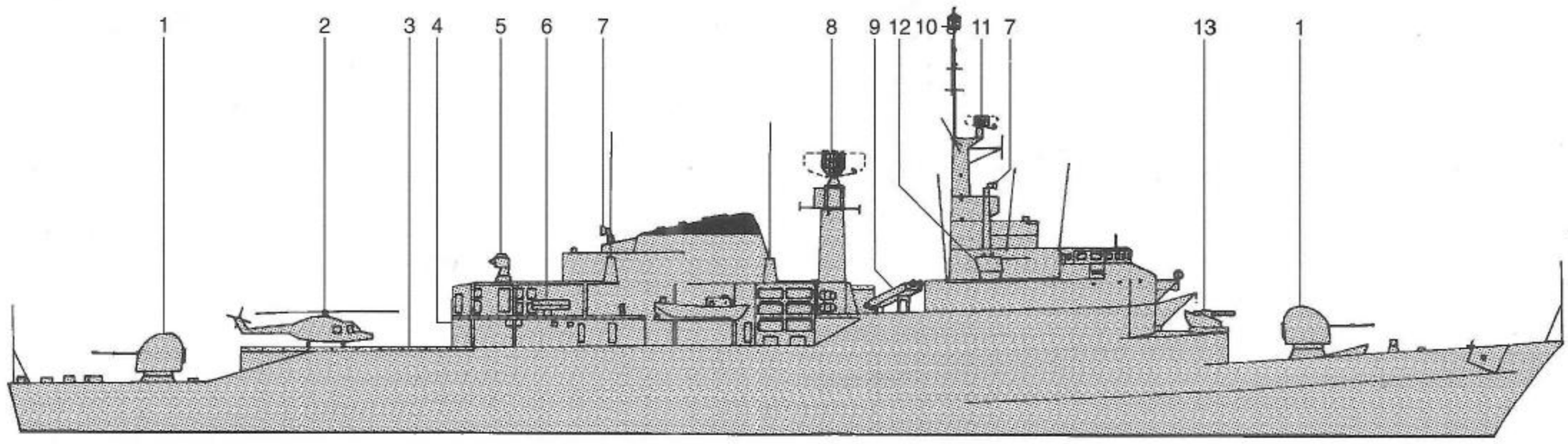
When the ships were being built the Vickers Mk 8 gun was not ready in time to be installed in the first two ships, which were given a 114 mm Mk 5 as a stopgap. This was put right when *Saam* and *Zaal* went to the British naval dockyard at Devonport in 1975 and had a major refit, which included having their Mk 5 guns replaced by Mk 8s. The refit was completed in 1977.

The ships were all modified in 1988, the work including replacing the Seacat SAM launcher with a Russian 23 mm gun. By mid-1991 the 23 mm on both boats had been replaced by GAM-BO1 20 mm guns and the Sea Killer launcher had been modified to launch BM-21 rockets.

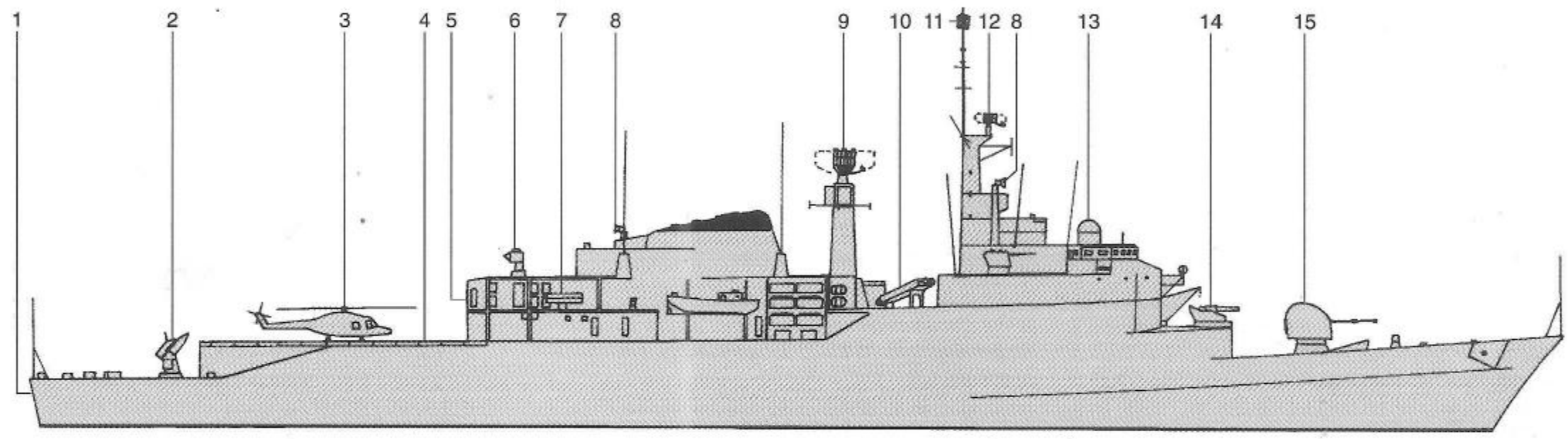
DEPLOYMENT

During the Iran-Iraq war there were numerous naval engagements both between the protagonists and the international forces engaged in keeping the sea lanes open. USS *Stark* (FFG) was severely damaged by Iraqi missiles on 17 May 1987 and *Sahand* was sunk by USN on 18 April 1988. *Sabalan* had her back broken by a laser-guided bomb in the same skirmish but was out of dock by the end of 1990 and operational again in late 1991.

NITEROI (VOSPER THORNYCROFT TYPE 10)



Constituição *(GP)* (Ian Sturton)
1 *Vickers 114 mm (4.5 in)/55 Mk 8* **2** *Westland SAH-11 Lynx* **3** *Flight deck* **4** *Hangar* **5** *Short Seacat SAM launchers* **6** *Triple Plessey STWS-1 torpedo tubes* **7** *Selenia Orion RTN 10X fire control (for SeaCat)* **8** *Plessey AWS 2 with IFF Mk X* **9** *Aerospatiale MM40 Exocet anti-ship missile (four)* **10** *FH5 HF/DF* **11** *Signaal ZW06 surface search radar* **12** *Bofors 40 mm/70* **13** *Bofors 375 mm twin tube rocket launcher*



Independência (Ian Sturton)
1 *EDO 700E variable depth sonar* **2** *Branik ASW missile launcher* **3** *Westland SAH-11 Lynx* **4** *Flight deck* **5** *Hangar* **6** *Short Secat SAM launcher* **7** *Plessey STWS-1 triple 324 mm torpedo tubes* **8** *Selenia Orion RTN 10X* **9** *Plessey AWS 2 with IFF Mk X; air/surface search* **10** *Aerospatiale MM40 Exocet anti-ship missiles* **11** *FH5 HF/DF* **12** *Signaal ZW06 surface search radar* **13** *Ikara fire control* **14** *Bofors 375 mm twin-tube ASW rocket launchers* **15** *Vickers 114 mm*

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: Brazil
Type: Vosper Thornycroft Type 10

Class: NITEROI

Built: 6
Active: 6

Displacement:
standard: 3,200 t
full load: 3,800 t

Dimensions
Length: 129.24 m (424.0 ft) (oa); 121.92 m (400.0 ft) (wl)
Beam: 13.5 m (44.2 ft)
Draught: 5.5 m (18.2 ft) (sonar)

Speed: 30 kts (gas turbines); 22 kts (diesels)
Range: 5,300 n miles at 17 kts on 2 diesels; 4,200 n miles at 19 kts on 4 diesels; 1,300 n miles at 28 kts on gas turbines
Endurance: 45 days

Complement: 217 (22 officers)

SHIPS

NITEROI (F 40)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down 8 Jun 1972
Launched 8 Feb 1974
Commissioned 20 Nov 1976

DEFENSORA (F 41)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down 14 Dec 1972
Launched 27 Mar 1975
Commissioned 5 Mar 1977

CONSTITUICAO (F 42)*
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down 13 Mar 1974
Launched 15 Apr 1976
Commissioned 31 Mar 1978

LIBERAL (F 43)*
Builder Vosper Thornycroft, Woolston, Hampshire, UK

Defensara (F41), second to be completed (Robert Pabst)

Laid down 2 May 1975
Launched 7 Feb 1977
Commissioned 18 Nov 1978

INDEPENDENCIA (F 44)
Builder Arsenal de Marinha, Rio de Janeiro, Brazil

Laid down 11 June 1972
Launched 2 Sep 1974
Commissioned 3 Sep 1979

UNIAO (F 45)
Builder Arsenal de Marinha, Rio de Janeiro, Brazil

Laid down 11 June 1972
Launched 14 Mar 1975
Commissioned 12 Sep 1980

* = General purpose variants

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Short Seacat GWS.22

There are two Short Seacat GWS.22 triple launchers mounted on the hangar roof, with a total of 60 missiles carried. (See 'Modernisation' below).

Specifications
Missile
Length: 1.48 m (4.85 ft)
Diameter: 19 cm (7.4 in)
Wing span: 65 cm (25.5 in)
Weight: 68 kg (150 lb)
Speed: Mach 0.8
Range: 2.7 n miles (5 km)
Radar: Type 904 (see radar table below)

Manufacturer/Contractor
MSI-Defence Systems (formerly Short Brothers plc), Belfast, UK.

ANTI-SHIP MISSILES

Exocet MM 40

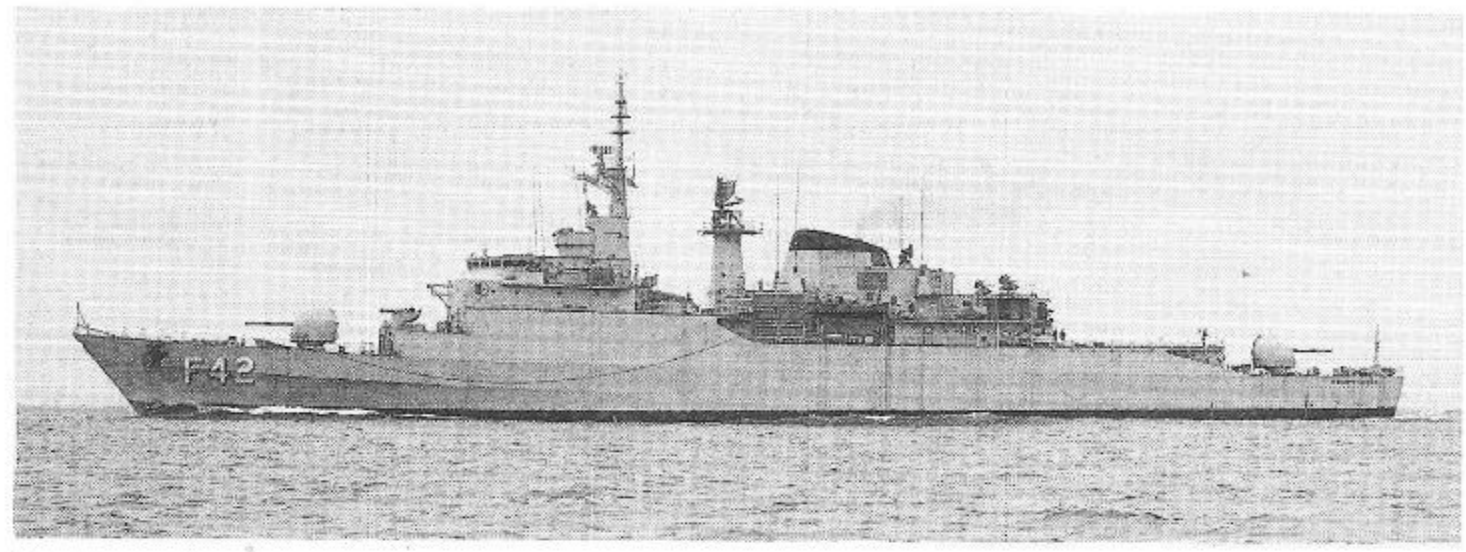
Four MM 40 Exocet anti-ship missile launchers are located immediately abaft the foremast. The launch canisters are mounted in two groups of two facing across the ship at an angle of about 60° to the centreline and at +12° to the horizontal.

There are two versions of MM 40, designated Blocks 1 and 2. Block 2 missiles feature a new J-band (10-20 GHz) seeker with improved ECCM performance, associated electronics and a new guidance computer, although no further details are currently available. The new electronics permit the missile to optimise its sea-skimming height, allowing it to operate in conditions to Sea State 7 even in severe ECM conditions. The fire-control system has also been adapted with the development of the Cat-Visac console which can operate with two types of the Exocet missile simultaneously. The new fire-control system allows improved target selectivity, attacks upon multiple targets by diverging and converging salvos.

Targets for the missiles are acquired by the ship's sensors, and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence which can take up to 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change in the course of its flight. Once the missile has cleared the launcher-container, the sustainer carries it into the cruise phase and it then travels towards the general location of the target at a height of about 100 m (330 ft) which is low enough to reduce the chance of detection but adequate for target acquisition. Once the target is detected the missile descends to 9-15 m (30-50 ft) in the approach phase before descending to 8 m (26.2 ft) (2-5 m (6.5-16.4 ft) in a calm sea) for a sea-skimming terminal phase. A salvo may be fired in 12-20 seconds.

Specifications

	MM 40 Block 1	MM 40 Block 2
Length	5.78 m (19.0 ft)	5.80 m (19.02 ft)
Diameter	35 cm (13.8 in)	35 cm (13.8 in)
Wing span	1.13 m (3.7 ft)	1.13 m (3.7 ft)
Weight	855 kg (1,885 lb)	870 kg (1,918 lb)
Speed	Mach 0.9	Mach 0.9
Range	2-38 n miles (4-70 km)	2-40.5 n miles (4-75 km)
Warhead	165 kg (364 lb) HE frag	155 kg (341 lb) HE frag
Fuze	delay impact/ proximity	impact/proximity
Guidance	Intertial and active radar	



The 'as built' appearance of Constituicos *(F 42), one of the two general purpose variants of the design. There is a single Vickers 114 mm (4.5 in/55 in 'A' and 'Y' positions), and a Bofors 375 mm ASW rocket system in 'B' position. Note also the large flight deck and the Short Seacat launchers on the hangar roof* (Vosper Thornycroft)

Manufacturers/Contractors
Aerospatiale Missiles, Paris Cedex, France (Prime).
Luchaire Défense, Versailles Cedex, France (Warhead).

ANTI-SUBMARINE MISSILES

Branik (Ikara M4 modified) ASW weapon system

Ikara is an unmanned miniature aircraft with a fixed tail, stubby wings and a torpedo payload faired into the underside.

It is powered by a solid propellant, boost/sustainer rocket motor and the guidance system is designed to interface with a full tactical data handling system. Missiles and torpedoes are stored in a magazine and when required are automatically guided along an electrically powered rail system to an assembly room where the wings are fitted and the Ikara is hydraulically lifted onto the trainable launcher which is fixed at a 55° angle.

Ikara is capable of attacking enemy submarines out to the maximum range of the ship's sonar in all weather conditions. Target information from the ship's long-range sonar is fed into a computer which calculates the dropping position, taking into account such factors as ship's own course and speed, wind effect and target movement during time of flight. The outputs from the computer are passed to the missile via the guidance system, a ship-mounted radio/radar system enabling the missile to be tracked and guided accurately to the drop zone where command signals initiate the torpedo release sequence.

The Branik (Brazilian Ikara) is a modified version of the M4 with a revised launcher-computer interface in which the dedicated missile tracking and guidance system is fully integrated with one of the ship's Ferranti FM 1600 B computers. A lightweight, semi-automated missile handling system is also incorporated. Ten Branik missiles are carried. (See 'Modernisation' below).

Specifications
Length: 3.42 m (11.2 ft)
Wing span: 1.52 m (5.0 ft)
Range: 12.93 n miles (24 km)
Speed: Mach 0.8
Guidance: Radio/radar
Payload: 1 Mk 46 torpedo

GUNS

Vickers 114 mm (4.5 in)/55 Mk 8 multipurpose gun

Constituicao (F 42) and *Liberal* (F 43) both have two Vickers 114 mm mountings; one is in 'A' position, the other in 'Y' position. The other four ships have only one 114 mm gun, which is in 'A' position. The 114 mm gun provides quick-reaction short-range air defence, engages surface targets including fast attack craft, and provides gunfire support to ground forces. The weapon system consists of the gun mounting, the ammunition feed system, the remote power control system, and the captain-of-turret panel.

The barrel is 6.22 m (20.4 ft) long, is fitted with a muzzle brake and fume extractor, and has a life of 3,300 rounds EFC. The mounting is completely enclosed in a glass fibre shield which protects it against the environment, blast and shrapnel. The loading system is hydraulically operated, with an autoloader which is manually fed by two loaders and has a capacity of six rounds. The hoist transfers them in two stages to the turret from where they are raised by a pivoting loading arm to the breech where they are inserted by a power rammer. After the shell is fired the case is extracted automatically and ejected through a chute in the front of the mounting.

Specifications
Calibre: 113 mm
Length of barrel: 55 calibres
Traverse: 340° at 40°/s
Elevation: −10 to +55° at 40°/s
Muzzle velocity: 868.7 m/s (2,850 lb)
Weight of projectile: 21 kg (46.3 ft/s)
Rate of fire: 25 rds/min
Range:
anti-surface: 11.9 n miles (22 km)
anti-air: 6,000 m (20,000 ft)
Crew: 4 (gun captain (CIC), loading supervisor, 2 loaders)

Manufacturer/Contractor
Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

Bofors 40 mm L/70

Two single Bofors 40 mm AA guns in open mounts are located either side of the foremast.

Specifications
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000-1,025 m/s (3,280-3,363 ft/s)
Range:
anti-surface: 6.75 n miles (12.5 km)
anti-air (nominal): 6,900 m (22,638 ft)
Rate of fire: 300 rds/min (practical)
Ammunition: 2.21 kg (4.8 lb)

GEC-Marconi STWS-1

There are two STWS-1 324 mm triple launchers, one set on either side of the hangar. STWS-1 (Ship's Torpedo

Defensora (F41)

Weapon System-1) was developed from the US Navy's Mk 32 Mod 5/7 torpedo launcher and is designed to operate with the Mk 44 and Mk 46 lightweight torpedoes and also transistor logic in the presetter/launch controller.

Specifications
Length: 3.65 m (12 ft)
Height: 1.4 m (4.5 ft)
Width: 1.23 m (4.0 ft)
Weight: 1,560 kg (3,439 lb) (unloaded)
Power requirements: 440 V, three phase, 60 Hz; 115 V, single phase, 60 Hz; 28 V DC, 24 V DC ship maintenance supply

Manufacturer/Contractor:
GEC-Marconi Underwater Systems Ltd.

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

ANTI-SUBMARINE MORTARS

Bofors 375 mm Model B2 ASW rocket system

There is a single, twin-tubed ASW rocket launcher in 'B' position, immediately ahead of the bridge. The system consists of a rocket launcher, handling system, the ship sonar and a fire-control system. The launch tubes are mounted on trunnions with an automatic contact device to connect the rockets with the fire-control system. The hydraulic laying machinery is in the front of the mounting and a flame deflector in the rear. Each system features an automatic electrohydraulic handling system. The rounds are stored vertically beneath the mounting and selected by an operator. A grab on a roof-mounted rail picks up the round by the nose and transfers it to the loading table. A hoist brings this through the deck hatch to where the launch tubes have been elevated to their loading position. The rounds are then inserted through the rear of the launch tube. Reload time is approximately 1 minute, each tube being loaded separately. Rockets may be fired singly or in salvo. There are two types of rocket, both with Hexotonal filling. The Type E (Erika) rocket has Stidar time and impact fuzes, while the Type N (Nelli) uses the Zambo proximity and impact fuzes.

Specifications
Launcher
Tubes: 4
Weight: 7,500 kg (16, 534 lb)
Traverse: 260°
Elevation: −15 to +90°
Traverse speed: 18°/s
Elevation speed: 18°/s
Crew: 4

Rockets

	Type E	Type N
Weight	250 kg (551 lb)	230 kg (507 lb)
Muzzle velocity	130 m/s (426 ft/s)	205 m/s (676 ft/s)
Explosive weight	107 kg (236 lb)	80 kg (176 lb)
Range	0.35/0.87 n miles (0.65/1.63 km)	0.85/2.11 n miles (1.58/3.62 km)
Final sinking speed	10.7 m/s (35 ft/s)	9.2 m/s (30 ft/s)
Automatic loading range	1,600 m (5,249 ft)	

Manufacturer/Contractor
Bofors Ordnance, Sweden.

DEPTH CHARGES

Constituicao (F 42) and *Liberal* (F 43) only. One depth-charge rail can be fitted, if required. The rail can carry five charges at a time.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

(The EW suite is in the process of change in advance of the modernisation programme — see 'Modernisation' below. Ships may, therefore, have a combination of the following.)

Cutlass B1 ESM system

Cutlass B1 is designed for operation in very dense signal environments, receiving signals in the 1 to 18 GHz frequency range, measuring their parameters, comparing these with those in the radar library which contains the parameters of 2,000 radars, and displaying the information — all within one second. The EW operator is presented with a tabular display for threat identity and threat evaluation, and a tactical display giving a pictorial representation of the RF environment. Selected digital outputs can be sent to other local systems, and hard copy printout of the intercepted radar is also available. The tabular display can indicate 150 intercepts, in the order of priority. Cutlass is wide open in both bearing and frequency: that is, it does not employ sweep techniques, giving a very high intercept probability (nearly 100 per cent). Cutlass B1 uses the Cutlass processor and an Instantaneous Frequency Measurement (IFM) receiver. It has a 32-element array antenna to provide bearing measurement by phase analysis techniques. This antenna also provides RF for the IFM. In both systems the processor is provided with fast and accurate information on incoming pulses.

Specifications
Frequency coverage: 2-18 GHz
Accuracy: 2° RMS in bearing
Coverage: 360° azimuth; +40 to −10° elevation
Pulse density capability: 500,000/s
Radar store capability: 2,000 modes

Manufacturer/Contractor
Racal Radar Defence Systems Ltd, Chessington, Surrey, UK.

Racal Cygnus B1 jammer

The Cygnus radar jammer operates in the I- or J-bands and was designed for integration with Cutlass ESM equipment. Cygnus uses both responsive noise and deception jamming to provide an effective jamming capability against all types of radar including early warning, target acquisition and missile guidance. It has a narrow beamwidth giving high effective radiated power (300 kW) and is kept on target by a built-in, interferometer type, passive tracking system in both azimuth and elevation. The tracking system may also be used to relay accurate position data to systems of other ships. RF received by the tracking antennas is also used as the basis of transmitted RF and modulation and power management is under the control of a processor which also controls the tracking procedure. Types of modulation sequence available include range gate pull off and false target generation.

Manufacturer/Contractor
Racal Radar Defence Systems Ltd, Chessington, Surrey, UK.

IPqM EW suite

The aim appears to be to outfit all ships in due course with EW equipment that has been designed by the Brazilian Instituto de Pesquisas da Marinas (IPqM) and built in Brazil. Information on this equipment is sparse but it appears to include equipment designated SDR-2 and SDR-7.

DECOYS

Plessey Shield Tactical Decoy System

There are two launchers, each with six parallel barrels, for the Plessey Shield system, sited on either beam, just forward of the mast. Shield is a microprocessor-controlled, fully automatic missile decoy system, which is designed to provide effective protection for various sizes of ship, including fast attack craft, corvettes, frigates and destroyers. On detecting a threat, Shield selects the most appropriate response from up to six million scenarios held in its EPROM memory, using data obtained from onboard sensors such as radar and ESM and then automatically deploys the pattern of decoys that will give the highest probability of success. GEC-Marconi chaff rockets are fitted with a variable fuze which allows the chaff to be dispersed at optimum positions along the trajectory. To counter threats with a dual-mode capability, both chaff and infra-red decoys can be deployed automatically. Shield offers four protection modes — confusion; distraction; seduction/breaklock; and seduction dump — and uses two types of decoy, chaff and infra-red, which may be used on their own, or in combination with each other. (See also 'Modernisation' below.)

Manufacturer/Contractor
GEC-Marconi Naval Systems, Addlestone, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

CAAIS 400 tactical picture compilation system

CAAIS 400 (Computer Assisted Action Information System) is a British system which evolved in the 1960s during development of ADAWS and is in service in a variety of RN ships as Outfit DBA. The first export customer was Brazil which bought CAAIS 400 for the 'Niteroi' class frigates.

CAAIS 400 is a mainframe system using the FM1600B computer and Coral 66 software language. The hardware includes a three-cabinet digital suite which houses a 24-bit computer, operating at 200 Kips and with a 780 k memory, as well as a datalink terminal. In addition there are peripheral control units which include radar extraction units, encoder/decoders, display drive unit and the MMI control units. The last two elements support the display system which, in the CAAIS 400 series, can include up to six CA 1600 horizontal displays.

The search radars have two methods of tracking, LAX (Limited Area automatic eXtraction) and LFX (Limited output Full area automatic eXtraction), either of which involves tracking up to 20 air and surface targets. LAX exploits the capabilities of E/F- and I/J-band radars to produce a combined tracking capability but it is normally used in conjunction with surface search radars. Tracks are initiated manually and the area around the target is highlighted. Where several targets overlap this limits the data rate of position extraction. LFX is similar but is usually used with air search radars and initially merely indicates the presence of such targets. Location data is not automatically provided to the computer until the operator requests it to form a track.

Manual rate-aided tracking is also available in severe clutter or ECM conditions. Automatic tracking may also be transferred by manual order from one radar to another as well as between manual and LAX. The displays may also accept inputs from ESM and optical/electro-optical systems.

Data from up to three sonars may be accepted by a CAAIS system with data fed to the computer semi-automatically by means of synchro-resolvers at the sonar operator's controls. Initially they are displayed as unassociated points which are 'rippled' in time sequence to assess the tactical position. When a submarine is believed to be in the area an automatic investigation is initiated by the operator around its suspected location. The computer then checks records to see if a track can be initiated and monitored by the sonars. There is provision for the 'rippled' display of up to 16 unassociated points, 32 associated detections shared by up to four tracks.

The datalink in the Brazilian CAAIS 400 system is Link YB (see below).

Manufacturer/contractor

Ferranti Naval Systems, UK.

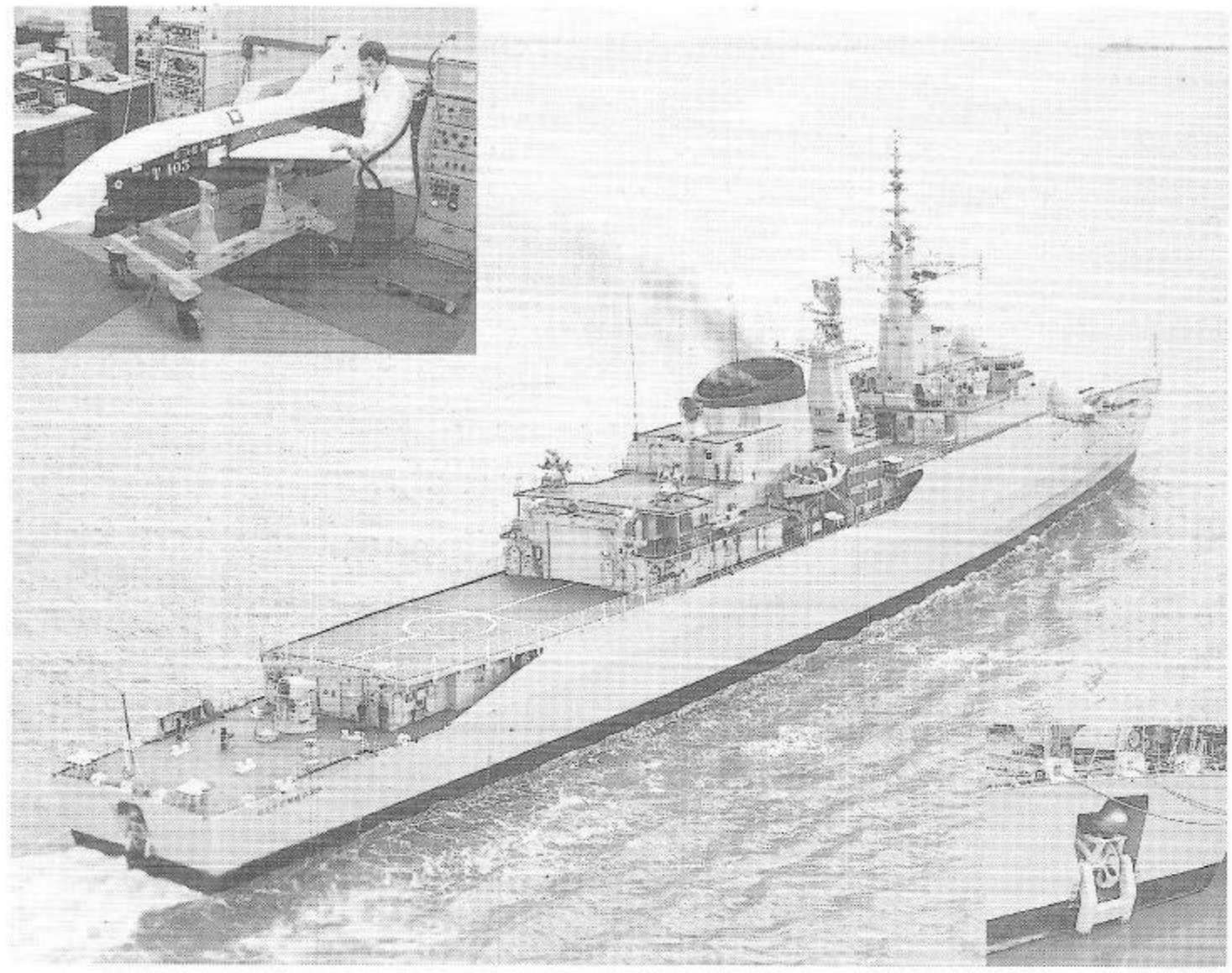
Link YB

Link Y is a datalink for non-NATO navies, originally developed by Ferranti, but with equipment now being marketed also by Signaal. It uses the same equipment as NATO Link 10, but with different programming of the message structure. Link Y enables track data, management data, status reports and commands to be exchanged between a maximum of 31 shipborne, airborne and land-based participating units (PUs). Transmissions are made using a Time Division Multiple Access (TDMA) protocol in which the Net Control Station automatically allocates slots to each PU, depending on the amount of data to be transmitted.

Link Y operates in a serial mode, in which each PU uses its allocated time slot for transmission, receiving in all other slots. PUs can also operate in a receive only mode. Link Y Mk 1 operates at a transmission speed of 300-1200 bits/s, while Signaal's Link Y Mk 2 works at 4,800 bps. The link occupies about 3 kHz of bandwidth and uses either HF ground wave or UHF line of sight, including satellite links.

Different versions have been developed for specific customers, the versions being identified by a single letter suffix. Egyptian vessels, for example, are known to use Link YE, while the Brazilian Navy uses Link YB.

IFF: Mk 10



Defensora *(F 41), an ASW variant, in 'as built' condition, with an inset close-up (bottom right) of the EDO 700E variable depth sonar. The Branik launcher is on the quarterdeck and a close-up of the missile is at the top left* (Vosper Thornycroft)

RADARS

Set	AWS-4	ZW-06	RTN-10X
Company	Plessey	Signaal	Selenia
Role	Air search	Surface search	Fire control
Band	D/E	I	I/J
Beam	1.9 × 30°	0.9 × 19°	—
Peak Power	—	60 kW	200 kW
Gain	—	32 dB	31 dB
Pulsewidth	1.0/0.3 µs	0.06/0.6 µs	1.5 µs
PRF	680/1,360 pps	4,000/200 pps	450-550 pps
Scan rate	10/20 rpm	24 rpm	—
Typical ranges	55 n miles (105 km)	Surface: 14 n miles on 10m² target Air: 20,000 ft	—

SONARS

EDO Model CWE-610E hull-mounted active sonar system

The CWE-610E low-frequency (LF) sonar is installed in all six ships. CWE-610E is designed for the long-range detection of submarines in deep and shallow water. There is a 36 stave transducer in a dome under the hull and two active consoles, enabling it to perform a search-while-track function. Facilities offered include a search capability in three 120° sectors, passive correlation, and reverberation processing. Transmissions are at 6, 7 and 8 kHz and use 10° preformed receiver beams. Range of the active system is approximately 30,000 m and there is a passive display for greater ranges. The sonar system outputs data automatically into SEWACO-V. All mode changes and range scale changes are controlled by console push-buttons, and displays include a Doppler display on each of the active consoles and a passive sonar bearing time recorder display.

Manufacturers/Contractors

EDO Corporation, Government Systems Division, College Point, New York, USA.

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

EDO Model 701E variable depth sonar

The Model 701E VDS is installed in *Constituicao* (F 42) and *Liberal* (F 43) only. The 701E is a VDS designed specifically to work with the CWE-610E. There 'fish' contains a 24 stave transducer 4.95 m (16.2 ft) in diameter and 7.87 m (25.8 ft) high, and operating at a frequency of approximately 13 kHz.

Manufacturers/Contractors

EDO Corporation, Government Systems Division, College Point, New York.

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 24.0 × 13.5 m (79 × 44 ft)

HELICOPTERS

One Westland SuperLynx SAH-11

Specifications
Dimensions:
main rotor diameter: 12.80 m (42.00 ft)
tail rotor diameter: 2.21 m (7.25 ft)
length overall (rotors turning): 15.165 m (49.75 ft)
Weights:
empty: 2,740 kg (6,040 lb)
empty, equipped (ASW): 3,343 kg (7,370 lb)
Performance:
cruising speed: 125 kts (232 km/h; 144 mph)
speed for max endurance: 70 kts (130 km/h)
max rate of climb: 661 m (2,170 ft)/min
time on station (ASW): 50 n miles (93 km) radius: 2 h
max range: 320 n miles (593 km)
max endurance: 2 hour 50 minutes
Power plant: 2 Rolls-Royce Gem 41-1 with max contingency rating of 835 kW (1,120 shp)
Crew: 2 (pilot and co-pilot/observer)
Radar: GEC-Marconi ARI5979 Seaspray Mk 3 lightweight search and tracking radar
Mission: CAE Electronics AN/ASQ-504(V) internal MAD
EW: Racal Kestrel EW suite; Racal MIR 2 ESM
ASW role: 2 Mk 44 or Mk 46 torpedoes, or depth bombs
Anti-ship: 4 BAe Sea Skua missiles

PROPULSION

Specifications
System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 Rolls-Royce Olympus TM3B gas turbines; 37.9 MW (50,880 hp) sustained; 4 MTU 16V 956 TB91 diesels; 11 MW (15,000 hp(m)) sustained
Shafts: 2
Propellers: cp
Auxiliary power: 3 MTU 956TB61 diesel alternator sets

FURTHER INFORMATION

PROGRAMME

The Brazilian naval staff drew up a requirement in the late 1960s for an ocean escort ship with a long range, sustained high speed for convoy duties and a higher boost speed for attacks, broad ASW and anti-surface capabilities, and a close in air defence system. Specifications were drawn up with the assistance of US consultants Gibbs & Cox, following which an international design competition was run. The winner was British company Vosper Thornycroft with a modified version of its Mk 10 frigate and the contract for detailed design and construction of six frigates was signed on 29 September 1970 between the Brazilian Government and the company. The contract called for four ships to be built in the UK, with the last two ships being built in Brazil, where materials, equipment and lead-yard services would be provided by Vosper Thornycroft.

It was originally intended that there should be six identical ships, but the development of ASW helicopters led to a decision to complete two as 'general purpose' designs and the other four as ASW ships.

A seventh ship, to a considerably modified design, was constructed in Brazil. *Brasil* (U 27) was commissioned in 1986 and is a purpose-built training ship, serving both the naval and merchant marine academies. The heaviest weapons are two Bofors 40 mm and the ship has no known combat role.

DESIGN

The Mk 10 has the general appearance of the Vosper Thornycroft frigates of the 1960s and 1970s, with a sharply raked stem (which did not indicate the presence of a bow-mounted sonar below), a knuckle forward, and flare carried right aft to the broad transom. Following the practice of the time the superstructure was fabricated from aluminium primarily in order to reduce stability problems resulting from the combination of increased topweight and reduced machinery weights. Seaworthiness and steadiness is enhanced by twin non-retractable fin stabilisers.

The weapons fit required by the Brazilian Navy was heavy for the time and for the size of hull and included:

One Vickers 114 mm (4.5 in) gun in the ASW version and two in the GP version (at a time when the UK Royal Navy was ceasing to fit such guns at all)
Four Exocet anti-ship missile launchers
Two Short Seacat SAM launchers
Bofors twin 375 mm ASW rocket launcher
A Branik ASW missile launcher (a version of the Australian Ikara, developed specifically for the Brazilian Navy)
Two triple ASW torpedo launchers
One Westland Super Lynx ASW helicopter

MODERNISATION

In the late 1980s the Brazilian Navy decided on a major update for the 'Niteroi' class, which are generally in good condition, especially the hulls and CODOG propulsion system, but need more modern weapons and sensors. The requirement was issued in 1991 and in 1993 it was announced that Italian company AESN (Alenia Elsag Sistemi Navali) had won the competition, with Brazilian company ESCA responsible for modernising and integrating the command system. The contract was eventually finalised in March 1995 and the work will take place between October 1997 and December 2000.

In essence, the modernisation programme will enhance the AAW capabilities of the ships, update the command, ESM and other electronic systems, and greatly reduce the current differences between the 'GP' and 'ASW' versions of the class. It will also increase commonality with the navy's 'Inhauma' class. In more detail:

A new SAM system will be installed, consisting of Aspide missiles and an Albatros launcher. This will be located on the afterdeck and will involve deleting the Branik ASW launcher in the current ASW version and the after 114 mm gun in the GP version. The two Seacat launchers on the hangar roof will be deleted in all ships.

The new SAM will require a new fire-control system, which will be provided by the RTN-30X, which will replace the RTN-10X in its present position immediately aft of the stack.

The new Alenia RAN-20S 2D, E-band (2-3 GHz) radar will replace the Plessey AWS-2. RAN-20S has a roll-and-pitch-stabilised 4.5 m planar array and a solid-state transmitter, and is reported to be capable of detecting a fighter-sized target at more than 60 n miles with a range accuracy of 20 m and an angular accuracy of 0.3°.

The Kelvin Hughes Type 1007 navigation radar will replace the Signaal ZW-06.

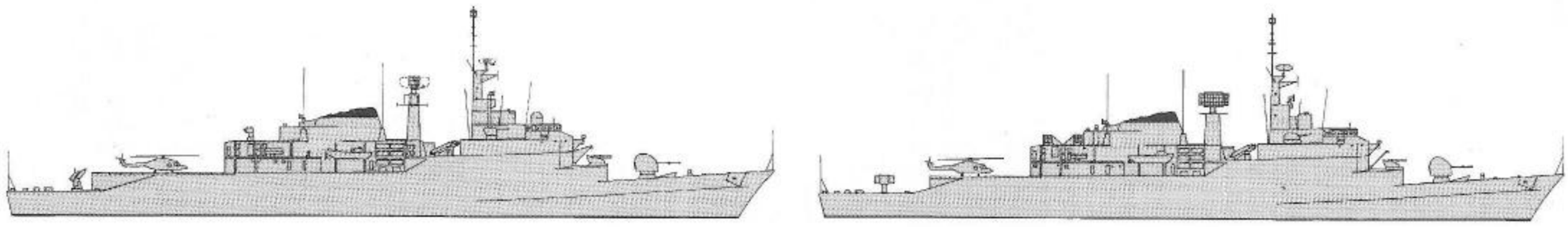
The two 40 mm guns will be upgraded to Bofors 40 mm L/70 standard, with a 10 per cent increase in the rate of fire, an improved ammunition feed system and substantial improvements in elevation and training.

ESM improvements include Plessey Shield countermeasures and Racal Cutlass ESM equipment (as fitted in the 'Inhauma' class), but may also include some equipment currently under development by the Brazilian Instituto de Pesquisas da Marinas (IPqM).

A new command system will be installed. This is being developed by IPqM and will almost certainly be either the same as (or very similar to) the SICONTA-2 (SICONTA = Sistema Controle Tactico) recently installed in the aircraft carrier *Minas Gerais*.

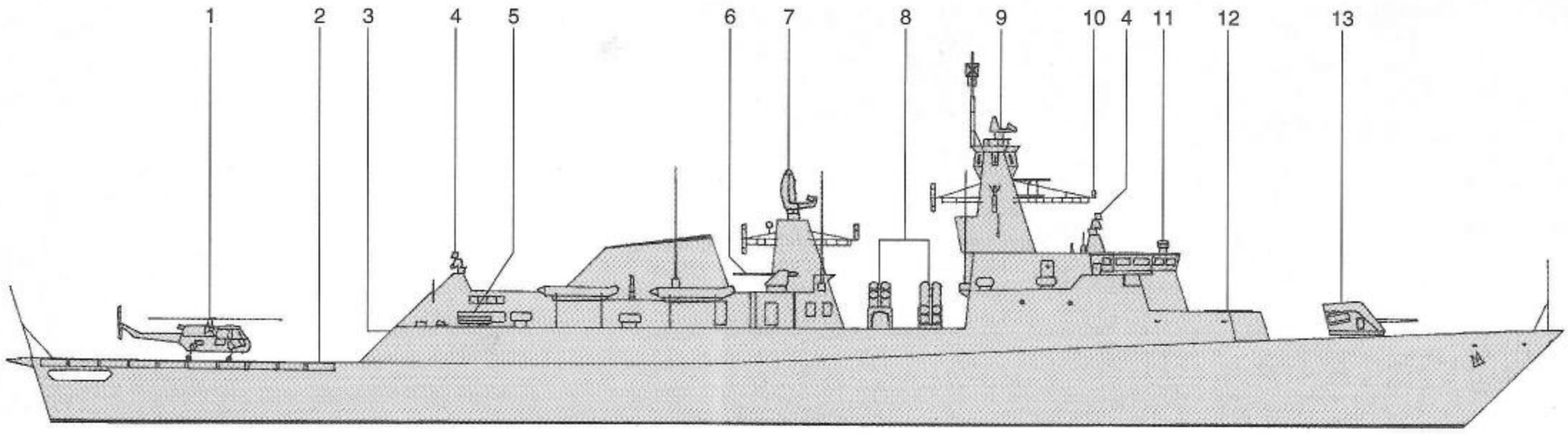
Although officially part of the Niteroi upgrade, the navy's SAH-11 Lynx helicopters are currently undergoing an upgrade to Super Lynx standard, which will, again, enhance the capabilities of these ships.

Reports that new engines and sonars might be fitted have been denied.



Niteroi class as built (left) and as it will appear after modification (right)

LEKIU



Lekiu (Ian Sturton)
1 *Westland Wasp HAS. Mk1* **2** *Flight deck* **3** *Hangar* **4** *GEC-Marconi 1802 fire control* **5** Whitehead B515 triple 324 mm torpedo tubes **6** *MSI 30 mm DS30B* **7** *Signaal DA08 air search* **8** *Aerospatiale MM 40 Exocet Block II* **9** *CelsiusTech Sea Giraffe 150HC* **10** *Racal-Decca navigation radar* **11** *Radamec 2000 electro-optic director* **12** *BAe vertical launch Seawolf (16 launchers)* **13** *Bofors 57 mm/70 SAK Mk 2*

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: Malaysia
Type: Yarrow frigate

Class: LEKIU

Building: 2
Active: 0

Displacement:
standard: 1,845 t
full load: 2,270 t

Dimensions
Length: 105.5 m (346.1 ft) (oa), 97.5 m (319.9 ft) (wl)
Beam: 12.8 m (42 ft)
Draught: 3.6 m (11.8 ft)

Speed: 28 kts
Range: 5,000 n miles at 14 kts

Complement: 146 (18 officers)

SHIPS

LEKIU (30)

Builder	Yarrow (Shipbuilders), Glasgow, UK
Laid down	Mar 1994
Launched	3 Dec 1994
Commissioned	Nov 1996

JEBAT (29)

Builder	Yarrow (Shipbuilders), Glasgow, UK
Laid down	Nov 1994
Launched	May 1995
Commissioned	Aug 1996

Lekiu *(30)* (Jane's/H M Steele)

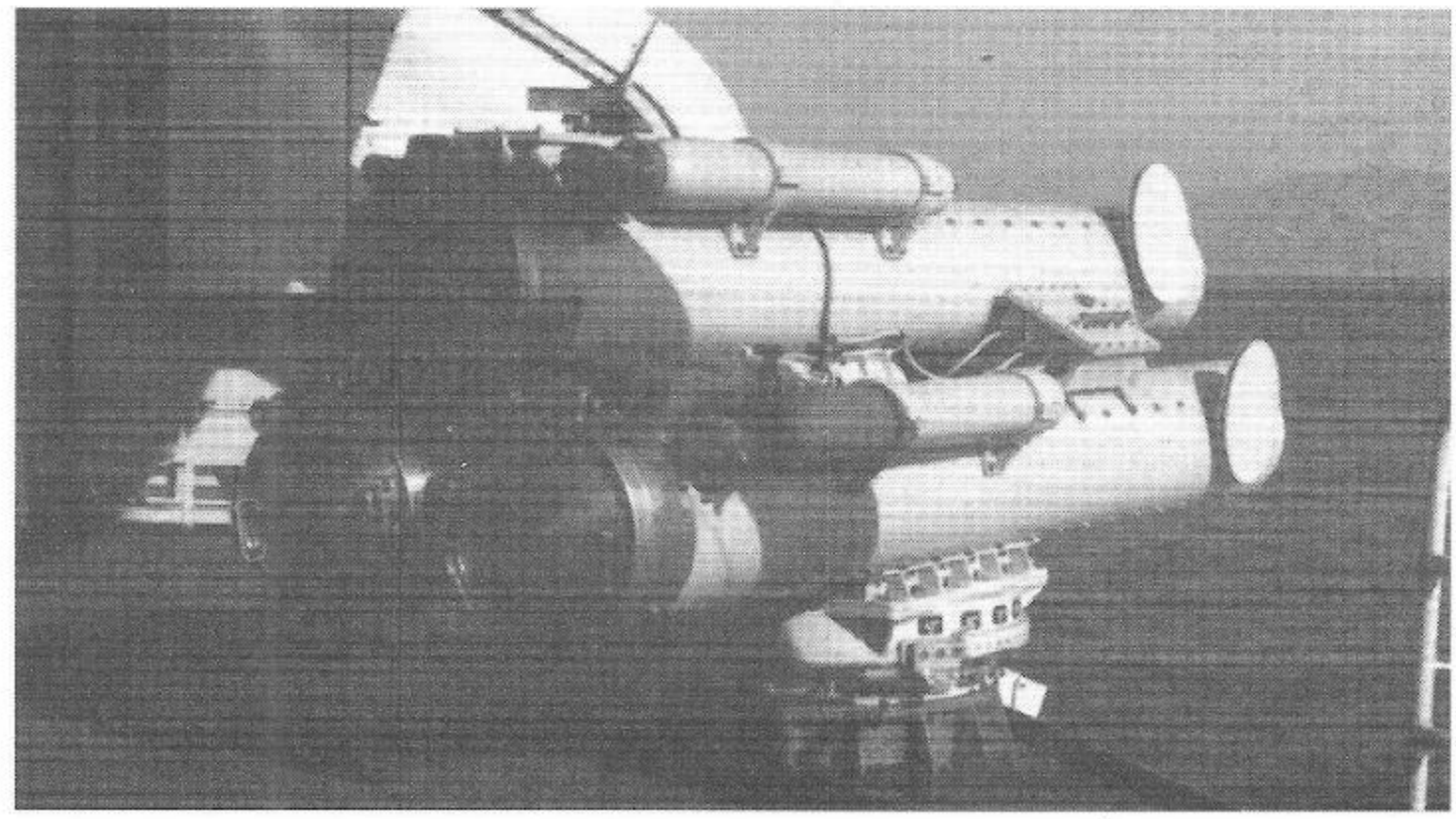
WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 40 medium-range anti-ship missile

Eight MM 40 Exocet launchers in two groups of four are mounted immediately abaft the foremast, firing across the ship.

Specifications
MM 40 Block 2
Length: 5.80 m (19.0 ft)
Diameter: 35 cm (14 in)
Wing span: 1.13 m (3.7 ft)
Weight: 870 kg (1,918 lb)
Speed: Mach 0.9
Range: 2-40.5 n miles (4-75 km)
Warhead: 155 kg (342 lb)HE frag
Fuze: Impact/proximity
Guidance: Inertial and active radar



Whitehead B515 anti-submarine torpedo system consisting of three 324 mm tubes, with one set on each beam (Whitehead)

SURFACE-TO-AIR MISSILES (SAM)

Seawolf (GWS.26) close area defence and anti-missile system

There are 16 launch tubes for Seawolf GWS.26 Mod 1 immediately before the bridge. The GWS.26 system consists of an air/search radar, two trackers, the missile subsystem and the command subsystem, which uses a Ferranti FM1600E processor. The Seawolf VL missile is identical internally to earlier models and is 3.3 m (10.8 ft) long, 60 cm (23.6 in) diameter in a sealed launcher-container. The canister, which has its own efflux management system, is then loaded into a missile silo. The canisters are grouped into eight-cell modules with a missile firing unit and efflux ducting system.

Specifications
Seawolf VL
Length: 3 m (9.84 ft)
Diameter: 18 cm (7.0 in)
Wing span: 70 cm (27.5 in)
Weight: 140 kg (309 lb) (Seawolf VL)
Speed: Mach 2.5
Range: 3.2 n miles (6 km) (Seawolf VL)
Guidance: CLOS
Warhead: Royal Ordnance 14 kg (31 lb) fragmentation high explosive
Fuze: Thorn EMI impact-proximity

Manufacturer/Contractor
BAe Defence Ltd, Dynamics Division.

TORPEDOES

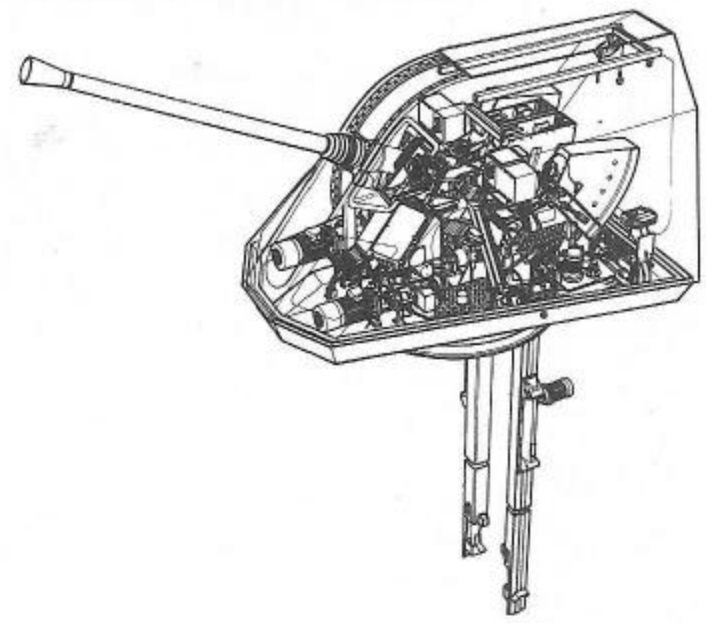
Whitehead B515 anti-submarine torpedo launching system
The B515 system consists of two triple 324 mm diameter torpedo tubes mounted on the open deck, with one installation on each side of the ship. The tubes are manually loaded and trained but remotely operated from the combat information centre, although emergency local operation is possible.

Specifications
Length: 3.4 m (11.0 ft)
Height: 1.2 m (3.9 ft)
Width: 1.285 m (4.2 ft)
Weight: 1,050 kg (2,315 lb) (unloaded)

Manufacturer/Contractor
Whitehead, Salviano, Italy.

A244/S lightweight anti-submarine weapon
The torpedo used by the 'Lekiu' class frigates is the Whitehead A244/S with an Alenia CIACIO-S seeker, which is capable of active, passive or mixed modes for closing on to its target. It can also discriminate between decoys and real targets in the presence of heavy reverberations by specially emitted pulses and signal processing. The seeker also discriminates between target noise and reverberations, as well as having a series preset of programmable search patterns and tactical manoeuvres (including re-attack procedures). The seeker has a large search volume covered by multiple preformed beams following a number of self-adaptive search patterns and is reported capable of target detection at −5 dB in good acoustic conditions. The computerised homing system also provides for presettable combinations of signal processing, spatial filtering and tactical torpedo manoeuvring. The software may be reprogrammed by the customer to meet new tactical conditions. Upon launching, the A244/S initially steers a straight course and, if the target is not detected, it then begins a search pattern which may be either a spiral between preselected depths or a helix pattern.

Specifications
Length: 2.7 m (8.9 ft)
Diameter: 324 mm (12.75 in)
Weight: 215 kg (474 lb) (warshot version)
Warhead: 34 kg (75 lb) shaped charge HBX-3 HE
Propulsion: Electric; silver/zinc batteries
Range: 3.5 n miles (6 km)
Speed: 30 kts



Cutaway of the Bofors SAK 57 Mk 2 system (Bofors)

Guidance: Active/passive sonar, self-adaptive programmed patterns

Manufacturer/Contractor
Whitehead, Salviano, Italy.

GUNS

Bofors SAK 57 L/70 Mk 2
There is a single Bofors SAK 57 L/70 Mk 2 in 'A' position. This is intended to engage air and surface targets and to provide gunfire in support of troops ashore. It is housed inside a 'stealthy' shield.

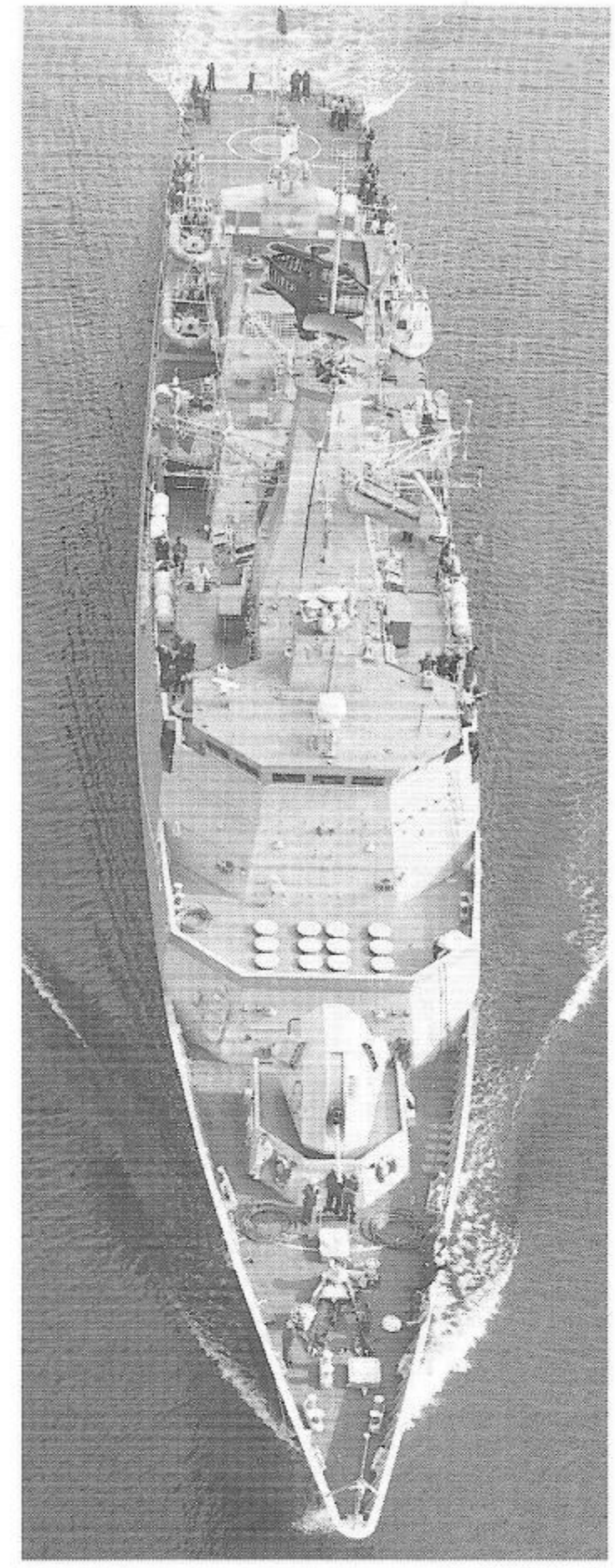
Specifications
Calibre: 57 mm (2.2 in)
Length of barrel: 70 calibres
Traverse: 360° at 55°/s
Elevation: −10 to +77° at 40°/s
Crew: 3
Range: 9 n miles (17 km)
Rate of fire: 220 rds/min
Projectile weight: 2.4 kg (5.3 lb)

Manufacturer/Contractor
Bofors, Karlskroga, Sweden.

MSI DS 30B 30 mm gun mounting
There are two single 30 mm gun mountings either side of the radar tower immediately before the stack. The weapon itself is an Oerlikon KCB 30 mm cannon, which is positively locked and gas operated, with a belt-feed mechanism fixed to the cradle. The left-hand feed KCB-B02 is used in the DS 30B mounting.

The weapon includes a muzzle brake, axial recoil buffer and mechanical ignition system. The KCB normally fires in automatic mode only but in the DS 30B a single shot capability has been included.

The mounting is a locally controlled, power-driven and line of sight stabilised unit designed to allow a variety of sensor and weapon packages to be fitted. The pedestal contains the stabilisation and training machinery and the open gunner's position is on the right of the mounting with the 160-round magazine on the left. The mounting incorporates alloys to reduce magnetic signature and has clean lines to meet NBC washdown requirements. An integral battery pack provides up to 10 minutes of operation in the event of ship power failure.



Lekiu *(30). On the foredeck is the Bofors SAK 57, a gun that is becoming widely used. In 'B' position are 16 vertical launch tubes for VL Seawolf, giving the ship a good self-defence capability* (Yarrow)

Specifications
Mounting (DS 30B)
Traverse: 230° (operational)
Elevation: −25 to +70°
Traverse speed: 55°/s
Elevation speed: 55°/s
Crew: 1

Gun (KCB)
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 650 rds/min
Ammunition weight: 870 g

Manufacturer/Contractor
MSI Defence Systems, Norwich, Norfolk, UK.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

GEC-Marconi Mentor 2
Mentor systems are designed around a 32-bit signal processor with software written in Ada and can operate in either automatic or manual modes. The displays show raw and synthetic formats on a dynamic cartesian display, using colour coding to differentiate between friendly, neutral, unknown or hostile emitters. Details of new emitters are shown in tabular form, while areas of particular interest can be expanded for detailed viewing. The simultaneous tracking capability is 200 emitters. Mentor 2 provides immediate warning of missile attacks, with radars being detected, analysed and full information displayed in less than 1 second, with both audible and visual warnings given. Mentor 2 also triggers the deployment of offboard countermeasures.

Specifications
Mentor 2
Frequency range: D-J
Bearing accuracy: 3-6°
Channels: 6
Sensitivity: −60 dBm
Dynamic range: 60 dB
Emitter library: 3,000
Response time: 1 s
Scan types: Circular, sector, steady, conscan, raster, complex
Track file: >200
Pulsewidth range: <100 ns to 100 µs/CW
PRF range: 100-130 kHz
Elevation coverage: −10 to +50°
Azimuth coverage: 360°

Loading a Sea Siren launcher

Super Barricade system

Manufacturer/Contractor
GEC-Marconi Defence Systems, Stanmore, Middlesex, UK.

Thorn EMI Scimitar ECM system
Scimitar is a descendant of a system developed by MEL; others are Signaal's Reprogrammable Advanced Multimode Shipborne ECM System (RAMSES) and the Canadian SLQ-503. Scimitar is a modular naval electronic countermeasures system designed to provide protection against radar threats. It is an integrated responsive jammer capable of long-range jamming of search radars and the deception of missiles once launched. In its normal mode of operation, Scimitar is controlled by the Mentor 2 system, so that a dedicated ECM operator is not therefore required. In the back-up mode, Scimitar can be manually controlled (target designation and jamming) from the remote-control panel located near the EW operator.

Scimitar operates in I/J-band and is capable of high pulse and CW Effective Radiated Power (ERP). Multimode jamming operation is possible with multitarget handling capability. There are two antennas in small 'egg-shaped' radomes on each side of the ship, at the end of the yard-arms. The two Scimitar antennas are vertically separated with the receive antenna uppermost. On receiving orders from Mentor, the Scimitar receiver trains towards the designated threat, searches for it and then locks onto it, whereupon the system automatically triggers a programmed response. With two separate systems, two targets can be handled simultaneously but, in addition to this, jamming sequences for the next targets can be set up, so that as soon as one target has been dealt with the next can be tackled.

Manufacturer/Contractor
Thorn EMI, UK.

DECOYS

ML Aviation Super Barricade countermeasures system
There are two Super Barricade launchers either side of the hangar. Super Barricade is an improved version of the widely used Barricade system and provides ships with means of deploying chaff and infra-red (IR) decoys to counter missile attacks, using a layered defence against the various types of anti-ship missile. The system uses a 102 mm rocket and a redesigned launcher with four sets of triple-cell launchers. The system has a similar control unit to Barricade Mk III and the same tactical computer. The ammunition lockers each contain 24 rockets. There are four decoy modes:

- Confusion, in which long-range (Stockade) rockets are fired to confuse enemy search radar and make target selection difficult
- Distraction, in which medium-range chaff and/or infra-red rockets are fired in a pattern of six around the ship to present alternative targets to missiles during their search phase, affording defence against multiple missiles coming from different directions
- Dump is used where a missile has locked on to the ship. The ship uses a jammer to remove the missile's range gate and then fires a single rocket to produce a chaff cloud on which the gate may be 'dumped', thus allowing the jammer to be redeployed.
- Centroid is a close-range, final defence mode, used against single missiles. If the incoming missile is locked on to the ship, a pattern of short-range chaff and/or IR rockets is fired to create a large alternative target close to the ship, which manoeuvres away, leaving the missile to home on to the decoy.

Månufacturer/Contractor
ML Wallop Defence Systems, Andover, Hampshire, UK.

Sea Siren decoy system
Sea Siren is a towed torpedo decoy system developed from the G 738, which produces a realistic noise signature of the ship to decoy passive homing torpedoes, and generates sonar-like echoes to confuse active-homing torpedoes. User-programmable parameters are employed to ensure total confidentiality and the decoy can be updated easily to counter the latest threats. Easy deployment and handling is ensured using a davit or gantry system. One or two decoys can be used and can be controlled remotely from any position in the ship over a serial datalink.

Specifications
Acoustic/operational data
Active decoy signal (CW)
Sweep frequency bands: Up to five programmable sweep frequency bands are provided to cover a wide range of torpedo sonar frequencies
Sweep rate: User-programmable
Chopped CW: On/off chopping periods programmable by the user
Output modes: CW only; noise only; CW and noise simultaneously; CW and noise alternately
Passive decoy signal
Noise bandwidth: Pseudo-random noise spectrum band to cover a wide range of passive torpedo sonar frequencies
Modulation: Choice of modulation envelope shape and programmable modulation depth
Modulation frequency: Dependent on rpm and number of propeller blades
Chopped noise: On/off chopping period programmable by the user

Manufacturer/Contractor
Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

NAUTIS-F command and weapon control system

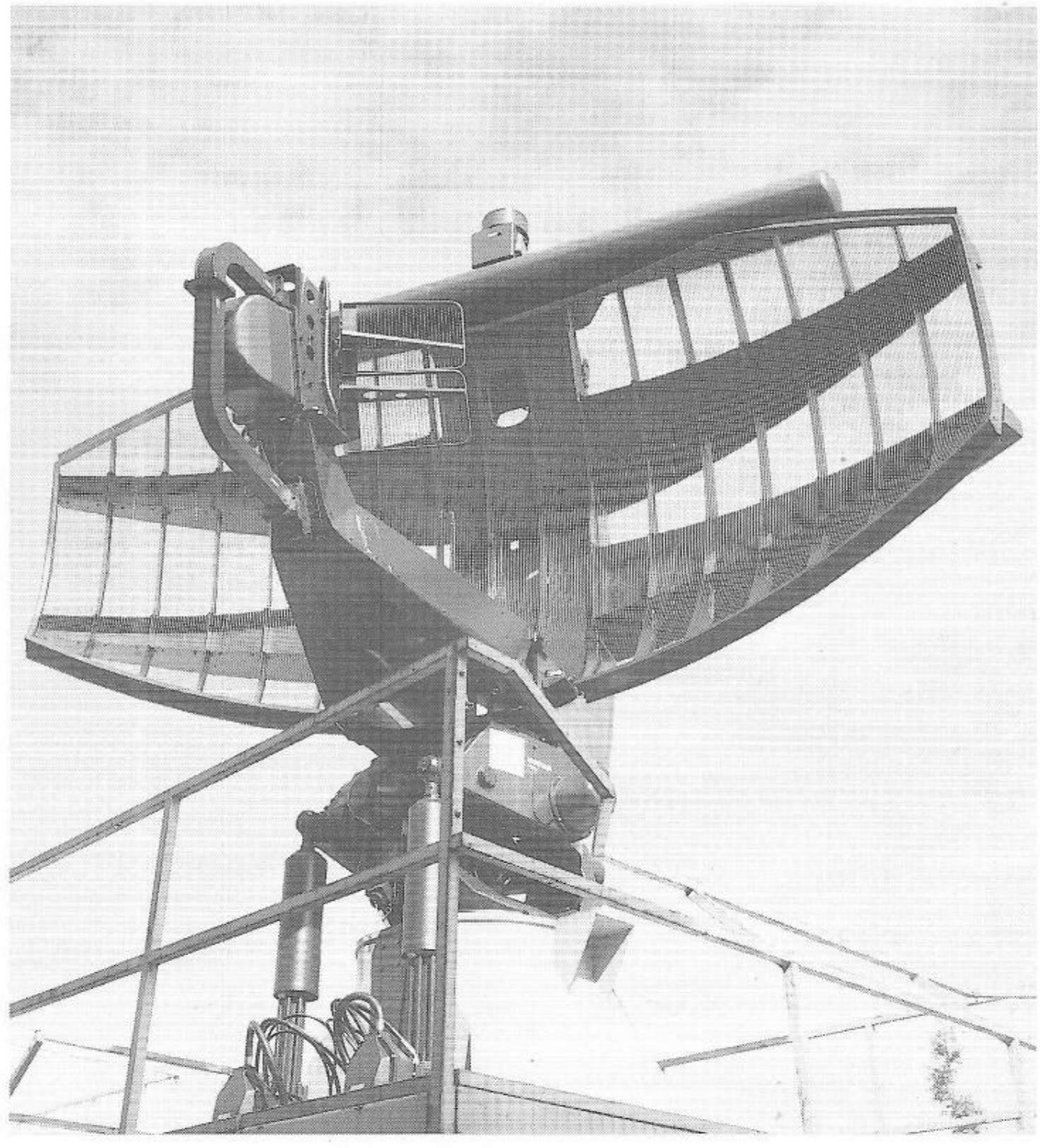
NAUTIS-F (Naval AUTonomous Information System - Frigate) is a command and weapon control system, which, as installed in the Malaysian ships, uses five NAUTIC (Naval AUTonomous Intelligent Console) multifunction intelligent workstations. NAUTICs are based upon Intel iAPX-86 processors with 3 Mbyte RAM together with 2 Mbyte non-volatile magnetic bubble memory. Dual iAPX-286 microprocessors are used in Multibus configurates, while iAPX-186 microprocessors are used for intelligent interfaces. Each NAUTIC uses 150,000 lines of Ada-language software code. NAUTIC consoles are linked by a dual-redundant MIL-STD-1553B data highway.

An extensive system database is replicated in each console, and typically covers an area 2,000 × 2,000 n miles square (3,704 × 3,704 km). It includes radar and sonar tracks, route/search plans, user-designated tactical maps and synthetic charts. System capacity is 200 air, surface and submarine tracks and reference points with integral radar auto-tracking for up to 80 air and surface targets. The database can also include up to six user-designated tactical maps, 15 synthetic charts, 200 labelled reference points, 5,000 fully detailed underwater contacts and 32 labelled bearing lines. Manually initiated automatic radar tracking is possible for a minimum of 20 tracks.

Workstations accept various combinations of digital, synchro and analogue input/output for the whole range of sensors and weapons and interface options, including point-to-point, the data highway or a general purpose combat system highway. They also interface with optional elements, such as chart tables, plotter/printers and magnetic tape units, through point-to-point interfaces or the data highway. The NAUTICs are networked into a system designed to meet customer requirements with the workstations configured to meet specific tasks such as radar displays, automatic target tracking, tactical picture compilation, weapon direction and navigation.

Manufacturer/Contractor

GEC-Marconi Naval Systems, Combat Systems Division.



Signaal DA-08 air search radar (Signaal)

RADARS

Type	DA-08	Sea Giraffe 150 HC	1802 (two)	—
Maker	Signaal	Ericsson	GEC-Marconi	Racal
Role	Air	Surface search	Fire control	Navigation
Band	F	G/H	I/J	I
Beam	1.5 × csc² to 40°	1.8°	2.4°	
Peak power	145 kW	60 kW	50 kW	
Gain	33 dB	30 dB	37 dB	
Pulsewidth	35/69 µs	3.2/6/4 µs	0.67/0.3/1.0 µs	
PRF	1,000/500 pps	1,000-7,000 pps	Non-MTI: 3,000 pps MTI: 4,000 pps	
Scan rate	10/20 rpm	30/60 rpm	—	
Typical range	110 n miles (204 km) for 2 m² target		22 n miles (40 km)	

COMMUNICATIONS AND DATALINKS

Link YM

The Malaysian Navy purchased Link YM, which was developed in the UK by Ferranti as a digital link suitable for sale to non-NATO countries for naval and aircraft use. Different users have versions tailored to their own needs; Link YB, for example, is exclusive to the Brazilian Navy and Link YM to the Malaysian Navy. Link Y, generally, uses a standard message format of two 24-bit words and a transmission speed of 300-1,200 bits/s.

WEAPONS CONTROL

Radamec Series 2000 electro-optic director

There is a Radamec Series 2000 electro-optic director on the bridge roof. This is an electro-optical surveillance system with a stabilised, remotely operated, director. It has a full sector auto-scan facility and is used for target identification. It may be integrated with display systems of the customer's choice. Sensors include the HK 203 low-light TV cameras and a thermal imager. The HK 203 can detect a 10 m² target at 4 km, while the thermal imager can detect such a target at 13-18 km.

Manufacturer/Contractor

Radamec Defence Systems, Chertsey, Surrey, UK.

SONAR

TSM 2633 hull-mounted sonar

TSM 2633 is the hull-mounted version of the Spherion VDS and is a long-range active sonar for ASW surface combatants. It comprises a spherical hull-mounted array with an electronic processing system that allows for real-time computation in transmission and reception modes; three-dimensional stabilisation to compensate for pitch, roll and yaw in the parent vessel; and a beam-tilting capability to counter adverse sound velocity profiles and strong reverberation.

Specifications

Acoustic array: Spherical with 160 individual transducers
Frequency: 7 kHz (approx)
Transmitter: Omnidirectional and sectoral transmissions in CW and FM modes, various modes including TRDT
Receiver: 36 preformed beams stabilised in azimuth and elevation; advanced processing with replica correlator in FM and spectrum analysis (FFT) in CW
Video processing: Data processing in FM and CW modes: automatic detection and tracking; simultaneous multitrack extraction (up to 64); target analysis (apparent length, Doppler measurement)
Display: High-resolution, flicker-free colour TV monitors
Total weight: 4,000 kg (8,820 lb)

Manufacturer/Contractor

Thomson Sintra Activités Sous-Marines, Sophia Antipolis Cedex, France.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 22.8 × 12.8 m (75 × 42 ft)

HELICOPTERS

The Malaysian Navy's current shipboard helicopter is the Westland Wasp HAS. Mk 1, but it is actively seeking a replacement.

Wasp HAS. Mk 1

Specifications

Dimensions
Main rotor
diameter: 9.83 m (32.25 ft)
Tail rotor
diameter: 2.29 m (7.5 ft)
Fuselage length: 9.24 m (30.33 ft)
Height to top of rotor hub: 2.72 m (8.92 ft)
Weights:
empty: 1,566 kg (3,452 lb)
max take-off: 2,495 kg (5,500 lb)

Performance:
max level speed (sea level): 104 kts (193 km/h)
economic cruising speed: 96 kts (177 km/h)
max range: 263 n miles (488 km)
Power plant: 1—710 ehp (derated) Rolls-Royce/Bristol Nimbus 503 turboshaft
Avionics: PTR 170 and PV 141 UHF and UHF homing radio, and standby UHF
Weapons: 2 Mk 44 or 1 Mk 46 torpedoes, or 2 AS.12 anti-ship missiles

PROPULSION

Specifications

System: Combined diesel and diesel (CODAD)
Main machinery: 4 MTU 20V 1163 TB93 diesels; 24.5 MW (33,300 hp(m)) sustained

Shafts: 2
Propellers: KaMeWa cp

FURTHER INFORMATION

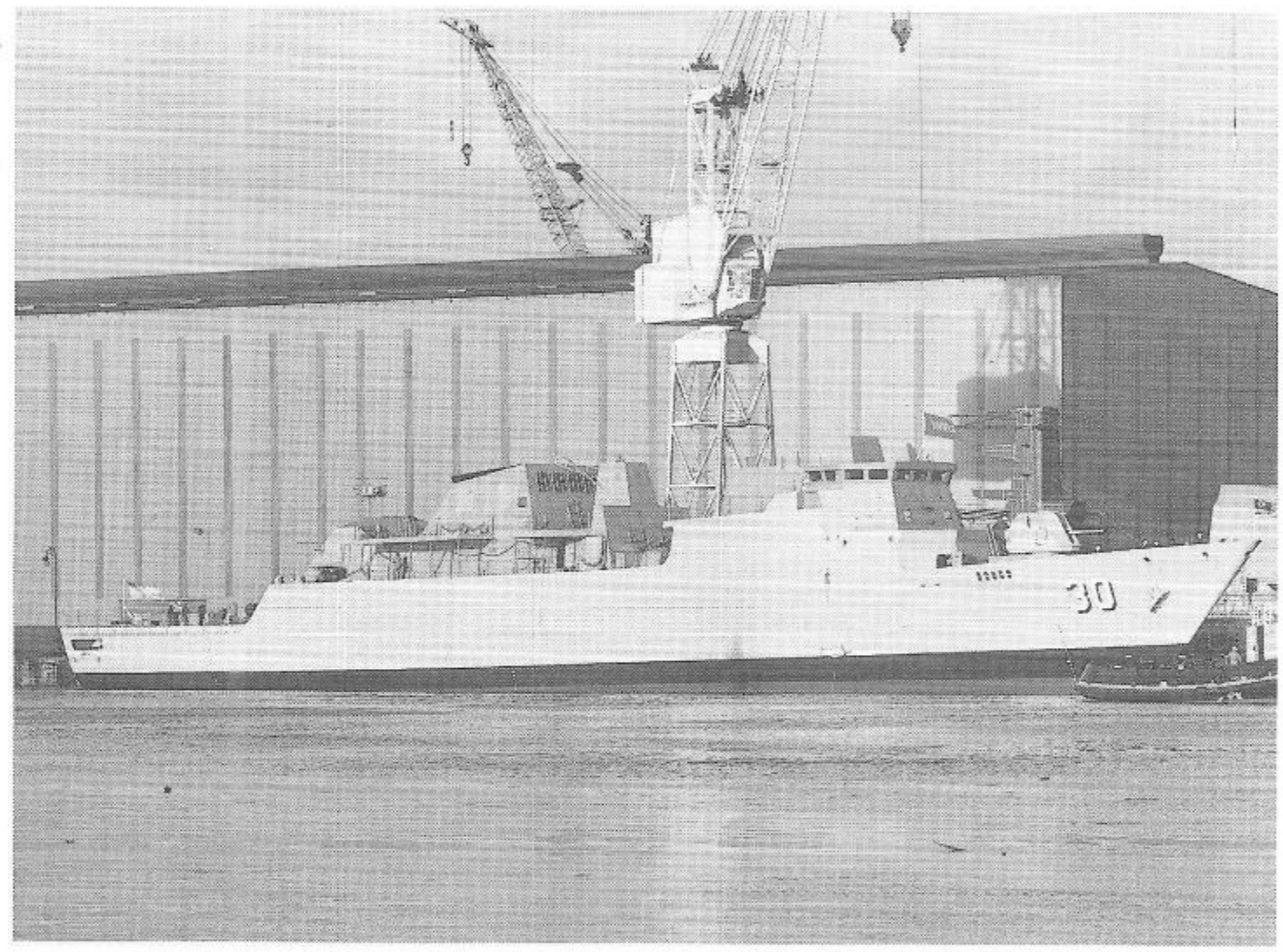
PROGRAMME

The Malaysian Navy originally sought an 80 m (262.5 ft) corvette and started negotiations with Yarrow in the late 1980s for two such ships. The ship design eventually expanded into a frigate-size vessel and a contract was announced on 31 March 1992 for two ships to the Yarrow 'Frigate 2000' design at a cost of £400 million. First steel was cut in March 1993 and the ships were launched on 3 December 1994 *(Lekiu)* and May 1995 *(Jabat)*.

Pennant numbers
The first to be launched and into service was *Lekiu,* which should, therefore, have had the lower pennant number. However, for naval reasons it was desired that *Jabat* should be the 'senior' ship and, therefore, given the lower pennant number (29). Despite that, the class name remains the 'Lekiu' class.

DESIGN

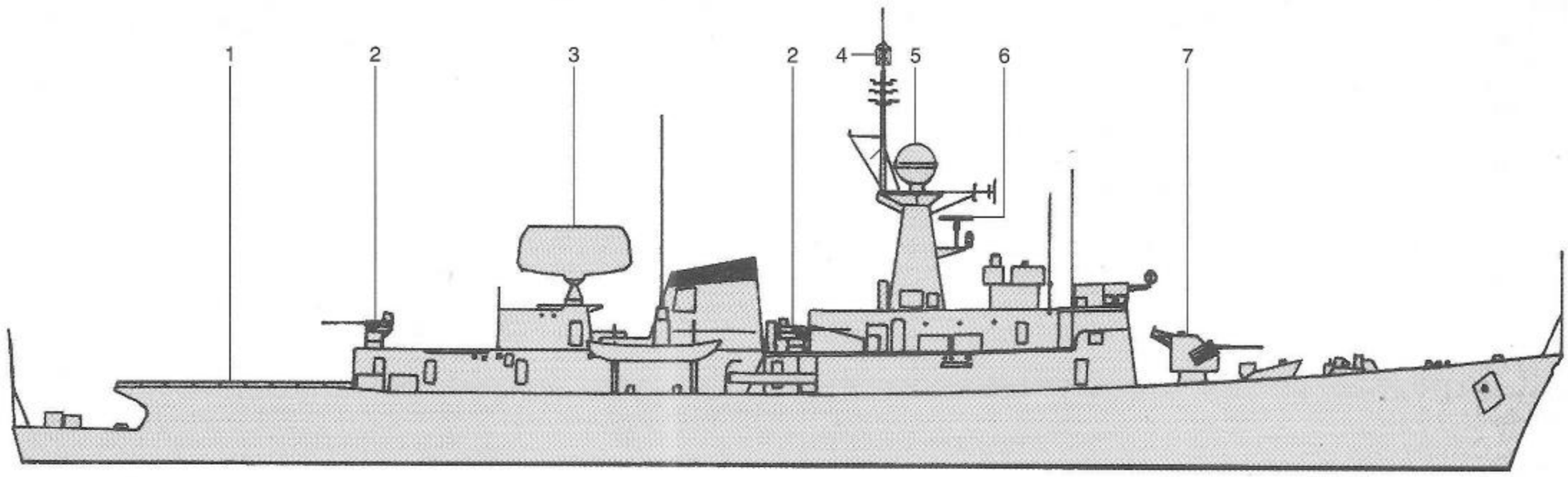
The ship is the GEC Naval Systems Frigate 2000 design with minor alterations to meet Malaysian requirements. Despite its relatively modest size, it has a substantial armament, including Seawolf missiles, a 57 mm gun, eight Exocet MM 40 missiles, two 30 mm cannon and an ASW helicopter. It also has a modern combat data system and automated machinery control.



Lekiu *(30) fitting out* (Yarrow)

Lekiu *(30) at sea on builder's trials* (Yarrow)

RAHMAT (YARROW FRIGATE)



Rahmat (Ian Sturton)
1 *Limbo Mk 10 three-tube ASW mortar (under hatch)* **2** *Bofors 40 mm/70 anti-aircraft weapon* **3** *Signaal LW02 air search radar* **4** *FH-4 HF D/F* **5** *Signaal M22 fire control* **6** *Racal-Decca 626 surface search radar* **7** *Vickers 114 mm (4.5 in)/45 Mk 5 gun*

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: Malaysia
Type: Yarrow Frigate

Class: RAHMAT

Built: 1
Active: 1

Displacement:
standard: 1,250 t
full load: 1,600 t

Dimensions:
Length: 93.9 m (308 ft)
Beam: 10.4 m (34.1 ft)
Draught: 4.5 m (14.8 ft)

Speed: 26 kts (gas turbine); 16 kts (diesel)
Range: 6,000 n miles at 16 kts; 1,000 n miles at 26 kts

Complement: 140

SHIPS

RAHMAT (24)
Builder Yarrow (Shipbuilders), Scotstoun, Glasgow, UK

Laid down Feb 1966
Launched 18 Dec 1967
Commissioned 31 Aug 1971

WEAPONS SYSTEMS

ANTI-SUBMARINE MORTARS

Anti-Submarine Mortar Mk 10 Limbo

There is one Mk 10 Limbo mortar set in a well in the after deck. This weapon has three 304.8 mm (12 in) barrels installed in line on a massive metal mounting with a metadyne system for stabilising it in pitch and roll. The projectiles are loaded automatically from magazines alongside the mounting, the mortar tubes being laid horizontally with a pneumatic system moving rounds down the barrel. Fuze settings are set automatically through relays and uniselectors. The magazine has a capacity of 51 rounds. Training of the mortar is carried out automatically from the combat information centre using data from the ship's sonar system. The Limbo system fires its projectiles in a three-dimensional pattern. The projectiles can be set to explode at various depths using hydrostatic or impact fuzes and are identical to those used in Squid. Limbo has a crew of seven.

Limbo is controlled by the MCS (Mortar Control System) Mk 10. The original system used vacuum-tube technology and, during the 1960s, systems in British service were updated with new solid-state electronics in the computer and sonar display system. The sonar is the Type 170 with square transducer and a frequency of 15 kHz.

Specifications

Calibre: 304.8 mm (12 in)
Weight: 35 t
Range: 900 m (2,953 ft)
Projectile: 177 kg (390 lb)
Explosive: 94 kg (207 lb)

GUNS

Vickers 114 mm (4.5 in) Mk 5 semi-automatic gun

Rahmat has a single Vickers 114 mm (4.5 in) QF Mk V gun forward in 'A' position. The barrel has neither muzzle brake nor fume extractor and is 45 calibres long with 32 grooves (1 in 25 twist) and a life of approximately 750 EFC (Equivalent Full Charges). There is a hydraulically operated vertical sliding breech block and the gun fires separate ammunition. The recoil and run-out cylinders are incorporated in the breech ring so that the total weight of the weapon is 3,368 kg (7,426 lb). The turret is manually operated. There are 103 mm rocket launchers for illuminants on each side of the mounting.

Specifications

Mk V gun
Calibre: 114 mm
Length of barrel: 45 calibres
Muzzle velocity: 746 m/s (2,448 ft/s)
Weight of round: 25.5 kg (56 lb) (projectile only)
Range:
anti-surface: 9.3 n miles (17 km)
anti-air: 12,500 m (41,000 ft)
Rate of fire: 14 rds/min (Mk V gun)
Max elevation: 50°

Manufacturer/Contractor

Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

Bofors 40 mm/60 Mk 9

There are three single Bofors 40 mm/60 Mk 9 mounts: two are in the waist just forward of the stack, the third on the roof of the after deckhouse.

Specifications

Traverse: 360° (nominal) at 90°/s
Elevation: −3 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

UA-3 radar warning

A UA-3 radar warning receiver is fitted, covering 2.5 to 11.5 GHz.

FH-4 HF D/F

FH-4 is a 1960s-vintage British communications direction-finding equipment. It employs the 'birdcage' antenna at the head of the mast.

DECOYS

Mk I rail chaff launchers

There are two British Mk 1 chaff launchers.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Signaal SEWACO-MA

Rahmat has a Signaal DAISY (Digital Action Information SYstem) C^2 system which is integrated with the various radars and fire-control systems to form the SEWACO-MA (SEnsor Weapon control And COmmand - Malaysia) system. The DAISY system is designed to present raw and/or processed sensor data from search and fire-control radars together with IFF, sonar, electronic warfare and electro-optic systems to create a picture of the tactical situation. The onboard data is supplemented by data from offboard sensors which are brought to the ship via the Link Y tactical datalink. The data may also be used to designate targets to weapon systems and to assist in operations with auxiliary functions such as ASW helicopter direction and tactical navigation.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

COMMUNICATION AND DATALINKS

Link YM

The Malaysian Navy purchased Link YM, which was developed in the UK by Ferranti as a digital link suitable for sale to non-NATO countries for naval and aircraft use. Different users have versions tailored to their own needs; Link YB, for example, is exclusive to the Brazilian Navy and Link YM to the Malaysian Navy. Link Y, generally, uses a standard message format of two 24-bit words and a transmission speed of 300-1,200 bits/s.

RADARS

Set	LW-02	626	MS 32	M 22
Company	HSA	Decca	Kelvin Hughes	Signaal
Role	Air search	Surface search	Navigation	Fire control
Band	D	I	I	I/J
Beam	2.2 × csc² to 40°			Search: 1.5 × 7° Track: 2.4°
Peak power	500 kW			180 kW
Gain	31 dB			33.5 dB
Pulsewidth	2/5 µs			0.22/0.45 µs
PRF	500/250 pps			3,600/1,800 pps
Scan rate	1-10 rpm			60 rpm
Typical ranges	100 n miles (185 km) for 2 m² target at 18,000 m (59,000 ft)			

SONARS

Type 170B sonar

Type 170B is the sonar used to control the Squid ASW mortar. Operating frequency is 15-25 kHz and the system has a maximum operating range of about 1,800 m (2,000 yd) and a maximum depth of about 350 m (1,200 ft)

Type 174

The hull-mounted Type 174 is a 1950s-vintage active search sonar operating at 14-22 kHz, which operates in conjunction with the Type 170B (see above).

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 14 × 10 m (48 × 34 ft). The Limbo Mk 10 mortar is in the centre of the flight deck and is covered over, using a special hatch, prior to flying operations

Hangar: There is no hangar or other aviation facility

HELICOPTERS

If used for flying, *Rahmat* could embark one of the navy's current Westland Wasp HAS. Mk 1.

PROPULSION

System: Combined diesel or gas turbine (CODOG)

Main machinery: 1 Rolls-Royce (Bristol Siddeley) Olympus TM1B gas-turbine; 15.4 MW (20,626 hp); 1 Crossley Pielstick PC2.2 V diesel; 2.94 MW (4,000 hp)

Shafts: 2

Propellers: 2 Stone/KaMeWa cp

FURTHER INFORMATION

PROGRAMME

Rahmat was ordered on 11 February 1966 and was the first major unit to be designed and built for the (then) young Malaysian Navy. The ship was launched on 18 December 1967 and arrived in Malaysian waters on 23 December 1972.

NAMES

Rahmat was originally to have been named *Hang Jabat* after a legendary Malay hero, but this was changed to *Rahmat* before launch.

DESIGN

This ship was built to the 'Yarrow Mk 1 frigate' design for a general purpose, long-range warship with high endurance and high maximum speed. Payload is 150 tonnes of weapons and ammunition, which was higher than any other contemporary frigate at the time it was built.

The hull form has a fairly narrow beam, water-compensated fuel tanks are used, and the high freeboard and form result in a positive stability range. The ship has two spade-type rudders and non-retractable fin stabilisers.

PROPULSION AND POWER

The propulsion system was, for the time, quite unusual, as it was designed as a two-shafted CODOG installation in which the two driving elements were not used together. This required a combining gearbox enabling only one prime mover to drive both shafts. Both shafts are, therefore, permanently locked together and always revolving at the same speed, with thrust being varied by controllable pitch propellers. The engines are one Rolls-Royce Olympus in the forward engine room and one Paxman diesel in the after engine room, both using the same standard diesel fuel.

Rahmat *(24) was one of a series of frigates designed and constructed by Yarrow of Glasgow. Although it has been in service since 1971 the Royal Malaysian Navy plans to modernise it and extend its service into the 21st century*

Electrical power is supplied by four Paxman Ventura diesel engines, with three engines in one room aft and the fourth forward and above the waterline for survivability reasons. The whole ship load can be carried by any combination of two generators.

MODERNISATION

As built, the ship was armed with a Seacat SAM system, but this was removed during a major refit in 1982-83 and replaced by an additional Bofors gun. A fourth Bofors has been seen on a temporary mounting on the forward part of the flight deck.

There are plans for further modernisation.

THE FUTURE

The ship is now fairly old and the weapons and sensor systems dated. Nevertheless, the ship is in good condition and has proved successful in service, and continues to play a valuable role in helping the Malaysian Navy to meet its heavy commitments.

LEANDER

OVERVIEW

First of class, Leander *(F 109), was completed in 1963. The raised forecastle and the considerable freeboard gave excellent sea-keeping abilities, but the armament was relatively light, consisting of twin 114 mm (4.5 in) guns, two 40 mm Bofors and a Limbo ASW mortar* (Jane's)

During the 1950s the British produced no less than six classes of escort ships using four different hulls and it was then decided to combine the best characteristics of all these designs in a new, single, general purpose frigate. The result was the very successful 'Leander' class, of which a grand total of 44 were built in four countries, and, as of 1 January 1997, 24 remain in front-line service with seven navies (Table 1).

Basic design

The original Leander was armed with a single Mk 6 mounting with twin 114 mm (4.5 in) guns in 'A' position, two single Bofors 40 mm and one Mk 10 Limbo ASW mortar, which was located in a well at the after end of the flight deck. The flight deck and hangar were designed to operate a Westland Wasp helicopter. Compared to the previous 'Rothesay' class, the Leander hull had the forecastle extended aft and a superstructure deck. The ship was powered by the Y100 steam plant and was fitted with twin rudders, which combined to give it exceptional acceleration and manoeuvrability. As built, the 44 Leanders were divided into five versions.

UK

Two slightly different designs were built for the RN, with sixteen of the first version, outlined previously. These were followed by a second group of ten, known as the 'Broad Beam Leander,' because the hull was widened by 0.61 m (2 ft) to create extra space for future developments. The extra beam also increased both endurance and stability, but at the cost of a reduction of 0.5 knots in maximum speed.

Netherlands

In the mid-1960s the Dutch Navy needed to replace its six ex-US Navy 'Cannon' class destroyer escorts ('Van Amstel' class) and it was decided to adopt the Leander design. The Dutch ships retained the basic British design, but used Dutch equipment wherever this was both feasible and would not delay construction. The Dutch ships also had a broader enclosed bridge and two (as opposed to one) Seacat launchers.

India

The Indian Leanders were constructed between 1966 and 1981, and the first to be built was virtually identical with the British original, although, since the Indian Navy's standard Alouette III helicopter is longer than the British Wasp, a telescopic hangar was required. The last two were completed with a modified flight deck and hangar to enable them to accommodate a Sea King helicopter.

Australia

Australia intended to build six 'Yarra' class frigates between 1957 and 1964, which were improved versions of the British 'Rothesay' class frigates. However, the last two were cancelled in 1956 and there was then a nine year gap until a new order could be placed for the two additional frigates. These were produced to a design which represented a combination of the 'Yarra' class with many of the features of the British Leander, but without the hangar and flight deck. Nevertheless, these two ships are normally accounted as being 'Leander' class ships.

Chile

The Chilean Navy ordered two Leanders, which were built in the UK, being laid down in 1971 and delivered in

Jupiter *(F 60) was the third in the second series of ships known as the 'Broad Beam Leanders'. These had 0.61 m (2.0 ft) wider hulls, giving increased endurance, stability and internal volume*

TABLE I: BRITISH 'LEANDER' CLASS

A. ORIGINAL LEANDERS

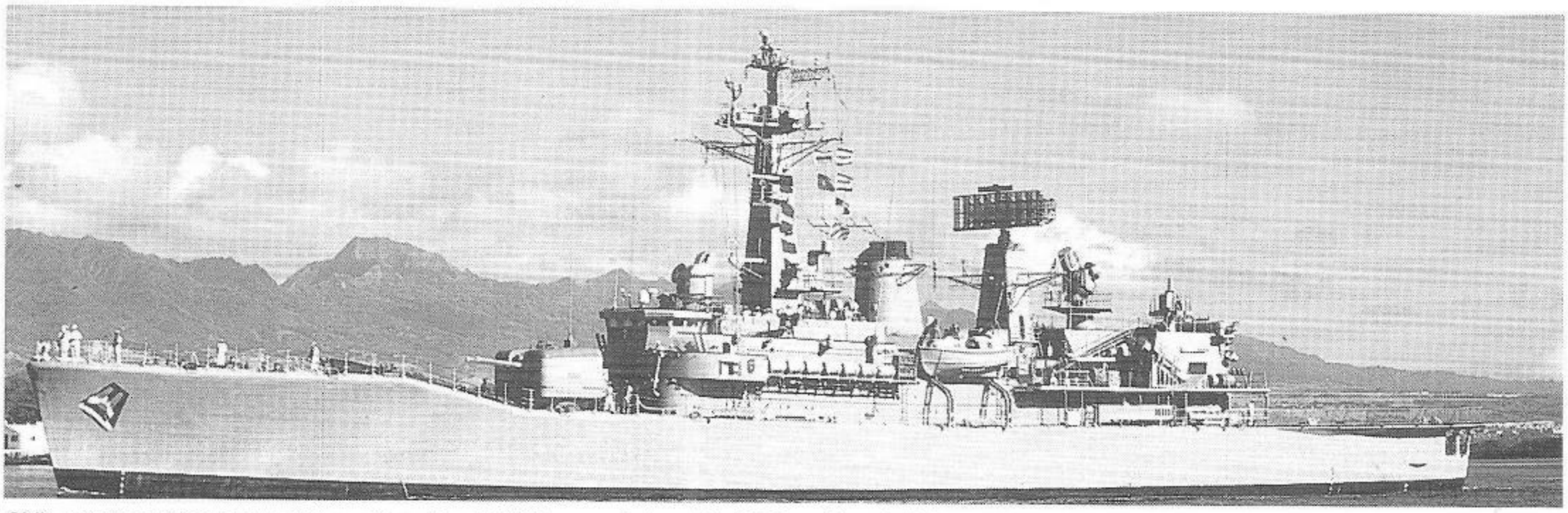
Serial	Name	Conversion	Completed	Fate	RN Disposals		Status
					New operator	New name	1 Jan 1997
1	*Leander* (F 109)	Batch 1	1963	Sunk as target 1989	—	—	—
2	*Ajax* (F 114)	Batch 1	1963	Broken up 1988	—	—	—
3	*Dido* (F 104)	Batch 1	1963	Sold — 1983	New Zealand	*Southland* (F 104)	Stricken 1995
4	*Penelope* (F 127)	Batch 2	1963	Sold — 1991	Ecuador	*Presidente Eloy Alfar* (FM-01)	In service
5	*Aurora* (F 10)	Batch 1	1964	Broken up 1990	—	—	—
6	*Euryalus* (F 15)	Batch 1	1964	Broken up 1993	—	—	—
7	*Galatea* (F 18)	Batch 1	1964	Sunk as target 1988	—	—	—
8	*Arethusa* (F 38)	Batch 1	1965	Sunk 1991	—	—	—
9	*Naiad* (F 39)	Batch 1	1965	Sunk 1990	—	—	—
10	*Phoebe* (F 42)	Batch 2	1966	Sold 1992			
11	*Cleopatra* (F 28)	Batch 2	1966	Broken up 1994	—	—	—
12	*Minerva* (F 45)	Batch 2	1966	Broken up 1994	—	—	—
13	*Sirius* (F 40)	Batch 2	1966	Stricken 1993			
14	*Juno* (F 52)	Note 1	1967	Broken up 1995	—	—	—
15	*Argonaut* (F 56)	Batch 2	1967	Stricken 1993	—	—	—
16	*Danae* (F 47)	Batch 2	1967	Sold — 1991	Ecuador	*Moran Valverde* (FM-02)	In service

B. BROAD BEAM LEANDERS

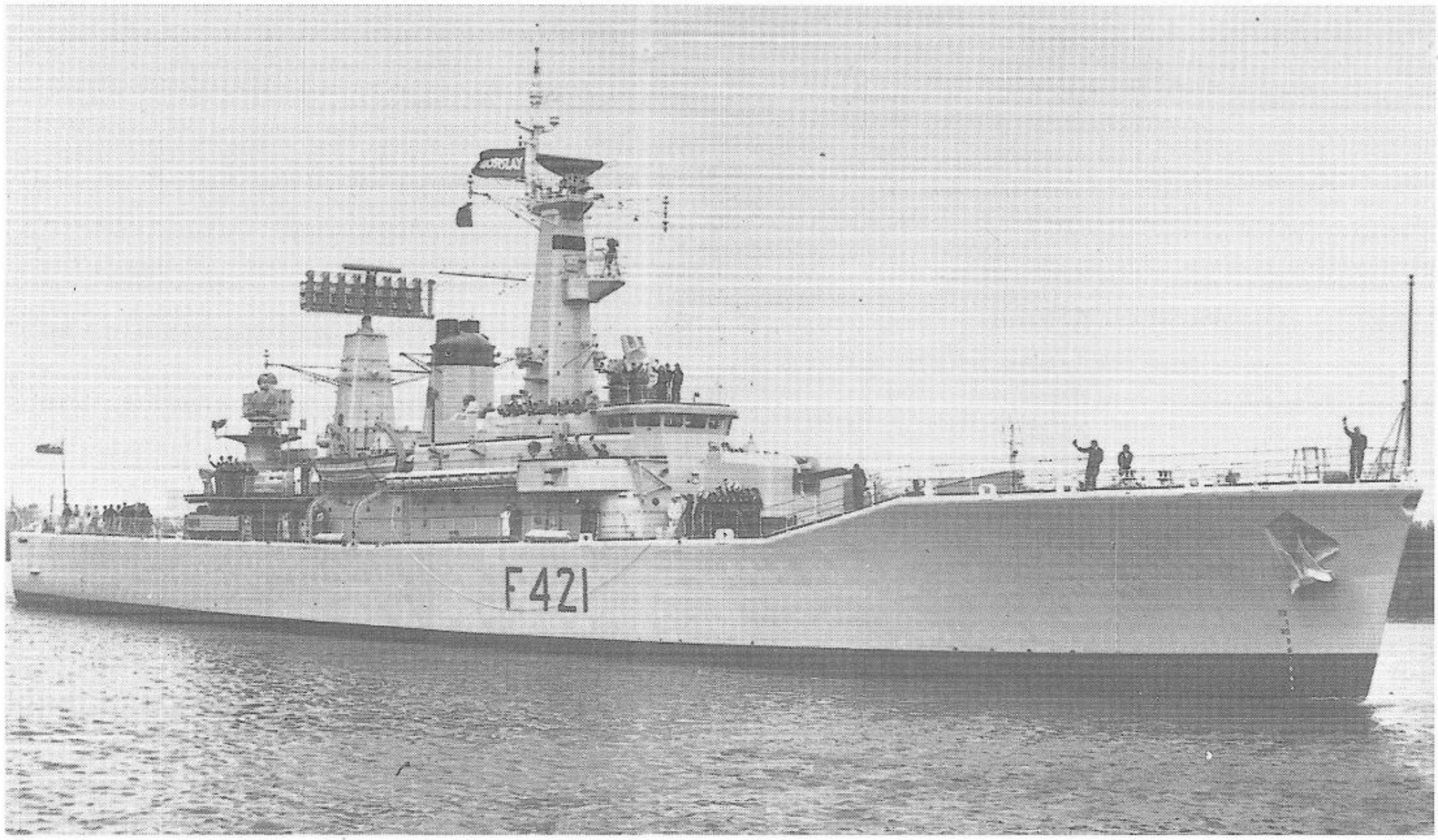
Serial	Name	Conversion	Completed	Fate	RN Disposals		Status
					New operator	New name	1 Jan 1997
1	*Andromeda* (F 57)	Seawolf	1968	Sold — 1995	India	*Krishna* (F 57)	
2	*Hermione* (F 58)	Seawolf	1969	For disposal — 1996			
3	*Jupiter* (F 60)	Seawolf	1969	For disposal — 1996			
4	*Bacchante* (F 69)	Note 2	1969	Sold — 1982	New Zealand	*Wellington* (F 69)	
5	*Charybdis* (F 75)	Seawolf	1969	Sunk as target 1993			
6	*Scylla* (F 71)	Seawolf	1970	Scrapped — 1996			
7	*Achilles* (F 12)	Note 2	1970	Sold — 1990	Chile	*Ministro Zenteno* (08)	
8	*Diomede* (F 16)	Note 2	1971	Sold — 1988	Pakistan	*Shamsir* (F 263)	
9	*Apollo* (F 70)	Note 2	1972	Sold — 1988	Pakistan	*Zulfikar* (F 262)	
10	*Ariadne* (F 72)	Note 2	1973	Sold — 1992	Chile	*General Baquedano* (09)	

Notes

1. *Juno* was scheduled for conversion in the Batch 2 (Exocet) programme, but this was cancelled.
2. The conversion of these Broad Beam ships to Seawolf configuration was cancelled.



Chile purchased two new-build Leanders: Condell *(06) commissioned in 1973 and* Lynch *(07) - seen here - which was commissioned in 1974. After 22 years continuous front-line service and several major rebuilds, both ships are still in excellent condition. Chile also bought two ex-UK Royal Navy Leanders in 1990 and 1992* (H & L van Ginderen Collection)



Another overseas customer was New Zealand, which bought two new-build ships. The second was Canterbury *(F 421), a 'Broad Beam Leander'* (Yarrow)

1973-74. These were generally similar to the original RN Leanders, but with taller foremasts.

New Zealand

The Royal New Zealand Navy (RNZN) initially ordered one 'Leander' class frigate in 1963, which was to the original British design, and was delivered in 1966 (*Waikato* (F 55). The order for the second ship was not placed until 1968 by which time UK production had moved on to the 'Broad Beam Leander' and *Canterbury* (F 148) was delivered to this design in 1961.

Mid-life Conversions for British 'Leanders'

The original 16 Leanders were divided into two separate groups for the major development programmes, which were known as Batches 1 and 2. In the event only 15 ships were converted, since *Juno* (F 52), which was originally intended to receive a Batch 2 conversion, had it cancelled on financial grounds. As a result, *Juno* was given a minor refit, with most of its weapons being removed to enable it to be employed as a training ship.

Batch 1. The Batch 1 conversion was applied to eight ships (see Table I) and involved replacing the twin 114 mm (4.5 in) gun with a GWS.41 Ikara anti-submarine missile and the addition of an ADAWS 5 tactical data system. The Type 965 air warning radar was removed, while a rearrangement of various equipments aft enabled a second Seacat SAM launcher to be mounted. The Mk 10 Limbo was retained and, since this occupied a large well at the rear end of the flight deck, this limited helicopter operations to the Westland Wasp.

Batch 2. Seven ships were converted under the Batch 2 programme, of which four were to Batch 2A standard and three to Batch 2B. In the Batch 2TA (TA = towed array) the work involved removing the 114 mm (4.5 in) gun and using the space to install four MM 38 Exocet launchers (GWS.50 in RN service) on low plinths. The Limbo mortar was removed and the well plated over to enable the flight deck to be used by Lynx helicopters. A Type 2031(1) towed array was installed right aft and since the winch and other elements took up a lot of deck space, F 40, F 42 and F 56 had a sponson fitted to ease the congestion. This was not, however, done in F 28. As further measures to reduce topweight, the forward Seacat launcher and director were removed, together with the Type 965 radar.

In the Batch 2B conversions the twin 114 mm (4.5 in) mount was also removed and replaced by four MM 38 Exocet launchers, but in this case each pair of launchers was mounted on a raised platform. The Limbo ASW mortar was removed and the hangar was enlarged to accommodate the new Lynx helicopter, and the ASW armament was enhanced by the installation of two triple 324 mm torpedo tubes (STWS.1 system). The number of Seacat launchers was also increased from one to three.

Batch 3. Five Broad Beam ships were converted to take Seawolf missiles and were then known as either 'Batch 3 Leanders' or 'Seawolf Conversions'. The work involved the ships being almost totally gutted and rebuilt, and was completed between 1981 and 1984. The twin 114 mm mounting and the Limbo ASW mortar were removed and various items resited, mainly in order to reduce topweight. This enabled a six-cell Seawolf SAM launcher (GWS.25 Mod 0) and four MM 38 Exocet launchers to be installed forward of the bridge, and the hangar and the flight deck to be adapted to take the Lynx helicopter. A new foremast was fitted and, since the large and heavy Type 965 antenna was removed, a much lighter mainmast was also fitted. The CAAIS tactical data handling system was installed. Other enhancements included the Type 967 radar, Sonar 2016, two triple lightweight STWS.1 torpedo tubes and the latest ESM/ECM equipment.

Unmodified Broad Beam Leanders. The curtailment of the Batch 3 conversion programme left five unmodified Broad Beam Leanders. One of these, *Bacchante* (F 69), was sold to New Zealand in 1982, and although the remaining four RN ships received major refits in the mid-1980s this did not amount to a 'mid-life' conversion.

Dispersal of the British and Dutch Leanders

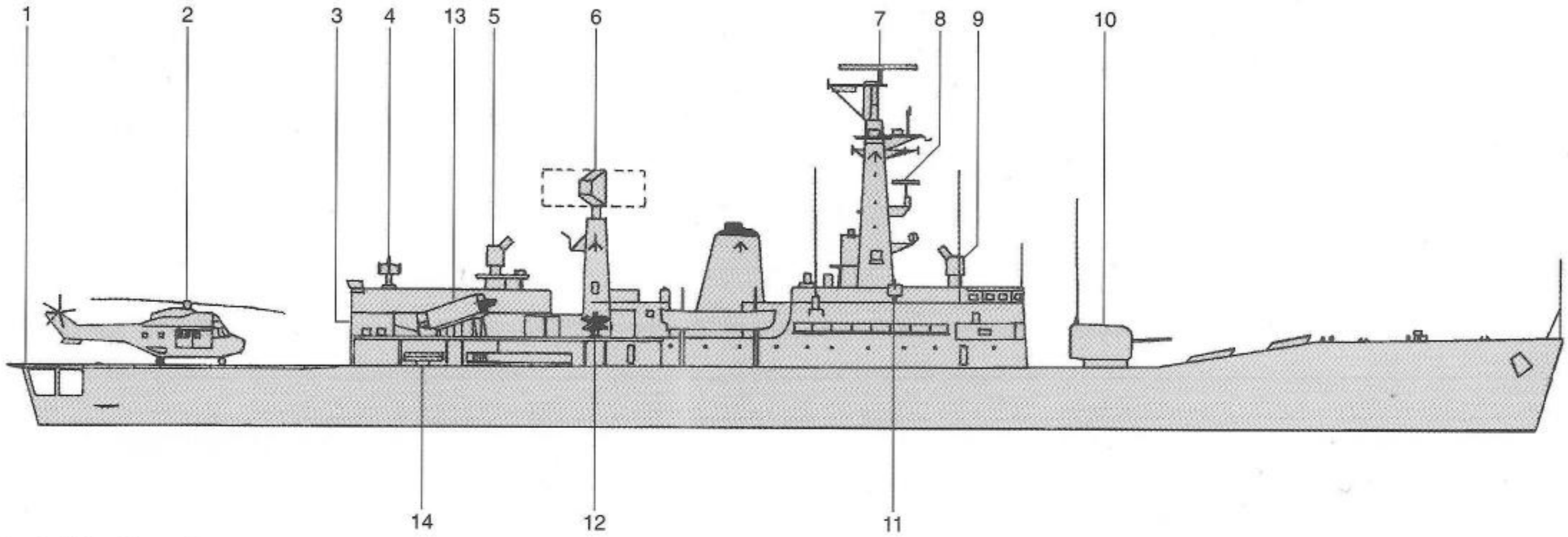
Of the 26 Leanders which served with the RN, 17 were either scrapped or expended as targets, while nine were sold to foreign customers:

New Zealand: 1 — 1982; 1 — 1983
Pakistan: 2 — 1988
Chile: 1 — 1990; 1 — 1992
Ecuador: 2 — 1991
India: 1 — 1995

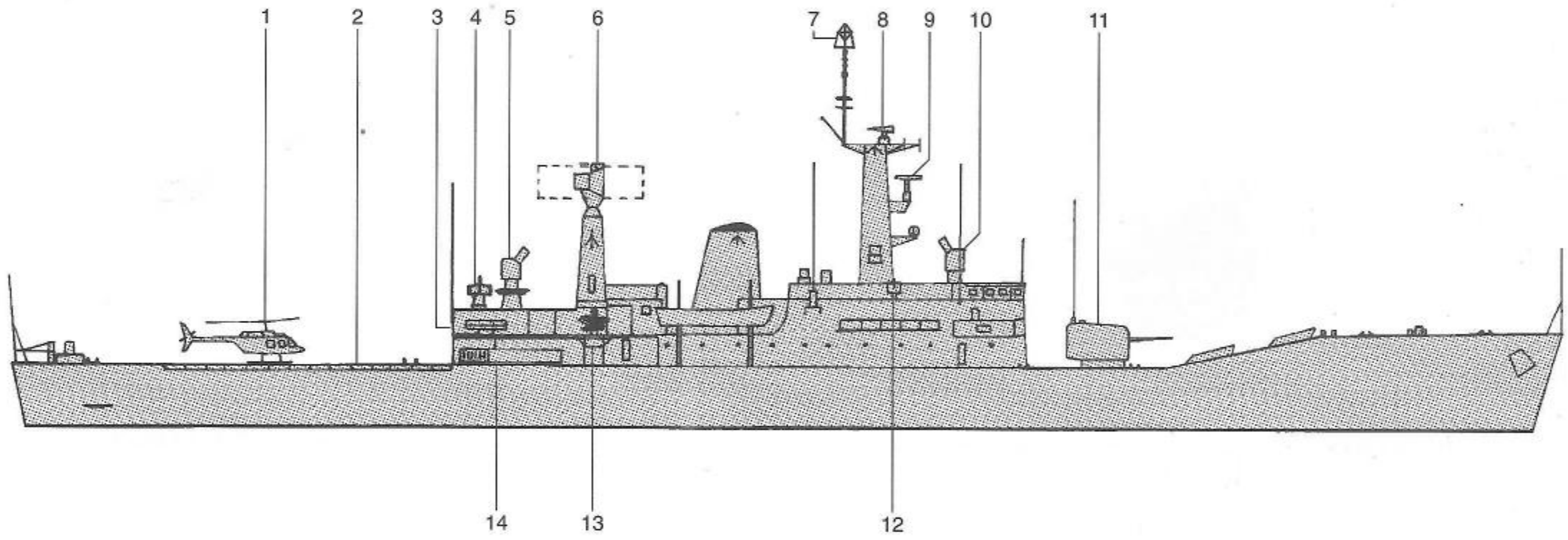
The RNethN built and operated six 'Van Speijk' class, and all six were sold to Indonesia between 1986 and 1989.

(**Footnote.** It is important to note that, while in later British classes batch numbers were applied to different groups as constructed (for example, Type 22 Batches 1, 2 and 3), in the 'Leander' class the term was applied to the different in-service conversions.)

CONDELL (LEANDER)



Condell (Ian Sturton)
1 *New enlarged flight deck* **2** *Cougar helicopter* **3** *New hangar* **4** *Seacat SAM launcher (being removed)* **5** *Plessey Type 904 (being replaced)* **6** *GEC-Marconi Type 965 radar* **7** *GEC-Marconi Type 992Q* **8** *Kelvin Hughes Type 1006 navigation radar* **9** *GEC-Plessey Type 903 fire control (114 mm guns)* **10** *Twin 114 mm (4.5 in)/45 Mk 6 semi-automatic guns* **11** *20 mm Oerlikon cannon* **12** *Corvus eight-barrel decoy launcher* **13** *Two MM 40 Exocet anti-ship missile launchers* **14** *Triple 324 mm Mk 32 torpedo tubes*



Ministro Zenteno (Ian Sturton)
1 *Bell 206B helicopter* **2** *Flight deck* **3** *Hangar* **4** *Seacat SAM launcher* **5** *Plessey Type 904 fire control (Seacat)* **6** *GEC-Marconi Type 965* **7** *FH-12 HF direction finding* **8** *Plessey Type 994 radar* **9** *Kelvin Hughes Type 1006 navigation radar* **10** *Plessey Type 903 fire control (114 mm guns)* **11** *Twin 114 mm (4.5 in)/45 Mk 6 semi-automatic guns* **12** *Oerlikon 20 mm Mk 9 (single)* **13** *Corvus decoy launcher* **14** *Triple 324 mm Mk 32 torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: Chile
Type: Leander

Class: CONDELL (FFG)

Built: 2
Purchased: 2
Active: 4

Displacement:
standard: 2,500 t
full load: 2,962 t

Dimensions
Length: 113.4 m (372 ft) (oa); 109.7 m (360 ft) (wl)
Beam: 13.1 m (43 ft)
Draught: 5.5 m (18 ft) (screws)

Speed: 29 kts
Range: 4,500 n miles at 12 kts

Complement: 263 (20 officers)

SHIPS

CONDELL (06)

Builder	Yarrow & Co, Scotstoun, UK
Laid down	5 Jun 1971
Launched	12 Jun 1972
Commissioned	21 Dec 1973

ALMIRANTE LYNCH (07)

Builder	Yarrow & Co, Scotstoun, UK
Laid down	6 Dec 1971
Launched	6 Dec 1972
Commissioned	25 May 1974

MINISTRO ZENTENO (08)

Builder	Yarrow & Co, Scotstoun, UK
Laid down	1 Dec 1967
Launched	21 Nov 1968
Commissioned (RN)	9 Jul 1970 (*Achilles* (F 12))
Sold to Chile	Sep 1990

GENERAL BAQUEDANO (09)

Builder	Yarrow & Co, Scotstoun, UK
Laid down	1 Nov 1969
Launched	10 Sep 1971
Commissioned (RN)	10 Feb 1973 (*Ariadne* (F 72))
Sold to Chile	Jun 1992

WEAPONS SYSTEMS

Lynch *(07). This is one of the two original ships built for Chile and has a taller foremast than the British ships topped by a GEC-Marconi Type 992Q radar* (Yarrow)

ANTI-SHIP MISSILES (ASM)

Exocet MM 40 Block 1 anti-ship missiles

Four MM 40 Exocet anti-ship missile launchers were installed in all four ships in the early 1990s, replacing MM 38 in *Condell* and *Lynch,* and adding to the weapon fit in *Zenteno* and *Baquedano.* They are located in two pairs either side of the hangar at the 01 deck level. Targets for the missiles are acquired by the ship's sensors, and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence which can take up to 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change in the course of its flight. Once the missile has cleared the launcher-container, the sustainer carries it into the cruise phase and it then travels towards the general location of the target at a height of about 100 m (330 ft) which is low enough to reduce the chance of detection but adequate for target acquisition. Once the target is detected the missile descends to 9-15 m (30-50 ft) in the approach phase before descending to 8 m (26 ft) (2-5 m (6.6-16.4 ft) in a calm sea) for a sea-skimming terminal phase. A salvo may be fired in 12-20 seconds.

Specifications

MM 40 Block 1
Length: 5.78 m (18.96 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.13 m (3.67 ft)
Weight: 855 kg (1,885 lb)
Speed: Mach 0.9
Range: 2-38 n miles (4-70 km)
Warhead: 165 kg (364 lb) HE frag
Fuze: Delay impact/proximity
Guidance: Inertial and active radar

Manufacturers/Contractors

Aerospatiale Missiles, Paris Cedex, France (prime).
Luchaire Défense, Versailles Cedex, France (warhead).

BARAK-1 point defence system

These Chilean ships have recently been fitted with two Barak-1 vertical launch units (replacing the previous Seacat SAM launchers), each containing eight missiles. The Barak-1 point defence missile system is designed to protect ships against both manned aircraft and anti-ship missiles; it has a quick reaction time, typically 3 seconds, which includes 0.6 seconds to turnover in the anti-missile role. The Barak-1 missile is powered by a triple-thrust rocket motor, giving it a speed of approximately Mach 2.

The fire-control system is based upon the Elta EL/M-2221GM I/J and K-band monopulse coherent tracking and illumination radar which is supplemented, on its right-hand side, by a Rafael thermal imager. The radar has a dish antenna with front feed on four 'legs', with an elevation of −25 to +85°. Search acquisition and tracking may be conducted in either I/J (8-20 GHz) or K (20-40 GHz) bands and it can track the target or targets while controlling two missiles. The system can also be used to control guns, possibly with the assistance of a separate ballistic computer. The Fire-Control Console (FCC) is used to control both the Barak weapon system (through the missile control unit) and also guns (through the gun control unit) and it acts as interface between the Barak weapons system and other ship systems. Upon acquisition of the target/targets by the ship's search radar the fire-control radar designates the targets and the system automatically calculates the level of threat from each target, allocates a missile or missiles and automatically launches them. In the anti-ship missile role the Barak-1 leaves the launcher vertically and is then 'turned over' towards the target by the thrust vector control system which is automatically discarded, presumably by explosive bolts, upon completion of the task. The missile is acquired and controlled by the fire-control radar which then guides it towards the target. The missile is capable of engaging targets 2 m (6.56 ft) above the sea and can manoeuvre at 25 *g*.

Specifications

Length: 2.17 m (7.12 ft)
Diameter: 17 cm (6.7 in)
Wing span: 68.4 cm (26.9 in)
Weight: 97.9 kg (216 lb)
Speed: Mach 2 (580 m/s (1,900 ft/s))
Range:
aircraft: 6.5 n miles (500 m to 12 km)
missiles: approx 2.7 n miles (5 km)
Guidance: Command/line of sight (CLOS) or optical
Warhead: 22 kg (48.5 lb) HE fragmentation

Manufacturers/Contractors

Israel Aircraft Industries (IAI), Ben Gurion International Airport, Israel (prime).
Rafael, Haifa, Israel (launch unit).

TUBES

Six 324 mm US Mk 32 (two triple) torpedo tubes. These were originally mounted either side of the hangar at the 01 deck level but have now been moved down to the 02 level.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

Manufacturer/Contractor

GEC-Marconi Naval Systems, UK.

TORPEDOES

Alliant Techsystems Mk 44 Mod 1 324 mm torpedoes

Specifications

Length: 2.56 m (8.4 ft)
Diameter: 324 mm (12.75 in)
Weight: 233 kg (514 lb)
Warhead: 34 kg (75 lb) HE
Propulsion:
Speed: 30 kts
Range: 3 n miles (5.5 km)
Homing: Active acoustic homing
Max depth: 300 m (approx)

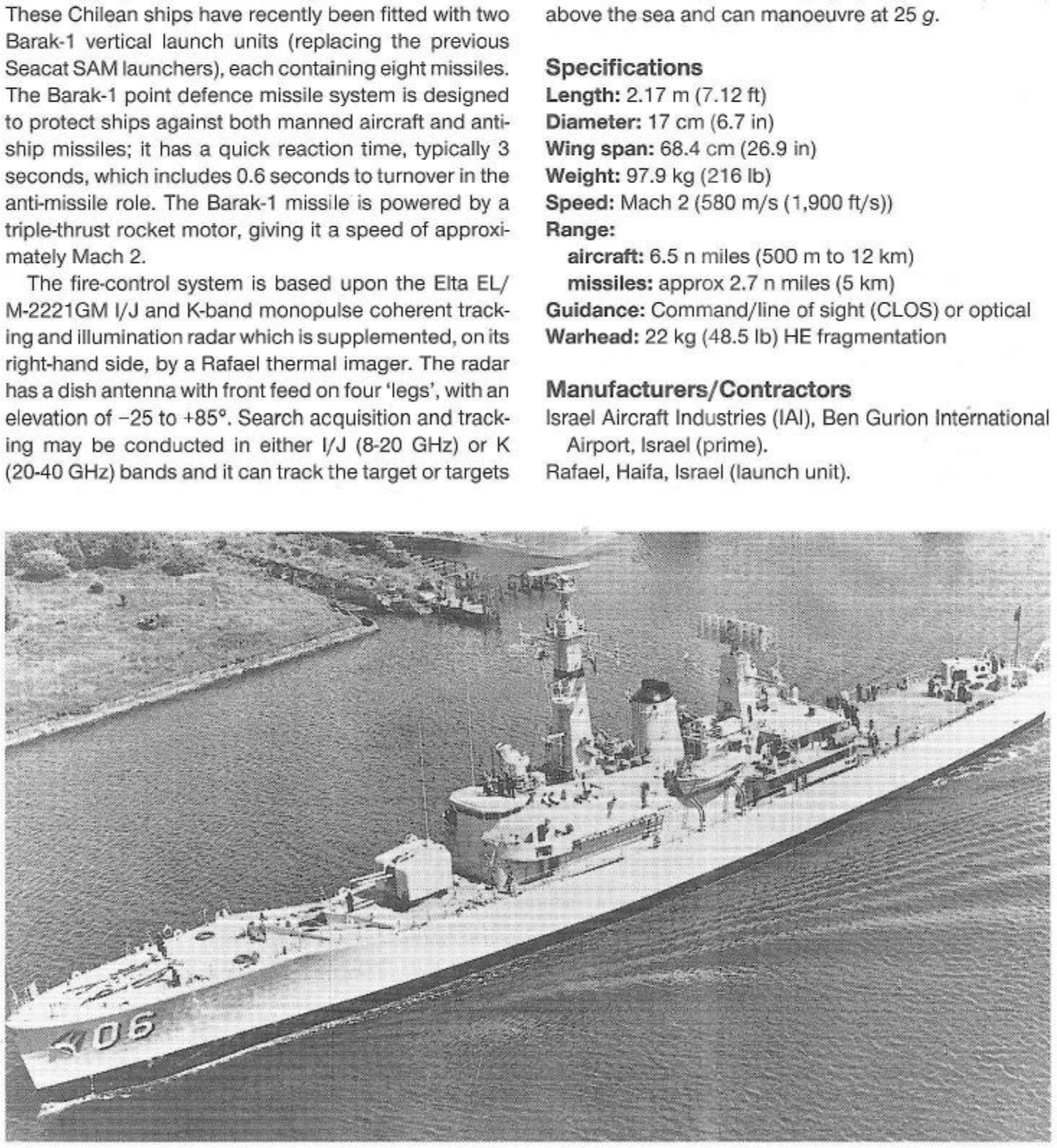
GUNS

Vickers 114 mm (4.5 in)/55 Mk 6 multipurpose gun

All four ships retain their twin 114 mm (4.5 in) Mk 6 mounting in 'A' position to provide quick-reaction short-range air defence, to engage surface targets including fast attack craft, and to provide gunfire support to ground forces. The weapon system consists of the gun mounting, the ammunition feed system, the remote power control system, and the captain-of-turret panel. The mounting includes two Mk V barrels, which are 6.22 m long, fitted with a muzzle brake and fume extractor, and have a life of 3,300 rounds EFC. The mounting is completely enclosed in a shield which protects it against the environment, blast and shrapnel. The loading system is hydraulically operated, with an autoloader which is manually fed by two loaders and has a capacity of six rounds. The hoist transfers them in two stages to the turret from where they are raised by a pivoting loading arm to the breech where they are inserted by a power rammer. After the shell is fired the case is extracted automatically and ejected through a chute in the front of the mounting.

Specifications

Calibre: 114 mm



Condell *(06). Note the gear at the after end of the flight deck, restricting the space available for use by the helicopter* (Yarrow)

Length of barrel: 45 calibres
Traverse: 360°
Elevation: *0 to +89°*
Muzzle velocity: 746 m/s (2,448 ft/s)
Weight of projectile: 25.5 kg (56 lb)
Rate of fire: 14 rds/min/barrel
Range:
anti-surface: 10.25 n miles (19 km)
anti-air: 12,500 m (41,000 ft)
Crew: 20

Manufacturer/Contractor

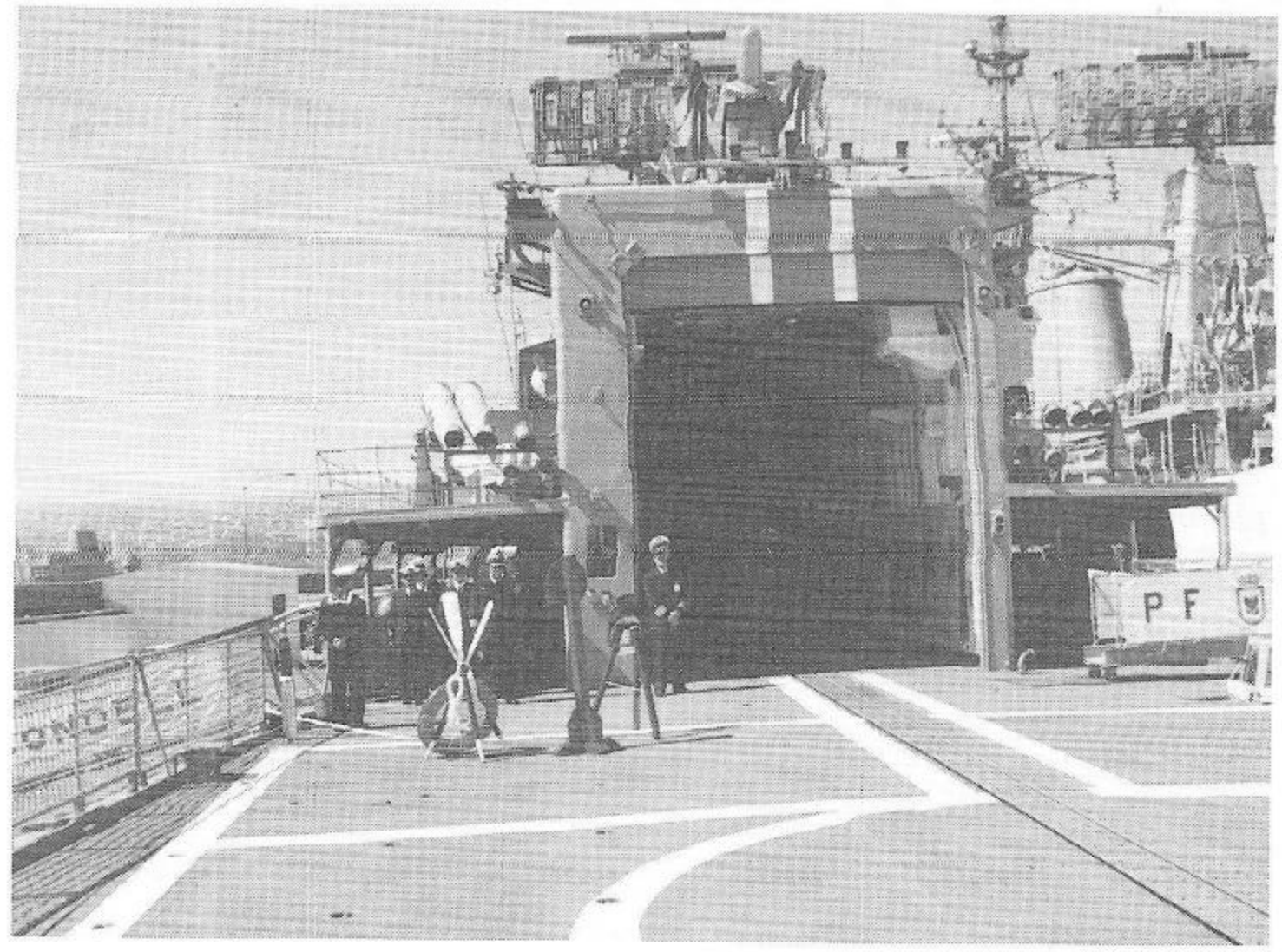
Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

Oerlikon 20 mm Mk 9 in Mk 7 mounts

There are two Oerlikon 20 mm cannon mounts in *Condell* and *Lynch* only.

Specifications

Calibre: 85 mm
Muzzle velocity: 1,050-1,150 m/s (3,445-3,772 ft/s)
Range:
anti-surface: 0.9 n miles (1.7 km)
anti-air: 1,700 m (5,600 ft)
Rate of fire: 900 rds/min
Max elevation: 55°



Condell *(06). The flight deck of the rebuilt* Condell *showing the new, larger hangar, the Indal's ASIST recovery-gear trackway, the Seacat on the hangar roof and the MM 40 Exocet launchers on the platforms either side of the hangar* (Jane's/David Miller)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Elisra NS-9003A radar ESM system

The Israeli NS-9003A naval ESM system is designed to operate in a dense environment and to cope with frequency agility, frequency-hopping, and staggered (wobbulated) PRI emitters. The system automatically receives, analyses and identifies over-the-horizon radar signals with a 100 per cent probability of intercept over the frequency range 2 to 18 GHz. The direction of arrival of each pulse is instantaneously measured using an accurate multibeam antenna array. This instantaneous direction-finding enables the system to locate any exotic type radar signal in the reception range within a fraction of a second. The analysed information is presented on a graphic situation display in several operator-selected modes for various EW tasks and the system has built-in power management provisions for ECM and chaff/flare activation. The NS-9003A antenna assembly includes a multibeam static antenna array with associated RF video and digital DF processing hardware, and an omnidirectional antenna array.

Specifications

Frequency range: 2-18 GHz (0.5-40 GHz optional)
DF accuracy: 1° I and J-bands; 2° E/F and G/H-bands
Sensitivity: −70 dBm
Frequency measurement: Instantaneous 2 MHz resolution

Manufacturer/Contractor

Elisra Electronic Systems, Bene Beraq, Israel.

FH-12 HF/DF

FH-12 is a British high-frequency direction-finding (HF/DF) set, which uses the 'birdcage' antenna array found at the head of the foremast on many 'Leander' class ships.

Outfit UA-13

Outfit UA-13 is a British VHF (25-1,400 MHz) direction-finding set with a conical antenna mounted at the masthead. Such a set was mounted in *Ariadne* (in place of the FH-12) while in British service and appears to have remained installed on transfer to Chile.

Elta IR sensor

An Elta IR sensor is fitted.

DECOYS

Corvus chaff dispensing system

There are two Corvus 8-barrel decoy launchers. Corvus is a quick reaction, self-defence system firing chaff dispensing rockets to form a radar decoy screen around the vessel. The system comprises: two multibarrelled rocket launchers, launcher control and firing panel, and the 'window' dispensing rockets themselves. There are two modes of operation: distraction decoy; and centroid decoy. A cylindrical rotating structure carries eight launching tubes mounted in two sets of three, one above the other, and crossed at 90° in azimuth with two further tubes set above, and aligned midway between the other tubes, all at a fixed elevation of 30°. The maximum loading of 16 'window' rockets provides protection against three missile attacks, before reloading. The normal limits of the training arc for the launcher are between 60 and 120° but as the lower sets of rocket barrels are angled about the centreline of the rotating structure, the arc covered by the rockets is considerably greater.

Specifications

Training
Bearing arc (normal) ie launcher axis: 60-120°
Bearing arc (max) ie tube axis: 15-165°
Tube diameter: 195 mm (7.67 in)
Tube length: 1.6 m (5.24 ft)
Weight (empty): 25 kg (55 lb)
No of guides: 4, RH spiral

Manufacturer/Contractor

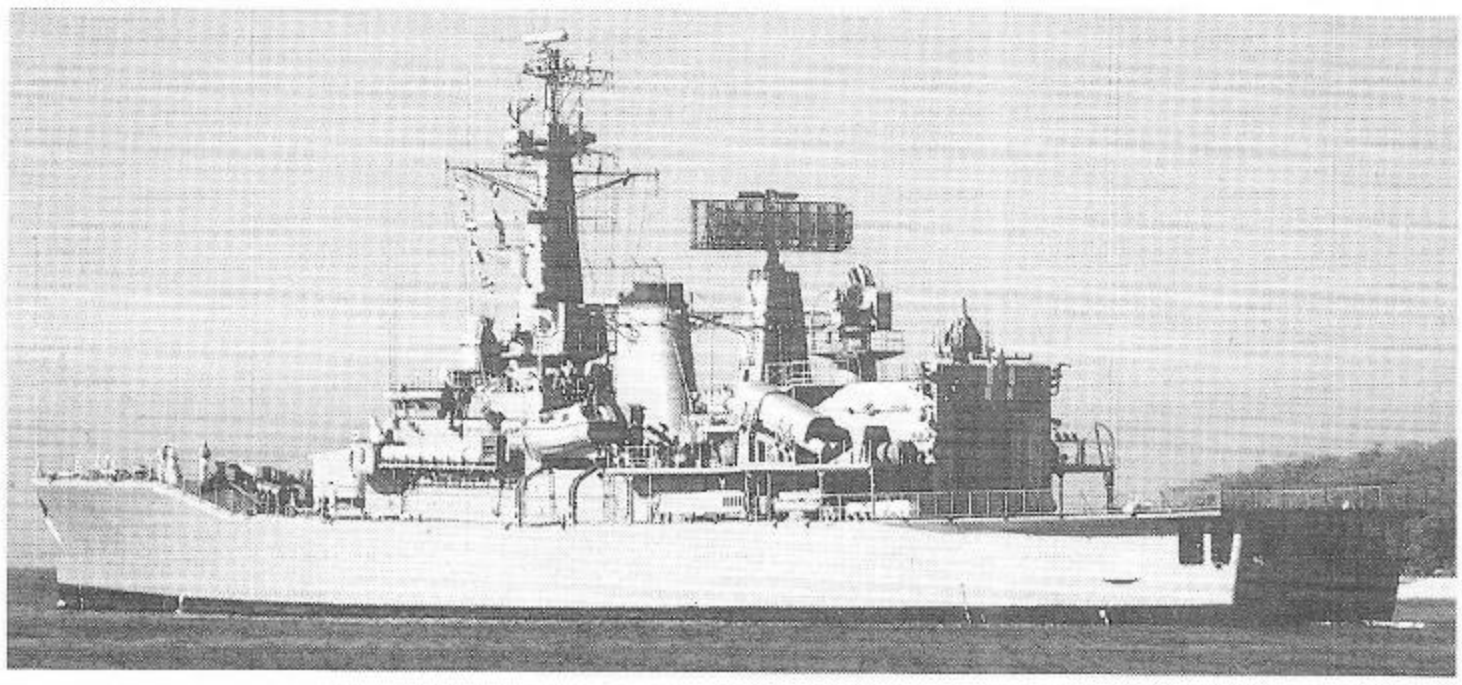
Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

ML Aviation Barricade countermeasures system

Barricade (British Navy designation = Outfit DLK) provides ships with means of deploying chaff and infra-red (IR) decoys to counter missile attacks, using a layered defence against the various types of anti-ship missile. The system uses a 57 mm rocket with a 900 rpm spin, to combine stabilisation with rapid chaff blooming. There are two types of rocket: Stockade — long range; and Palisade — short range. The system is integrated into the tactical data handling and command/weapon control system's electronic warfare suite.
The Chilean ships have two launchers (port and starboard), each consisting of six sets of triple cells, the outer three sets being angled 60° from the next in bearing so that the launchers provide all-round coverage. The inner three sets are preset to point to the same bearing, as required, but in different elevations. The inner three sets fire short-range Palisade rockets in centroid mode, while the outer barrels fire medium- and long-range Stockade rockets in dump, distraction and confusion modes. There are four decoy modes: confusion, distraction, dump and centroid.

Specifications

Stockade
Dimensions: 375 × 57 mm (14.8 × 2.24 in)
Weight: 1.89 kg (4.16 lb) (chaff); 1.77 kg (3.9 lb) (IR)
Payload: 0.4 kg (0.88 lb)
Range: 400-2,000 m (1,300-6,560 ft) at 30°
Rocket burn: 0.6 s



Lynch *showing the new wider and longer flight deck* (H & L van Ginderen Collection)

Recommended range:
confusion mode: 2,000 m (6,560 ft)
dilution mode: 800 m (2,625 ft)
Chaff frequency range: 2-20 GHz
IR payload: 550 W/steradian in 8-13 µm band

Palisade
Dimensions: 360 × 57 mm (14.1 × 2.22 in)
Weight: 2.1 kg (4.63 lb)
Payload: 0.6 kg (1.32 lb)
Rocket burn: 0.6 s

Chaff frequency coverage: 8-35 GHz
IR payload: 3-14 µm band for 20 s

Manufacturer/Contractor
ML Wallop Defence Systems, Andover, Hampshire, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEM

SISDEF SP 100 Command and weapon control system
The original British systems have been replaced by the SISDEF *(Sistemas de Defensa)* SP100 command and weapon control system. This is a distributed architecture system based upon the 32-bit Intel 80486DX2-66 and the TMS34020 processors, with the 8-bit Zilog Z80 being used for some interfaces. It uses Ada in all software applications, works to MIL-STD-2167A and uses commercial-off-the-shelf (COTS) hardware wherever possible. The basic hardware consists of Consolas Tacticas (CONTAC) with a typical destroyer/frigate system having three vertical and two horizontal units. A console has four Intel 80486 microprocessors including one for interface purposes, one for MMI and a graphics engine. Up to 512 tracks can be displayed and a similar number of ESM bearings while the console can interface with two datalink channels. The system has tactical preprocessors to link each sensor to the Ethernet-standard local area network, an environmental preprocessor to interface with the sensors such as log, wind indicator and gyrocompass, and weapons preprocessors to link with each weapon system. Peripherals such as plotter and printer have their own computer linked as does the datalink system.

Manufacturer/Contractor
Sisdef Ltda, Vinha del Mar, Chile.

RADARS

Set	Type 965	Type 992Q	Type 994	Type 1006	Type 903	Two Elta EL/M-2221GM
Ships	All	06, 07	08, 09	All	All	All
Company	GEC-Marconi	GEC-Marconi	Plessey	Kelvin Hughes	Plessey	Elta
Role	Air search	Short-range, air target designator	Short-range, air/ surface search	Navigation	Guns	Fire control for Barak
Band	A	I	E/F	I	I	I/J/K
Beam	12 × 40°	1.25 × 15°	2 × 35°	1 × 18°/ 0.75 × 18°	2°	—
Peak power	450 kW	2 MW	500 kW	25 kW	—	—
Gain	20 dB	30 dB		31 dB/34 dB	—	—
Pulsewidth	3.8/10 µs	2.0 µs	0.7/1.5 µs	0.8 or 0.25 µs/ 0.75 µs	0.1 µs	—
PRF	400/200 pps	750 pps	500 pps	1,600/800 pps	3,000 pps	—
Scan rate	8 or 10 rpm	—	24 rpm	24 rpm	—	—

SONARS

Type 184 P sonar
The Type 184 P is a modernised version of the British Type 184 active/passive search and attack sonar system, using a circular 32-stave transducer array 1 m (3.28 ft) in diameter and 1 m (3.28 ft) high in a retractable, keel-mounted dome. It operates at 6, 7.5 and 9 kHz with pulse lengths of 45 ms and 75 ms.

Manufacturer/Contractor
Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

Type 170 B sonar
Type 170 was the sonar used to control the ASW mortar. Since that weapon has now been removed it is probable (but not confirmed) that Type 170 sonar has been removed also.

Kelvin Hughes Type 162 M
The British Kelvin Hughes Type 162 M ('Cockchafer') side-looking target detection sonar is designed to detect and classify seabed targets, such as a bottomed submarine. There are three transducers: one faces downwards at 25° below the horizontal, while the other two face sideways to cover a 3° wide and 40° vertical sector. The transmitter delivers 40 W to the central, downward-looking transducer and 80 W each to the side-looking transducers. The set operates at 50 kHz and range scales are 270 m (300 yd), 550 m (600 yd) and 1,100 m (1,200 yd)

Manufacturer/Contractor
Kelvin Hughes, Watford, UK.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: *Condell* and *Lynch* now both have flight decks extending back to the stern and can handle a Cougar (Super Puma) helicopter

HELICOPTERS

Nurtanio (Eurocopter) NAS 332SC Cougar

Specifications
Dimensions:
main rotor diameter: 15.60 m (51.18 ft)
tail rotor diameter: 3.05 m (10.0 ft)
length, overall, rotors turning: 18.70 m (61.35 ft)
height, overall: 4.92 m (16.14 ft)
Weights:
empty: 4,460 kg (9,832 lb)
max take-off: 8,600 kg (18,960 lb)
Performance (at max take-off weight):
never-exceed speed (VNE): 150 kts (278 km/h)
cruising speed at sea level: 144 kts (266 km/h)
max rate of climb (sea level): 486 m (1,594 ft)/min
service ceiling: 4,600 m (15,090 ft)
range (sea level): 470 n miles (870 km)
Power plant: 2 Turbomeca Makila 1A1 turboshafts: each max continuous rating of 1,184 kW (1,588 shp)
Accommodation: 1 pilot (VFR)/2 pilots side by side (IFR); max accommodation 24 passengers
Equipment: Optional fixed or retractable rescue hoist (capacity 275 kg; 606 lb) starboard side; equipment for naval missions can include sonar, MAD and sonobuoys
Armament: 2 AM 39 Exocet missiles or 2 lightweight torpedoes, plus 2–20 mm guns or 2–7.62 mm machine guns

PROPULSION

Specifications
System: Steam-turbines
Main machinery: 2 Babcock & Wilcox boilers; 38.7 kg/cm² (550 psi); 450°C (850°F); 2 White/English Electric turbines; 22.4 MW (30,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The Chilean Navy ordered *Condell* and *Lynch* direct from Yarrow & Co Ltd, Scotstoun, UK in the late 1960s. These were generally similar to the original British Leanders, but with some differences in the sensors and a slightly higher foremast.

The second pair of ships, *Zenteno* and *Baquedano,* were both originally British 'Broad Beam' Leanders, which were purchased by Chile in 1991 and 1992, respectively.

DESIGN

The two original Chilean ships were generally similar to the British 'Broad Beam Leanders' but carry a Type 992Q surveillance radar atop a taller foremast, and a Plessey PMS-32 sonar. In addition, four MM 38 Exocet launchers were mounted right aft in two pairs, angled outwards at about 30°, the only Leanders ever to have such an arrangement. The two later ships were ex-British 'Broad Beam Leanders' from the unmodified group (see Overview).

MODERNISATION

All four ships have been modernised at the ASMAR yard at Talcahuano. *Lynch* was considerably modified in 1989 and was given two twin MM 40 Exocet launchers on the 01 deck either side of the hangar in place of the MM 38s aft. This displaced the Mk 32 torpedo tubes which were moved down one level to the 02 deck. The flight deck was also enlarged to enable it to take a Cougar (Super Puma) helicopter. The Elisra NS-9003 ESM suite replaced the UA-8/9 equipment.

Condell completed its ASMAR refit in 1993. This ship now has an even larger flight deck which extends right aft and is fitted with an Indal ASIST recovery system.

General Baquedano *(09), formerly the UK Royal Navy's Ariadne* (Chilean Navy)

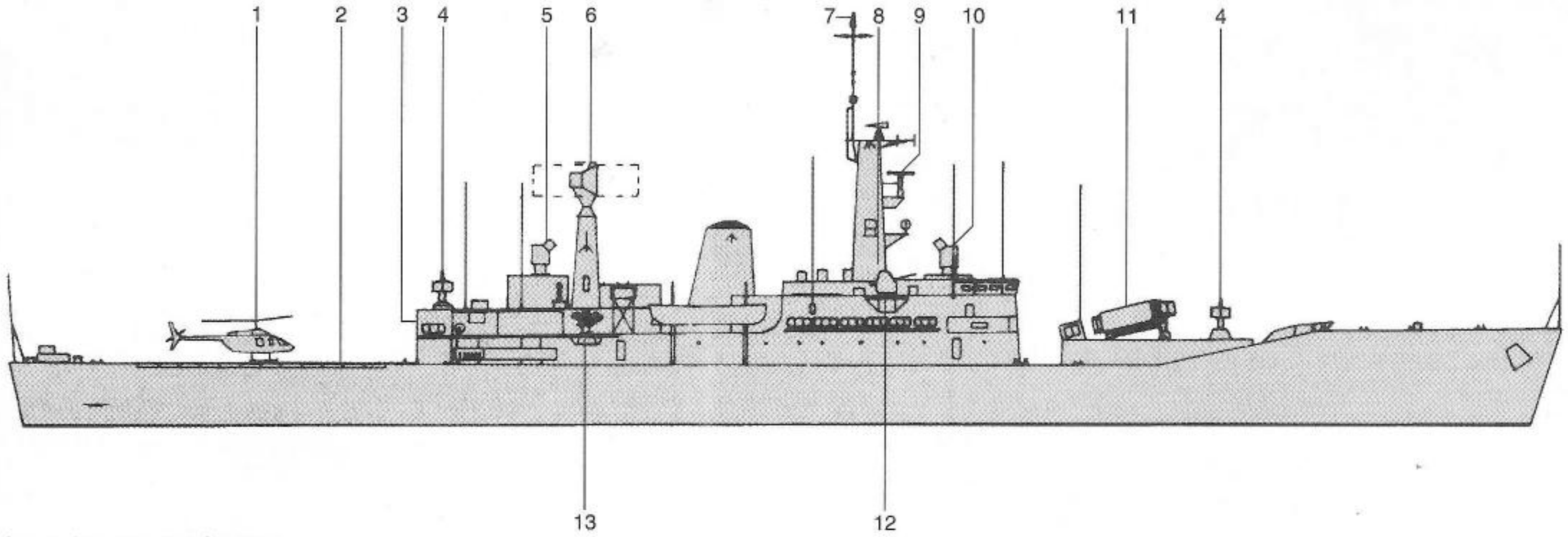
The hangar has also been enlarged to accommodate a Super Puma. A single Seacat launcher was retained on the hangar roof, but this has since been replaced by a Barak system. *Condell* was also fitted with a SISDEF SP-100 tactical data handling system. *Lynch* is having a similar refit.

THE FUTURE

The Chilean Navy is known to want to buy two more Leanders, but all the former British ships have now been disposed of and it appears unlikely that any of the others will come on the market for some years. Meanwhile, the four existing ships will continue to be modernised, and it has been suggested that one possibility under consideration is to replace the steam plant by a gas-turbine installation.

It is also understood that the current torpedoes will be replaced by Murène in due course.

ELOY ALFARO (LEANDER)



Moran Valverde (Ian Sturton)

1 *Bell 206B helicopter* **2** *Flight deck* **3** *Hangar* **4** *Seacat SAM launcher* **5** *Plessey Type 903 fire-control director* **6** *GEC-Marconi Type 966 air search radar* **7** *FH-5 HF/DF* **8** *Plessey Type 994 surface search radar* **9** *Kelvin Hughes Type 1006 navigation radar* **10** *Plessey Type 903 (for 114 mm guns)* **11** Aerospatiale MM 38 Exocet anti-ship missiles (four) **12** Bofors 40 mm/60 Mk 9 gun (two) **13** Corvus chaff dispenser

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: Ecuador
Type: Leander

Class: ELOY ALFARO

Purchased: 2
Active: 2

Displacement:
standard: 2,450 t
full load: 3,200 t

Dimensions
Length: 109.7 m (360 ft) (wl); 113.4 m (372 ft) (oa)
Beam: 12.5 m (41 ft)

Draught: 4.5 m (14.8 ft) (keel); 5.8 m (19 ft) (screws)

Speed: 28 kts
Range: 4,000 n miles at 15 kts

Complement: 248 (20 officers)

SHIPS

PRESIDENTE ELOY ALFARO (FM 01)		**MORAN VALVERDE** (FM 02)	
Builder	Vickers Armstrong, Newcastle-upon-Tyne, UK	**Builder**	HM Dockyard, Devonport, UK
Laid down	14 Mar 1961	**Laid down**	16 Dec 1964
Launched	17 Aug 1962	**Launched**	31 Oct 1965
Commissioned (RN)	31 Oct 1963 (*Penelope* (F 127))	**Commissioned (RN)**	7 Sep 1967 (*Danae* (F 47))

WEAPONS SYSTEMS

ANTI-SHIP MISSILES (ASM)

MM 38 medium-range anti-ship missile

Four Aerospatiale MM 38 Exocets are mounted on the foredeck in individual ITS *(Installation de Tir Standard)* launcher-containers, within which they are suspended from a launch rail in the ceiling. The launcher-containers point outwards and are raised at an angle of 12° to the horizontal. Targets are acquired by the ship's search radar and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence. This involves turning on the thermal battery, releasing the mechanical safety locks, igniting the booster and, finally, breaking the umbilical cord; the total process takes some 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change of course during its flight.

The attack consists of three phases:

Cruise phase. The cruise phase starts as the missile clears the container and the missile, powered by the sustainer motor, flies towards the general location of the target at a height of about 100 m (328 ft) which is low enough to reduce the chance of detection but adequate for target acquisition. This phase can be as long as 22 km and ends when the seeker acquires the target. This seeker is a Dassault Electronique ADAC (Auto Directeur Anti-Clutter) active monopulse radar, working in the I-band (8-10 GHz), which has a typical range of 13 n miles (24 km) against FACs.

Approach phase. On detecting the target the missile descends to 9-15 m (29.53-49.21 ft) in the approach phase.

Terminal phase. During this final phase the missile descends to 8 m (26.2 ft) (2-5 m (6.5-16.4 ft) in a calm sea) for a sea-skimming run in to the target.

A salvo may be fired in 12-20 seconds.

Specifications

MM 38
Length: 5.21 m (17.09 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,621 lb)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s.
Booster: 100 kg (220.5 lb) SNPE Epervier boost motor, weight 100 kg, burn time of 2.4 s
Warhead: Luchaire 165 kg (364 lb) fragmentation warhead
Fuzes: Delayed impact fuze and autopilot-controlled proximity fuze

Manufacturer/Contractor

Aerospatiale Tactical Missiles, Chatillon Cedex, France.

Short Seacat GWS.22

There are three Short Seacat GWS.22 quadruple launchers: one on the foredeck, ahead of the Exocet launchers, and two aft, on the hangar roof. These missiles also have a secondary, anti-ship capability.

Specifications

Missile
Length: 1.48 m (4.85 ft)
Diameter: 19 cm (7.48 in)
Wing span: 65 cm (25.59 in)
Weight: 68 kg (149.94 lb)
Speed: Mach 0.8
Range: 2.7 n miles (5 km)
Radar: Type 904 (see radar table (p 1126))

Manufacturer/Contractor

MSI-Defence Systems (formerly Short Brothers plc), Belfast, UK.

GUNS

Bofors 40 mm/60 Mk 9

Two single Bofors 40 mm/60 Mk 9 guns are mounted on the superstructure, either side of the mast.

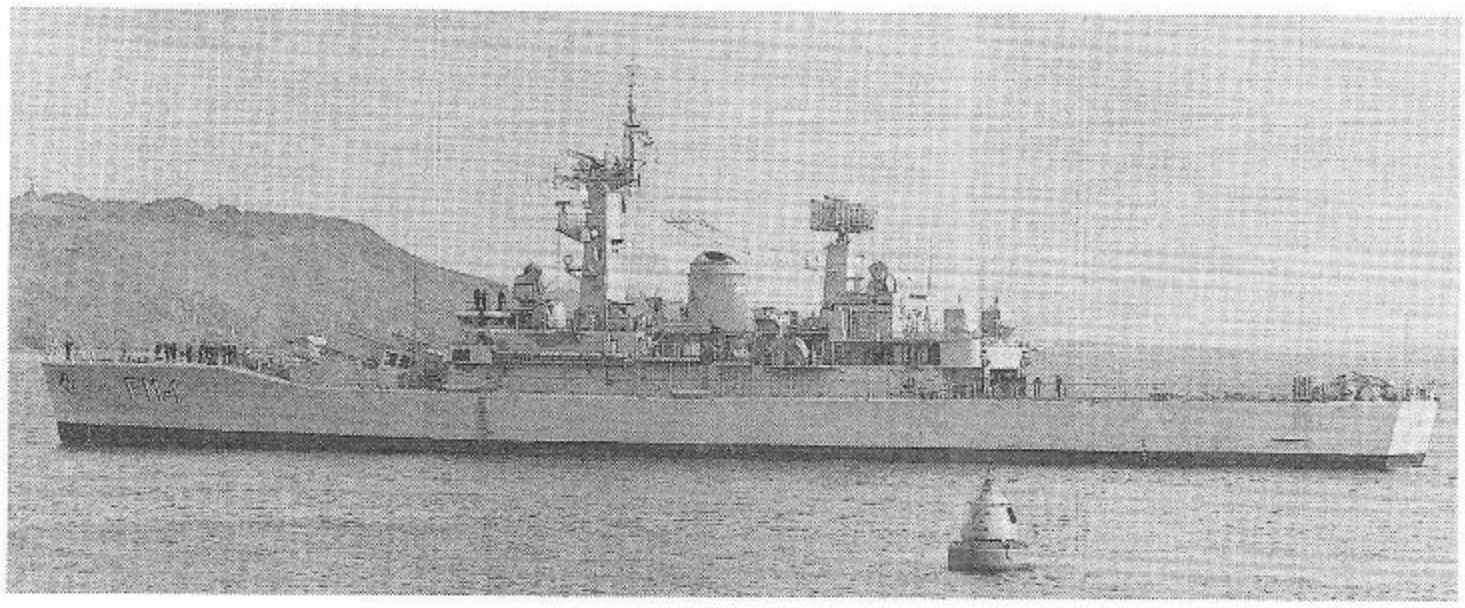
Specifications

Traverse: 360° (nominal) at 90°/s
Elevation: −3 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)

Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

20 mm Oerlikon mountings

Two GAM-BO1 mountings can be fitted, if required. GAM-BO1 uses a swivel fork with the sidewalls having the trunnion bearings. The cradle is made of light alloy and the weapon's working parts are enclosed in a protective case whose top opens to ease maintenance and installation. The sight, shoulder rests and back support strap are all attached to the sight bracket which is adjustable for height. Usually these mountings have an optical ring sight but they can also be fitted with a lead computing sight. The ammunition box with 200 rounds is attached to the front of the mounting and the belt is fed from the right side of the gun, with spent cartridge cases being ejected between the sidewalls of the cradle into a separate compartment, while the links are collected in a bag on the other side of the mounting.



Presidente Eloy Alfaro *(FM-01)* (David Warren)

Specifications

GAM-B01
Elevation: 55°
Gun Model: KAA
Calibre: 20 mm
Barrel length: 85 calibres
Effective range:
anti-surface: 2,500 m (2,700 yd)
anti-air: 1,200 m (4,000 ft)
Rate of fire: 1,000 rds/m
Round weight: 320-345 g
Projectile: 110-125 g

Manufacturers/Contractors

Royal Ordnance. Medium Calibre Gun Division (mounting).
Oerlikon Contraves AG, Defence (cannon).

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

UA-8/UA-9

These ships retain their British passive radar intercept systems: UA-8 covering the frequency band 2.4-4.1 GHz; and UA-9 (7-11.5 GHz). Both are elderly, analogue, manually operated equipments.

Manufacturer/Contractor

MEL.

ELECTRONIC COUNTERMEASURES (ECM)

Type 667/668 jammers

Type 667 and Type 668 are British-made noise jammers from the 1960s. Type 667 operates in two discrete areas in the D/E and H/I-bands, while Type 668 covers part of the F/G-band.

DECOYS

Graseby Type 182 towed torpedo decoy equipment

Type 182 towed torpedo decoy is designed to decoy both active and passive homing torpedoes, using signals electronically generated within the ship and fed, via the towing cable, to electroacoustic transducers within the towed body. The Type 182 produces two independently controllable output signals which are radiated simultaneously from the towed decoy. An amplitude modulated noise signal simulates the ship's propeller noise and causes passive-homing torpedoes to be seduced away from the ship towards the towed decoy. The second signal is a swept CW signal, which simulates sonar echoes, in order to confuse or jam the guidance system of active homing torpedoes, thus causing them to miss the ship. The frequency bands covered by both types of output are switchable to meet tactical scenarios and to enable concurrent operation of other sonar and communication equipments.

Specifications

Towed decoy:
diameter: 533 mm (21 in)
length: 2.01 m (6.6 ft)
weight: 74 kg (163 lb)
Towing cable:
length: 411 m (1,350 ft)
diameter: 1.5 cm (0.6 in)
weight: 269 kg (593 lb)

Manufacturer/Contractor

Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

Corvus chaff dispensing system

There are two Corvus 8-barrel decoy launchers. Corvus is a quick reaction, self-defence system firing chaff dispensing rockets to form a radar decoy screen around the vessel. The system comprises: two multibarrelled rocket launchers, launcher control and firing panel, and the 'window' dispensing rockets themselves. There are two modes of operation: distraction decoy; and centroid decoy. A cylindrical rotating structure carries eight launching tubes mounted in two sets of three, one above the other, and crossed at 90° in azimuth with two further tubes set above, and aligned midway between the other tubes, all at a fixed elevation of 30°. The maximum loading of 16 'window' rockets provides protection against three missile attacks, before reloading. The normal limits of the training arc for the launcher are between 60 and 120° but as the lower sets of rocket barrels are angled about the centreline of the rotating structure, the arc covered by the rockets is considerably greater.

Specifications

Training
Bearing arc (normal) ie launcher axis: 60-120°
Bearing arc (max) ie tube axis: 15-165°
Tube diameter: 195 mm (7.67 in)
Tube length: 1.6 m (5.25 ft)
Weight (empty): 25 kg (55 lb)
No of guides: 4, RH spiral

Manufacturer/Contractor

Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers

There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications

Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

CAAIS (Outfit DBA(1)) action data automation

CAAIS (Computer Assisted Action Information System) was developed in the early 1960s and entered service in 1974. CAAIS is a tactical picture compilation system, providing automatic tracking of air and surface targets, processing sonar and EW inputs, operating a digital datalink, designating targets, and providing torpedo control and vectored attack orders for ASW helicopters. The hardware includes a three-cabinet digital suite housing a 24-bit computer, operating at 200 Kips and with a 780 k memory, as well as a datalink terminal. In addition there are peripheral control units which include radar extraction units, encoder/decoders, display drive unit and the MMI control units. The datalink, known as Link X in NATO navies, is a serial transmission, medium-speed (1,200 baud) link suitable for HF and UHF channels. The programming language is Coral 66.

Manufacturer/Contractor

Ferranti Naval Systems Ltd.

COMMUNICATIONS AND DATALINKS

Datalinks

Link 10
Link 14 (receive)
Link X.

WEAPONS CONTROL

There are two weapons control systems: GWS.22 for Seacat and GWS.50 for Exocet.

RADARS

Set	Type 966	Type 994	Type 1006	Type 903 (two)
Company	GEC-Marconi	Plessey	Kelvin Hughes	Plessey
Role	Air search	Short-range, air/surface search	Navigation	Guns
Band	A	E/F	I	I
Beam	12 × 40°	2 × 35°	1 × 18°/ 0.75 × 18°	2°
Peak power	450 kW	500 kW	25 kW	—
Gain	20 dB		31 dB/34 dB	—
Pulsewidth	3.8/10 µs	0.7/1.5 µs	0.8 or 0.25 µs/ 0.75 µs	0.1 µs
PRF	400/200 pps	500 pps	1,600/800 pps	3,000 pps
Scan rate	8 rpm	24 rpm	24 rpm	—

SONARS

Type 162M sonar

Sonar Type 162M detects and classifies both mid-water and seabed targets, displaying port and starboard recordings simultaneously on a single straight-line recorder, which has a maximum range scale of 1,200 yd. Operation is simplified by entirely automatic gain control. The three transducers are all similar and employ 49.8 kHz barium titanate elements. Their beam pattern is fan-shaped, about 3° wide and 40° vertical angle; the side-looking elements have their axes 25° below the horizontal. A loudspeaker and a socket for headphones enable signals to be monitored aurally if required. The three range scales are 0 to 300, 0 to 600 and 0 to 1,200 yds, and accuracy is better than two per cent assuming a sound velocity of 4,920 ft/s.

Manufacturer/Contractor

AB Precision (Poole) Limited, Poole, Dorset, UK.

Type 184P active/passive hull-mounted search sonar

Type 184P was an in-service upgrade to Type 184M. Type 184P is a 360° scanning sonar, incorporating both active and passive modes of operation, which provides range, bearing and target Doppler data to the fire-control computer. The equipment provides a dual frequency transmission and three receiver systems. The latter comprise: an all-round search and tracking PPI system with, in the Type 184P, 16 receiving channels, which gives greater bearing accuracy. The upgrading also involved inserting 31 digital filters in each of the four beam channels, enabling the system to measure Doppler speeds of up to ±40 kts. There is also a continuous torpedo warning system with its own display. A circular 32-stave transducer array is employed. The keel-mounted, retractable dome is 3.99 m (13.0 ft) long, 1.62 m (5.3 ft) wide and 1.55 m (5.0 ft) deep. Operating frequencies are 7.5 kHz and 9 kHz.

Manufacturer/Contractor

Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 19.2 × 13.1 m (63 × 43 ft)

HELICOPTERS

One Bell Model 206 JetRanger

Specifications

Dimensions

main rotor diameter: 10.16 m (33.3 ft)
tail rotor diameter: 1.65 m (5.54 ft)
fuselage length (rotors turning): 11.82 m (38.78 ft)

Weights:

empty: 742 kg (1,635 lb)
max take-off weight: 1,451 kg (3,200 lb)

Performance:

never exceed speed (VNE), sea level: 122 kts (140 km/h)
service ceiling: 4,115 m (13,500 ft)
max cruising speed: 116 kts (134 km/h)
range: 404 n miles (748 km)
max rate of climb at sea level: 384 m (1,260 ft)/min

Power plant: 1 Allison 250-C20J; 236 kW (317 shp)

Crew: 2 (pilot, co-pilot)
Sensors: None
Typical weapons loads: 1 Mk 44 torpedo or depth bomb

Moran Valverde *(FM-02), the former UK Royal Navy* Penelope (D & B Teague)

PROPULSION

Specifications

System: Steam turbine
Main machinery: 2 Babcock & Wilcox boilers; 38.7 kg/cm²; 450°C (850°F); 2 White/English Electric turbines; 22.4 MW (30,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These two ships were purchased from the UK to replace two ex-US Navy ships: the 'Gearing' class destroyer *Presidente Eloy Alfaro* (DO 01) and the 'Charles H Lawrence' class destroyer-escort *Moran Valverde* (D 01). The two British ships were bought on 25 April 1991 and were given the same names as the two ships they had replaced, but with new pennant numbers. Their crews worked up in British waters and then sailed for their home country in July and August, respectively.

STRUCTURE

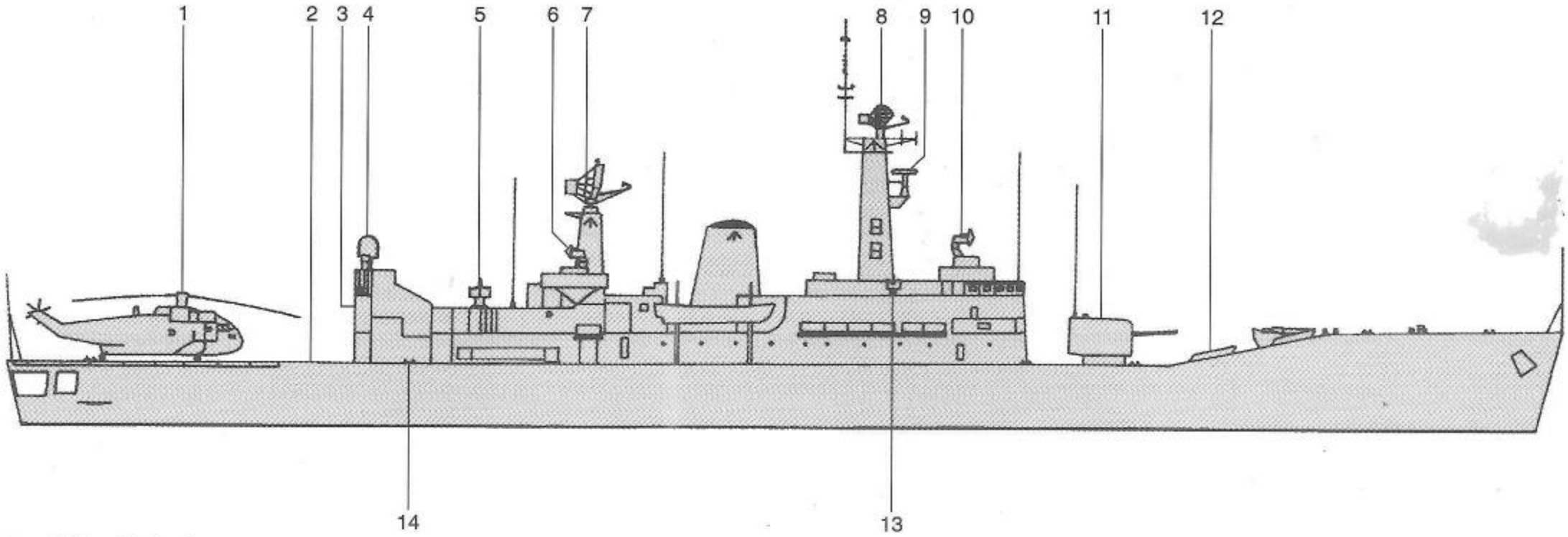
These were both units of the original production standard and were converted under the Batch 2 programme in 1980 and 1982, respectively. Their torpedo tubes were removed in 1988/89 and two Mk 36 SRBOC chaff launchers were fitted after transfer.

The two ships were transferred without any Exocet missiles, but it should be noted that the Ecuador Navy already operates both MM 38 and MM 40 Exocets aboard existing classes of ship. No Seacat missiles were sold either, but these will be much more difficult to replace should the navy wish to bring them into service.

FURTHER WORK

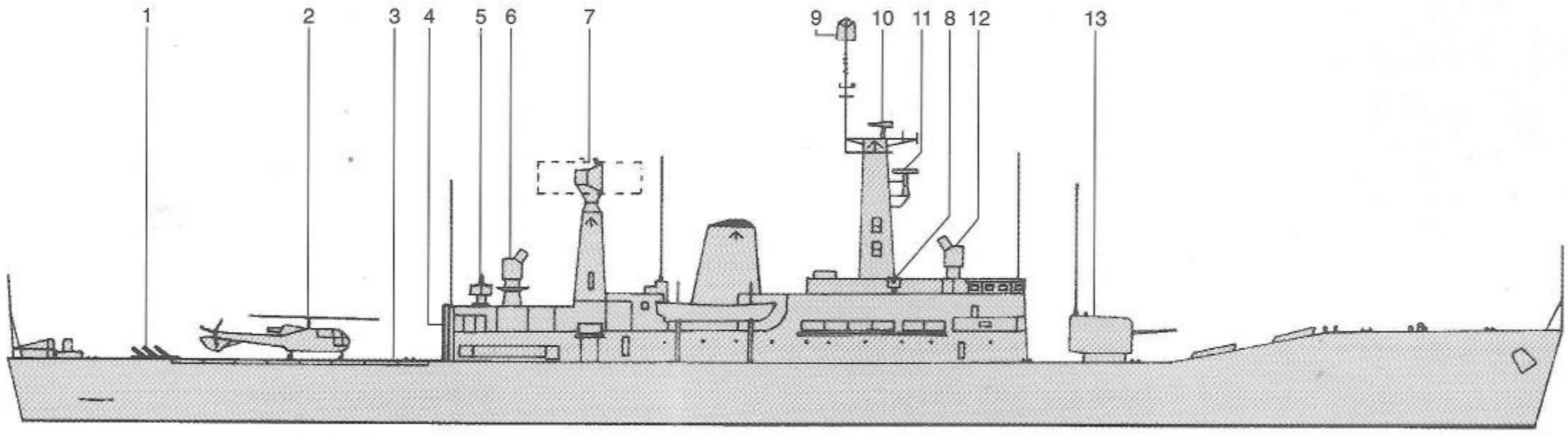
It was planned to send these two ships to the ASMAR yard at Talcahuano, Chile in 1995 for a refit, but this has been postponed for financial reasons.

NILGIRI (LEANDER)



Taragiri (Ian Sturton)

1 *Sea King Mk 42 helicopter* **2** *Flight deck* **3** *Telescopic hangar* **4** *Satcom* **5** *Seacat SAM launcher* **6** *Signaal M44 fire-control director (for Seacat)* **7** *Signaal LW 08 air search radar* **9** *Decca Type 1226 navigation radar* **10** *Signaal M45 fire-control director (114 mm guns)* **11** *VSEL 114 mm (4.5 in)/45 Mk 6 twin semi-automatic guns* **12** *Bofors 375 mm ASW rocket launcher* **13** *Oerlikon 20 mm/70 cannon* **14** *Triple 324 mm Mk 32 torpedo tubes*



Nilgiri (Ian Sturton)

1 *UK Limbo Mk 10 triple-tube ASW mortar* **2** *Chetak (licence-built Alouette III)* **3** *Flight deck* **4** *Hangar* **5** *Seacat SAM launcher* **6** *Plessey Type 904 fire-control director (for SAM)* **7** *GEC-Marconi Type 965M air search radar* **8** *Oerlikon 20 mm/70 cannon* **9** *FH-5 HF/DF* **10** *Type 993 surface search radar* **11** *Racal-Decca Type 1226 navigation radar* **12** *Plessey Type 903 fire-control (for guns)* **13** *VSEL 114 mm (4.5 in)/45 Mk 6 twin semi-automatic guns*

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: India
Type: Leander

Class: NILGIRI (FF)

Built: 6
Active: 6

Displacement:
standard: 2,682 t
full load: 2,962 t

Dimensions
Length: 113.4 m (372 ft)
Beam: 13.1 m (43 ft)
Draught: 5.5 m (18 ft)

Speed: 27 kts (first four); 28 kts (*Taragiri, Vindhyagiri)*
Range: 4,500 n miles at 12 kts

Complement: 267 (17 officers)

SHIPS

NILGIRI (F 33)

Builder	Mazagon Dock Ltd, Bombay, India
Laid down	Oct 1966
Launched	23 Oct 1968
Commissioned	3 Jun 1972

HIMGIRI (F 34)

Builder	Mazagon Dock Ltd, Bombay, India
Laid down	1967
Launched	6 May 1970
Commissioned	23 Nov 1974

UDAYGIRI (F 35)

Builder	Mazagon Dock Ltd, Bombay, India
Laid down	Jan 1973
Launched	9 Mar 1974
Commissioned	5 May 1977

DUNAGIRI (F 36)

Builder	Mazagon Dock Ltd, Bombay, India
Laid down	14 Sep 1970
Launched	24 Oct 1972
Commissioned	18 Feb 1976

TARAGIRI (F 41)

Builder	Mazagon Dock Ltd, Bombay, India
Laid down	1974
Launched	25 Oct 1976
Commissioned	16 May 1980

VINDHYAGIRI (F 42)

Builder	Mazagon Dock Ltd, Bombay, India
Laid down	1975
Launched	12 Nov 1977
Commissioned	8 July 1981

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Short Seacat GWS.22

Nilgiri (F 33) and *Himgiri* (F 34) have one Seacat launcher each, both with GWS.22 weapons control system, situated on the hangar roof. The remaining four ships each have two launchers and two Dutch M44 directors, located on small platforms either side of the hangar. The missiles also have a secondary, anti-ship capability.

Specifications

Missile
Length: 1.48 m (4.85 ft)
Diameter: 19 cm (7.48 in)
Wing span: 65 cm (25.59 in)
Weight: 68 kg (149.94 lb)
Speed: Mach 0.8
Range: 2.7 n miles (5 km)
Radar: Type 904 (see radar table (p 1129))

Manufacturer/Contractor

MSI-Defence Systems (formerly Short Brothers plc), Belfast, UK.

TORPEDOES

ILAS-3 surface vessel torpedo launching system

The last two ships to be completed, *Taragiri* (F 41) and *Vindhyagiri* (F 42) have two triple ILAS-3 torpedo launchers mounted on the upper deck abreast the hangar, with one set on either beam. Each torpedo launching system consists of three 324 mm torpedo tubes which launch lightweight anti-submarine torpedoes. The tubes are mounted on a base which can be manually trained by means of a suitable retractable handle, with the torpedo being fired after the tube has been trained into the designated sector.

Firing is achieved using compressed air stored in air bottles secured to the tube's outer surface and refilled via the air charging station (also made by Whitehead). Torpedo launching is controlled either electrically, by means of the Shipborne Remote-Control Panel (Whitehead production), or manually, acting on a special push-button located on each tube.

Specifications

Length: 3.4 m (11.15 ft)
Width: 1.2 m (3.94 ft)
Height: 1.20 m (4.2 ft)
Weight: 1,050 kg (2,315 lb)

Manufacturers/Contractors

Eurotorp, Sophia Antipolis, France.
Whitehead Motofides, Livorno, Italy.

Whitehead A244/S lightweight anti-submarine torpedo

The torpedo used is the Whitehead A244/S or the Indian-produced version, NST 58. The seeker in the A244/S is the Alenia CIACIO-S which is capable of active, passive or mixed modes for closing on to its target and can discriminate between decoys and real targets, in the presence of heavy reverberations, by specially emitted pulses and signal processing. It also discriminates between target noise and reverberations, as well as having a series preset of programmable search patterns and tactical manoeuvres (including re-attack procedures). The seeker has a large search volume covered by multiple preformed beams following a number of self-adaptive search patterns and is reported capable of target detection at −5 dB in good acoustic conditions. The computerised homing system also provides for presettable combinations of signal processing, spatial filtering and tactical torpedo manoeuvring. The software may be reprogrammed by the customer to meet new tactical conditions. Upon launching the A244/S initially steers a straight course and, if the target is not detected, it then begins a search pattern which may be either a spiral between preselected depths or a helix pattern.

Specifications

Length: 2.7 m (8.86 ft)
Diameter: 324 mm (12.75 in)
Weight: 215 kg (474 lb)
Warhead: 34 kg (80 lb) shaped charge HBX-3 HE
Propulsion: Electric; silver-zinc batteries
Range: 3.5 n miles (6 km)
Speed: 30 kts
Guidance: Active/passive sonar, self-adaptive programmed patterns

Manufacturer/Contractor

Whitehead SpA, Salviano, Italy.

GUNS

Vickers 114 mm (4.5 in)/55 Mk 6 multipurpose gun

All ships have a twin 114 mm (4.5 in) Mk 6 mounting in 'A' position to provide quick-reaction short-range air defence, to engage surface targets including fast attack craft, and to provide gunfire support to ground forces. The weapon system consists of the gun mounting, the ammunition feed system, the remote power control system, and the captain-of-turret panel. The mounting includes two Mk V barrels, which are 6.22 m (20.4 ft) long, fitted with a muzzle brake and fume extractor, and have a life of 3,300 rounds EFC. The mounting is completely enclosed in a shield which protects it against the environment, blast and shrapnel. The loading system is hydraulically operated, with an autoloader which is manually fed by two loaders and has a capacity of six rounds. The hoist transfers them in two stages to the turret from where they are raised by a pivoting loading arm to the breech where they are inserted by a power rammer. After the shell is fired the case is extracted automatically and ejected through a chute in the front of the mounting.

Specifications

Calibre: 114 mm
Length of barrel: 45 calibres
Traverse: 360°
Elevation: 0 to +89°
Muzzle velocity: 746 m/s (2,448 ft/s)
Weight of projectile: 25.5 kg (56.23 lb)
Rate of fire: 14 rds/min/barrel
Range:
anti-surface: 10.25 n miles (19 km)
anti-air: 12,500 m (41,012.5 ft)
Crew: 20

Oerlikon 20 mm Mk 9 in Mk 7 mounts

There are two Oerlikon 20 mm cannon mounts.

Specifications

Calibre: 85 mm
Muzzle velocity: 1,050-1,150 m/s (3,445-3,773 ft/s)
Range:
anti-surface: 1.7 km
anti-air: 1,700 m
Rate of fire: 900 rds/min
Weight of round: 320-345 g
Weight of projectile: 110-125 g
Max elevation: 55°

Manufacturer/Contractor

Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

ANTI-SUBMARINE MORTARS

Bofors 375 mm Model B2 ASW rocket system

There is a single, twin-tubed ASW rocket launcher on the forecastle in *Taragiri* and *Vindhyagiri* only. The system consists of a rocket launcher, handling system, the ship sonar and a fire-control system. The launch tubes are mounted on trunnions with an automatic contact device to connect the rockets with the fire-control system. The hydraulic laying machinery is in the front of the mounting and a flame deflector in the rear. Each system features an automatic electrohydraulic handling system. The rounds are stored vertically beneath the mounting and selected by an operator. A grab on a roof-mounted rail picks up the round by the nose and transfers it to the loading table. A hoist brings this through the deck hatch to where the launch tubes have been elevated to their loading position. The rounds are then inserted through the rear of the launch tube. Reload time is approximately one minute, each tube being loaded separately. The rate of fire is one round a second and rockets may be fired singly or in salvo. There are two types of rocket, both with Hexotonal filling. The Type E (Erika) rocket has Stidar time and impact fuzes, while the Type N (Nelli) uses the Zambo proximity and impact fuzes.

Specifications

Launcher
Tubes: 4
Weight: 7,500 kg (16,534 lb)
Traverse: 260° at 18°/s
Elevation: −15 to +90° at 18°/s
Crew: 4

Rockets

	Type E	Type N
Weight	250 kg (551 lb)	230 kg (507 lb)
Muzzle velocity	130 m/s (426 ft/s)	205 m/s (673 ft/s)
Explosive weight	107 kg (236 lb)	80 kg (176 lb)
Range	0.35/0.87 n miles (0.65/1.63 km)	0.85/2.11 n miles (1.58/3.62 km)
Final sinking speed	10.7 m/s (35 ft/s)	9.2 m/s (30 ft/s)

Manufacturer/Contractor

Bofors Ordnance, Sweden.

Anti-Submarine Mortar Mk 10 Limbo

The first four ships — *Nilgiri, Himgiri, Udaygiri and Dunagiri* — retain the British-developed Limbo, triple-barrel, 304.8 mm (12 in) mortar system, which is mounted aft of the flight deck. The three barrels are installed in line on a massive metal mounting with a metadyne system for stabilising it in pitch and roll. The projectiles are loaded automatically from magazines alongside the mounting, the mortar tubes being laid horizontally with a pneumatic system moving rounds down the barrel. Fuze settings are set automatically through relays and uniselectors. The magazine has a capacity of 51 rounds. Training of the mortar is carried out automatically from the combat information centre using data from the ship's sonar system. The Limbo system fires its projectiles in a three-dimensional pattern. The projectiles can be set to explode at various depths using hydrostatic or impact fuzes. Limbo has a crew of seven.

Limbo is controlled by the MCS (Mortar Control System) Mk 10. The original system used vacuum-tube technology and during the 1960s systems in British service were updated with new solid-state electronics in the computer and sonar display system. The sonar is the Type 170 with square transducer and a frequency of 15 kHz.

Specifications

Weight: 35 t
Range: 900 m (984 yd)
Projectile: 177 kg (390 lb)
Explosive: 94 kg (207 lb)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Ajanta

The Ajanta radar intercept suite is the first such Indian set to reach operational status. It is believed to be based on the Selenia (now Alenia) INS-3, but appears to have a much larger threat library. It is also installed in 'Delhi' class destroyers.

Manufacturer/Contractor

Bharat Electronics Ltd (BEL), Bangalore, India.

FH 5 HF/DF

Some ships are fitted with the FH 5 direction-finding equipment.

Type 667 jammer

All ships are fitted with the Type 667, a British, 1960s-vintage, noise jammer. Type 667 operates in two discrete areas in the D/E and H/I-bands.

DECOYS

G 738 towed torpedo decoy

G 738 is an improved and re-engineered version of the Type 182 towed torpedo decoy using solid-state signal generation equipment and compact, lightweight deck machinery. G 738 decoys both active and passive homing torpedoes with decoy signals being electronically generated within the ship and fed via the 411 m (450 yd) long towing cable to electroacoustic transducers within the towed body; the signals thus produced divert passive homing torpedoes astern and confuse or jam the steering mechanisms of active homing torpedoes.

The G 738 produces two independently controllable output signals. One is an amplitude modulated noise signal which simulates the ship's propeller noise and causes passive homing torpedoes to be seduced away from the ship towards the towed decoy. The second is a swept CW signal, which simulates sonar echoes and thus confuses or jams the guidance system of active homing torpedoes, and causes them to miss the ship.

Manufacturer/Contractor

Graseby Marine (Graseby Dynamics Ltd) Watford, UK.

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

IFF Type 944; 954M.

WEAPONS CONTROL

Weapons control equipments are:
Seacat
Nilgiri, Himgiri: GWS 22
Remainder: two M 44
Guns
Nilgiri: MRS 3

RADARS

The radars in first of class, *Nilgiri* (F 33), were virtually identical with those in the British Leanders. The remainder of the class, however, has most of the British radars replaced by Signaal systems.

***Nilgiri* (F 33)**

Set	Type 965M	Type 993	Type 1226	Type 904	Type 903 (two)*
Company	GEC-Marconi	Plessey	Racal-Decca	Plessey	Plessey
Role	Air search	Short-range, air/surface search	Navigation	Fire control (Seacat)	Guns
Band	A	E/F	I	I	I
Beam	12 × 40°	2 × 35°	1.2°	2°	2°
Peak power	450 kW	500 kW	25 kW	—	—
Gain	20 dB		30 dB	—	—
Pulsewidth	3.8/10 µs	0.7/1.5 µs	0.05/0.25/1.0 µs	0.1 µs	0.1 µs
PRF	400/200 pps	500 pps	—	3,000 pps	3,000 pps
Scan rate	8/10 rpm	24 rpm	28 rpm	—	—
Range			48 n miles	—	

Note
*In both *Nilgiri* and *Himgiri*

All other ships (F 34, F 36, F 41, F 42)

Type	LW-08	ZW-06	Type 1226	M 44	M 45 (two)
Maker	Signaal	Signaal	Racal-Decca	Signaal	Signaal
Role	Air search	Surface search	Navigation	Fire control	Fire control
Band	D (6 presets between 1,250-1,350 MHz)	I	I	I/J	
Beam	2.2 × csc^2 to 40°	0.9 × 19°	1.2°		
Power Peak Average	150 kW, pulse compressed; 5.2 kW	60 kW	25 kW		
Gain	30 dB	32 dB	30 dB		
Pulsewidth	35/90 µs	0.06/0.6 µs	0.05/0.25/1.0 µs		
PRF	1,000/500 pps	4,000/2,000 pps	—		
Scan rate	7.5/15 rpm	24 rpm	28 rpm		
Typical range	145 n miles at 26,000 m for 2 m^2 target	10 m^2 surface target — about 14 n miles Aircraft at 14 n miles (20,000 ft)	48 n miles		

SONARS

As with radars, there are different sonar fits:

Equipment	Type	F 33 F 35 F 36	F 34 F 42	F 41
Type 170B/AN/SQS-502	hull mounted for Limbo	X	X	
Graseby 750 (APSOH)	hull mounted trials		X	
AN/SQS-505	hull mounted	X		
Thomson-CSF Diodon	hull mounted			X
AN/SQS-505	VDS	X	X	
Thomson-CSF Sorel	VDS			X
Type 162M	hull mounted bottom classification	X	X	X

Type 170 B sonar

Type 170 B is the sonar used to control the Limbo Mk 10 ASW mortar; it was also produced in Canada as the AN/SQS-502. Operating frequency is 15-25 kHz and the system has a maximum operating range of about 1,800 m (2,000 yd) and a maximum depth of about 350 m (1,200 ft).

APSOH/G 750 active/passive hull-mounted search sonar

The Graseby G 750 is a search and attack all-round sonar, which was developed from the British Type 184M. It provides accurate fire-control data from two independent automatic tracking systems, whilst simultaneously maintaining all-round surveillance, independent Doppler search, and classification and continuous torpedo warning. Three separate processing and display systems are incorporated for all-round search and tracking; Doppler, and passive search.

In the standard G 750 system, an improved version of the Type 184M cylindrical 32-stave transducer is used to form a large number of beams. Range and bearing measurement is by in-beam scanning, obviating the need for separate expanded displays. Target range and bearing are measured by either: using a manually positioned marker technique, in which the circular markers are placed over the target echo, it being the marker position that is measured; or by echo gating, where the echo range and bearing are measured directly. This form of tracking is normally on acquisition of a possible target and is available either with or without computer assistance.

Operational capabilities of the equipment include active detection of submarines throughout 360° and the ability to track two targets simultaneously. Similar detection coverage and tracking capabilities are available in respect of torpedo targets, with suitable outputs to torpedo warning and avoidance systems. There is also an active search capability over a 45° arc with facilities for determining target Doppler. Four 11° beams forming a 45° 'searchlight' are providing a 360° search facility capable of measuring target Doppler up to ±40 knots. Targets can be tracked to a maximum range of 20 km. G 750 is being developed in India by Bharat Electronics as the APSOH (Advanced Panoramic Sonar) and underwent trials in *Himgiri* (F 34).

Manufacturers/Contractors

Graseby Marine (Graseby Dynamics Ltd) Watford.
Bharat Electronics, Bangalore, India.

Westinghouse Canada AN/SQS-505 sonar

The Canadian Westinghouse AN/SQS-505 sonar is a hull-mounted 7 kHz, search and attack sonar. It is a deep water, omnidirectional, surveillance system, but is also able to operate in a directional mode that can maintain search ability while tracking defined targets. Three selectable frequencies are available so that several ships can survey an area in close proximity without cross-talk. In high sea states leading to excessive roll and pitch of the ship, the AN/SQS-505 utilises transmit beam stabilisation, which delays transmission until near optimum roll and submergence conditions prevail, thereby minimising chances of the target being missed altogether.

Specifications

Coverage: 360° (azimuth)
Range: 183-3,000 m (200-3,200 yd)
Doppler range: ±40 kts (7.2 kHz)
Displays: Range (A Scan); Bearing (B Scan)
Doppler frequencies: 6.4, 7.2 and 8.0 kHz
Source levels: From 224.233 dB/µPa/m (transmission mode dependent)
Initial detection: 12 ping history of returns
Bearing accuracy: 1° RMS
Range accuracy: ±1% range reading
Transmission modes: Omni, TRDT, DT, ASPECT
Power level: High and low (10 dB reduction)

Manufacturer/Contractor

Westinghouse Canada Inc, Burlington, Ontario, Canada.

Thomson-CSF Diodon/Sorel sonar (TSM 2630)

Diodon is a hull-mounted sonar and Sorel the associated variable-depth sonar (VDS). They produce a panoramic medium-frequency sonar signal and a common data handling and sonar processing system provide target classification, automatic detection and tracking, and a man/machine interface. Embedded facilities include passive listening, sound ray tracer, an acoustic propagation prediction for the day and a recording system that can be used for debriefing and training.

Specifications

Acoustic array: 24 identical staves
Frequencies: 11, kHz, 12 kHz, 13 kHz
Transmitter: Omnidirectional transmission in CW and FM modes
Receiver: 36 preformed beams; advanced processing with replica correlator in FM and spectrum analysis (FFT) in CW
Video processing: Data processing in FM and CW modes; automatic detection and tracking; simultaneous multitrack extraction (up to 64); target analysis (apparent length, Doppler measurement)
Range scales: max 15,000 m (49,212 ft)
Display: High-resolution flicker-free colour TV monitors
Total weight: 1,500 kg (3,307 lb)

Manufacturer/Contractor

Thomson CSF, Sophia Antipolis Cedex, France.

Type 162M sonar

Sonar Type 162M detects and classifies both mid-water and seabed targets, displaying port and starboard recordings simultaneously on a single straight-line recorder, which has a maximum range scale of 1,200 yd. Operation is simplified by entirely automatic gain control. The three transducers are all similar and employ 49.8 kHz barium titanate elements. Their beam pattern is fan-shaped, about 3° wide and 40° vertical angle; the side-looking elements have their axes 25° below the horizontal. A loudspeaker and a socket for headphones enable signals to be monitored aurally if required. The three range scales are 0 to 300, 0 to 600 and 0 to 1,200 yds, and accuracy is better than two per cent assuming a sound velocity of 4,920 ft/s.

Manufacturer/Contractor

AB Precision (Poole) Limited, Poole, Dorset, UK.

AVIATION

AVIATION FACILITIES

General

There are two different arrangements for helicopters. In the first four ships (F 33, F 34, F 35, F 36) the layout is the same as in the British 'Broad Beam' Leanders. Thus, the Limbo Mk 10 ASW mortar is set into the main deck immediately aft of the flight deck, resulting in an area of sufficient size to operate a Chetak (Alouette III). The hangar is of the standard 'Leander' class design and size.

In the last two (F 41, F 42), the after end of the hull has been completely redesigned enabling the flight deck to be extended to the stern and resulting in an area of sufficient size to operate a Sea King helicopter. The hangar has also been rebuilt and is considerably larger.

HELICOPTERS

One HAL Chetak (licence-built Aerospatiale Alouette III) light helicopter

F 33, F 34, F 35, F 36.

Specifications

Dimensions:
main rotor diameter: 11.02 m (36.15 ft)
rotor disc area: 95.38 m² (1,026.6 sq ft)
Length overall, rotors turning: 12.84 m (42.13 ft)
height to rotor head: 2.97 m (9.45 ft)
Weights:
empty, standard: 1,230 kg (2,711 lb)
max take-off weight: 2,200 kg (4,850 lb)
Speed:
max speed (never-exceed) at sea level: 113 kts (210 km/h)
max cruising speed at sea level: 100 kts (185 km/h)
range with max fuel at sea level: 257 n miles (477 km)
Endurance: 3 h
Engine: 1–649 kW (870 shp) HAL-built Turbomeca Artouste IIIB turboshaft, derated to 410 kW (550 shp) for max continuous operation
Accommodation: 7 (pilot plus 6 persons)
Weapons: 7.62 mm machine gun (with 1,000 rds), or 20 mm gun (with 480 rds), or 2/4 wire-guided missiles, or 68 mm rocket pods

Manufacturer/Contractor

Hindustan Aircraft Ltd, India.

Westland Sea King Mk 48 B/C ASW helicopter

F 41, F 42.

Specifications

Dimensions:
main rotor diameter: 18.90 m (62.0 ft)
length overall (both rotors turning): 22.15 m (72.66 ft)
fuselage length: 17.02 m (55.83 ft)
height to rotor head: 4.74 m (15.5 ft)
Weights:
max take-off: 9,752 kg (21,500 lb)
internal cargo capacity: 2,720 kg (6,000 lb)
max speed (never-exceed): 144 kts (267 km/h)
Speed:
typical cruising speed: 120 kts (222 km/h)
service ceiling: 3,720 m (12,200 ft)
range with max standard fuel: 630 n miles (1,166 km)

Engines: 2—1,092 kW (1,465 shp) Rolls-Royce Gnome H.1400-IT turboshafts
Role equipment: 6 underwing pylons, torpedo bay, 32 sonobuoy ports, 2 depth-charge racks, search radar, FLIR, MAD
Accommodation: 4 (pilot, co-pilot, two sonar operators)
Sensors: Low-frequency 360° AQS-18/AQS-13F sonar; Doppler radar; SMA/APS-707 radar (chin radome)
Weapons: 2 or 4 homing torpedoes, or 4 depth charges or 2 Sea Eagle anti-ship missiles

Manufacturer/Contractor
Westland Helicopters, Yeovil, UK.

PROPULSION

Specifications
System: Steam turbine
Main machinery: 2 Babcock & Wilcox boilers; 38.7 kg/cm² (550 psi); 450°C (850°F); 2 steam turbines; 22.4 MW (30,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The Indian Navy depended on British warships for the first two decades of its independent existence; many of these were former RN ships, although some were built to Indian orders, but in British yards. When a new class of frigates was required, however, it was decided to take a British design, but to build it in India.

DESIGN

The basic design that was selected was the 'Broad Beam Leander' and the first to be built, *Nilgiri* (F 31), was an almost total repeat of the parent design, complete with the then standard RN combat suite, which comprised a Mk 6 twin 114 mm mounting, a Mk 10 Limbo ASW mortar, GWS.22 Seacat SAM launcher, Type 993 surveillance radar, Type 965 air warning radar, Type 184 hull-mounted sonar and Type 199 VDS.

The second, *Himgiri* (F 32), was very similar, but the electronics were increasingly replaced by Signaal-designed equipment, manufactured under licence in India by Bharat Electronics. Thus, in *Himgiri:*

air warning radar; DA 08 replaced Type 965
surveillance radar; ZW 06 replaced Type 993
forward fire control; M45 replaced Type 903

The third and fourth ships, *Udaygiri* (F 33) and *Dunagiri* (F 34), included all the changes made in *Himgiri,* but had two additional Seacat launchers aft (with Signaal M44 directors), and were delivered without the Type 199 VDS.

In the fifth and sixth ships, *Taragiri* (F 41) and *Vindhyagiri* (F 42), the after end was completely redesigned. The Limbo Mk 10 ASW launcher was removed, the flight deck considerably enlarged and a much bigger hangar installed.

This enabled the ships to operate a Sea King helicopter, but, since the new flight deck displaced the mooring facilities, it became necessary to open the deck below for handling mooring gear and to cut down the stern.

Other changes in the last two ships included installing two triple torpedo mountings abreast the hangar and a twin Bofors 375 mm ASW rocket launcher forward. There have also been reports, as yet unconfirmed, that these two ships have more powerful engines than the previous four.

MODERNISATION

At future refits it is planned that the first four ships will be brought up to the same standard of weapons and sensors as the last two.

DEPLOYMENT

These six ships form the 14th Frigate Squadron.

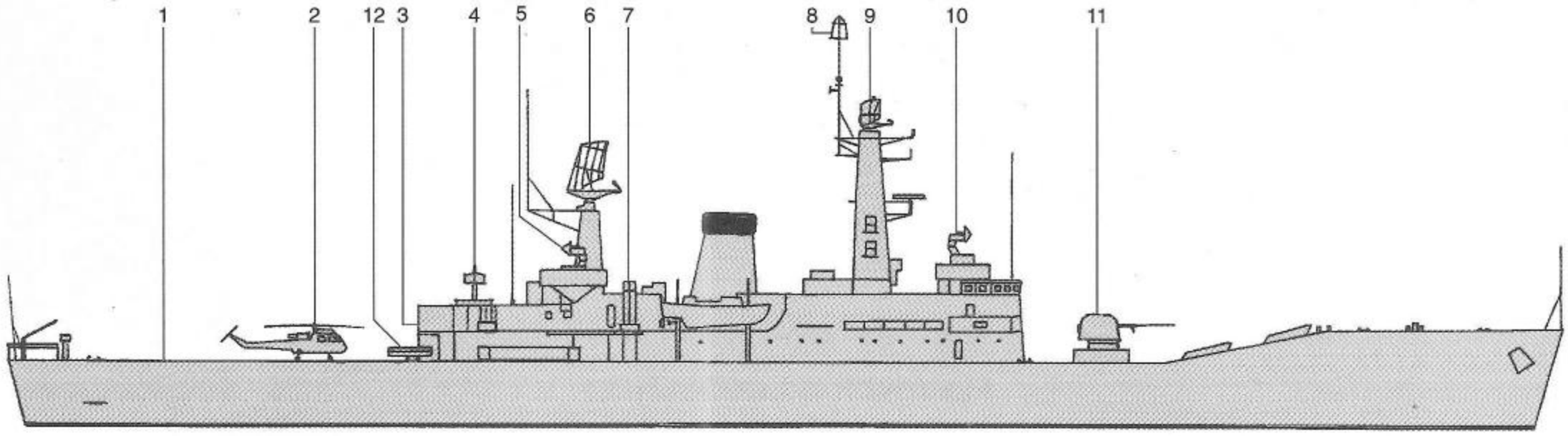
OPERATIONAL

Taragiri had a serious fire in 1994 but was repaired and returned to active duty in 1995.

INS Krishna
In addition to these six ships, the Indian Navy operates an ex-RN Leander, the former *Andromeda* (F 57), which was purchased in 1995. As *Andromeda* the ship had recently undergone an extensive refit for further RN service, but was then declared redundant and offered for sale. The Indian Navy bought the ship and has converted it for use in the training role. It now has minimum armament and although wearing a frigate pennant number (F 46) it is effectively an auxiliary.

Vindhyagiri *(F 42) in refit at Mazagon Dock, Bombay* (Mazagon Dock Ltd)

VAN SPEIJK (LEANDER)



Ahmad Yani (Ian Sturton)

1 Flight deck 2 Westland Wasp helicopter 3 Hangar 4 Seacat SAM launcher 5 Signaal M 44 fire director (for Seacat) 6 Signaal LW-03 air search radar 7 Harpoon anti-ship missile launchers 8 FH-5 HF/DF 9 Signaal DA-05 air/surface search radar 10 Signaal M 45 fire control (76 mm gun) 11 OTOBREDA 76 mm/62 compact gun 12 324 mm Mk 32 (two triple) torpedo tubes

GENERAL SPECIFICATIONS

Country of origin: Netherlands
Operator: Indonesia
Type: Leander

Class: VAN SPEIJK (FFG)

Purchased: 6
Active: 6

Displacement:
standard: 2,225 t
full load: 2,835 t

Dimensions
Length: 113.4 m (372 ft)
Beam: 12.5 m (41 ft)
Draught: 4.2 m (13.8 ft)

Speed: 28.5 kts
Range: 4,500 n miles at 12 kts

Complement: 180

SHIPS

AHMAD YANI (351)

Builder	Nederlandse Dok en Scheepsbouw Mij, Amsterdam, Netherlands
Laid down	1 Jun 1964
Launched	17 Dec 1965
Commissioned (RNIN)	16 Aug 1967 *(Tjerk Hiddes)*
Transferred	31 Oct 1986

SLAMET RIYADI (352)

Builder	Nederlandse Dok en Scheepsbouw Mij, Amsterdam, Netherlands
Laid down	1 Oct 1963
Launched	5 Mar 1965
Commissioned (RNIN)	14 Feb 1967 *(Van Speijk)*
Transferred	1 Nov 1986

YOS SUDARSO (353)

Builder	Koninklijke Maatschappij de Schelde, Flushing, Netherlands
Laid down	25 Jul 1963
Launched	19 Jun 1965
Commissioned (RNIN)	1 Mar 1967 *(Van Galen)*
Transferred	2 Nov 1987

OSWALD SIAHAAN (354)

Builder	Koninklijke Maatschappij de Schelde, Flushing, Netherlands
Laid down	25 Jul 1963
Launched	26 Mar 1966
Commissioned (RNIN)	9 Aug 1967 *(Van Nes)*
Transferred	31 Oct 1988

ABDUL HALIM PERDANAKUSUMA (355)

Builder	Koninklijke Maatschappij de Schelde, Flushing, Netherlands
Laid down	6 Jul 1965
Launched	18 Jun 1966
Commissioned (RNIN)	21 Dec 1967 *(Evertsen)*
Transferred	1 Nov 1989

KAREL SATSUITUBUN (356)

Builder	Nederlandse Dok en Scheepsbouw Mij, Amsterdam, Netherlands
Laid down	5 May 1965
Launched	10 Mar 1967
Commissioned (RNIN)	15 May 1968 *(Isaac Sweers)*
Transferred	1 Nov 1990

WEAPONS SYSTEMS

ANTI-SHIP MISSILES (ASM)

McDonnell Douglas RGM-84B Harpoon

Eight Harpoon anti-ship missiles are carried in two pairs of four launcher-containers mounted abaft the stack. The missiles are either Block 1B or Block 1C versions, the latter having a similar performance to the Block 1B but with certain additional options, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications

Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

Short Seacat GWS.22

These ships have two Seacat launchers and two Signaal M 44 directors, situated on the hangar roof. The missiles also have a secondary, anti-ship capability.

Specifications

Missile
Length: 1.48 m (4.86 ft)
Diameter: 19 cm (7.48 in)
Wing span: 65 cm (25.6 in)
Weight: 68 kg (150 lb)
Speed: Mach 0.8
Range: 5 km (2.7 n miles)
Radar: Type 904 (see radar table)

Manufacturer/Contractor

MSI-Defence Systems (formerly Short Brothers plc), Belfast, UK.

TUBES

Two 324 mm US Mk 32 torpedo tubes are mounted at the forward end of the after superstructure.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Compact

There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck. This was installed by Rykswerf, Den Helder during the Dutch Navy's mid-life modernisation programme.

Oswald Siahaan *(354) showing the hangar, the Seacat launcher and the large antenna for the Signaal LW-03 radar. Note also the 12.7 mm machinegun below and to the right of the crane jib, mounted for anti-piracy missions*

Specifications
Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/sec
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

UA-8/UA-9/UA-13

These ships retain their British passive radar intercept systems, which are all elderly, analogue, manually operated equipments.

UA-8 (all) covers the frequency band 2.4-4.1 GHz
UA-9 (all) covers the frequency band 7-11.5 GHz
UA-13 (355 and 356 only) is a DF equipment covering the frequencies 24 to 1,400 MHz.

FH 5 HF/DF

All ships are fitted with the FH 5 direction-finding equipment.

DECOYS

Corvus chaff dispensing system

There are two Corvus 8-barrel decoy launchers. Corvus is a quick reaction, self-defence system firing chaff dispensing rockets to form a radar decoy screen around the vessel. The system comprises: two multibarrelled rocket launchers, launcher control and firing panel, and the 'window' dispensing rockets themselves. There are two modes of operation: distraction decoy; and centroid decoy. A cylindrical rotating structure carries eight launching tubes mounted in two sets of three, one above the other, and crossed at 90° in azimuth with two further tubes set above, and aligned midway between the other tubes, all at a fixed elevation of 30°. The maximum loading of 16 'window' rockets provides protection against three missile attacks, before reloading. The normal limits of the training arc for the launcher are between 60 and 120° but as the lower sets of rocket barrels are angled about the centreline of the rotating structure, the arc covered by the rockets is considerably greater.

Indonesian frigate Ahmad Yani *(351) is the former Dutch* Tjerk Hiddes. *These ships have Signaal radars and electronic systems, an OTOBREDA 76 mm gun and US Mk 32 torpedo tubes*

Specifications
Training
Bearing arc (normal) ie launcher axis: 60-120°
Bearing arc (max) ie tube axis: 15-165°
Tube diameter: 195 mm (7.68 in)
Tube length: 1.6 m (5.25 ft)
Weight (empty): 25 kg (55 lb)
No of guides: 4, RH spiral

Manufacturer/Contractor
Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SEWACO V action data automation/Daisy data processing

SEWACO V is the system which was installed during the mid-life update of the six 'Van Speijk' class frigates. Sensors include an LW-02 air warning radar, a DA-05 air and surface warning and target indication radar, a Decca navigation radar with two displays, IFF and helicopter transponder system, two optical target designation sights, two sonar sets, an ESM system and an automatic datalink. The action information system is of the DAISY type and includes four horizontal tactical display consoles with alphanumeric displays and a plotting table. The weapons fit comprises an OTO Melara 76 mm/62 dual-purpose gun, controlled by an M 45 weapon control system, Seacat launchers controlled by an M 44 system, a Harpoon SSM system, ASW torpedoes and ECM equipment, and a Westland Wasp ASW helicopter.

SEWACO V's functions include:
Air, surface and subsurface warning
Compilation and display of tactical air, surface and subsurface situations
Threat evaluation and target engagement in AAW, EW, Anti-Surface Warfare, ASW and shore bombardment
Navigation including ASW helicopter direction
Communication including tactical datalink operation
Onboard scenario-driven training
Organisation and system management.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

WEAPONS CONTROL

LIOD electro-optic director

Signaal LIOD Mk 2 directors have been fitted in 353, 354 and 356. LIOD (LIghtweight Optronic Director) is a weapon control system designed to conduct automatic or manual rate-aided tracking of an air and a surface target while controlling two or more dual-purpose guns of different types. The system tracks targets moving at up to 800 m/s (3,048 ft/s) and can track large warships at 20 km and fighter-size aircraft at 10 km. It consists of an electro-optical director, one or two TDS directors and a control console. The main director has a TV camera with a field of view of 2-20°, an 8-12 micron IR camera with a field of view of 1.2/7.5° and an Nd:YAG laser rangefinder. The two cameras operate to the CCIR standard.

The console, which also houses the SMR-MU general purpose computer, receives data not only from the electro-optic systems but also from the ship's reference systems. Tracking is by the optical contrast technique whereby the target is tracked against its background as viewed by a TV or infra-red camera. The TV camera has automatic filters to adjust for light conditions. Alternatively a correlation tracker can be implemented which is capable of automatic target acquisition. Range information is provided by a laser rangefinder. Alternatively a laser-tracker can be fitted. Both the camera and rangefinder are co-mounted on the director head unit, which is provided with appropriate servos and anti-vibration mountings. The daylight version is fitted with a TV camera and laser, while the high-performance model has a TV camera, infra-red camera and laser rangefinder.

The LIOD sensor in its basic version, employed as an autonomous weapon control system, is capable of performing the following functions:

Optical surveillance for air and surface targets
Target designation for anti-air and anti-surface engagements
Air or surface fire control
Automatic or rate-aided tracking of one air or surface target
Air or surface target gun prediction calculation
Independent control of two or more dual-purpose guns of the same or different calibre
Engagement monitoring, kill assessment, and gun fire correction
System status monitoring.

Specifications

Director
Weight: 200 kg (441 lb)
Traverse: 360°
Elevation: −30 to +115°
Traverse speed: 130°/s
Elevation speed: 130°/s
Laser rangefinder
Beam divergency: 1.2-1.5 mrad
Pulse length: 20 ns
Max repetition frequency: 10 Hz
Fields of view: 3-30° (TV camera); 3° (IR camera)
Power requirements: 115 V 400 Hz (2.5 kVA); 115 V 60 Hz (0.7 kVA)

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

Type	LW-03	DA-05	Type 1229	M 45	M 44 (two)
Company	Signaal	Signaal	Racal-Decca	Signaal	Signaal
Role	Air/surface search	Air/surface search	Navigation	Fire control (76 mm gun)	Fire control (Seacat)
Band	D	E/F	I	I/J	I/J
Beam	2.2 × csc² to 40°	1.5 × 8°	1.2°		
Peak Power	500 kW	1,200 kW	25 kW		
Gain	31 dB	32.2 dB	30 dB		
Pulsewidth	2/5 µs	1.3/2.6 µs	0.05/0.25/ 1.0 µs		
PRF	500/250 pps	1,000/500 pps			
Scan rate	1-10 rpm	10/20 rpm	28 rpm		
Typical range	120 n miles (219 km) for 2 m² target	75 n miles (137 km) for 2 m² target	48 n miles		

SONAR

EDO CWE-610 hull-mounted active sonar system

The CWE-610 low-frequency (LF) sonar is designed for the long-range detection of submarines in deep and shallow water. There is a 36 stave transducer in a dome under the hull and two active consoles, enabling it to perform a search-while-track function. Facilities offered include a search capability in three 120° sectors, passive correlation, and reverberation processing. Transmissions are at 6, 7 and 8 kHz and use 10° preformed receiver beams. Range of the active system is approximately 30,000 m (98,430 ft) and there is a passive display for greater ranges. The sonar system outputs data automatically into SEWACO-V. All mode changes and range scale changes are controlled by console push-buttons, and displays include a Doppler display on each of the active consoles and a passive sonar bearing time recorder display. CWE-610 was designed specifically to meet Dutch requirements for the 'Tromp' class and was also fitted in the 'Van Speijk' class. There is also a VDS.

Manufacturers/Contractors

EDO Corporation, Government Systems Division, College Point, New York.
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 25.3 × 12.5 m (83 × 41 ft)

HELICOPTERS

One Westland Wasp.

Specifications

Wasp HAS Mk 1
Dimensions:
main rotor diameter: 9.83 m (32.25 ft)
tail rotor diameter: 2.29 m (7.5 ft)
fuselage length: 9.24 m (30.33 ft)
height to top of rotor hub: 2.72 m (8.92 ft)
Weights:
empty: 1,566 kg (3,452 lb)
max take-off: 2,950 kg (5,500 lb)
Performance:
max level speed (sea level): 104 kts (193 km/h)
economic cruising speed: 96 kts (177 km/h)
max range: 263 n miles (488 km)
Power plant: 1—710 ehp (derated) Rolls-Royce/Bristol Nimbus 503 turboshaft
Avionics: PTR 170 and PV 141 UHF and UHF homing radio, and standby UHF
Weapons: 2 Mk 44 or 1 Mk 46 torpedoes, or 2 AS.12 anti-ship missiles

PROPULSION

Specifications

System: Steam turbines
Main machinery: 2 Babcock & Wilcox boilers; 38.7 kg/cm² (550 psi); 450°C (850°F); 2 Werkspoor/English Electric turbines; 22.4 MW (30,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

On 11 February 1986 an agreement was signed with the Netherlands for the transfer of two of this class with an option on two more. The ships were provided with all spare parts but not towed arrays.

DUTCH MODERNISATION

While still serving with the Dutch Navy, this class underwent mid-life modernisation at Rykswerf, Den Helder between 1976 and 1983. The work included replacing the 114 mm (4.5 in) turret by an OTO Melara (now OTO-BREDA) 76 mm Compact, removing the Mk 10 Limbo ASW mortar and mounting twin triple 324 mm torpedo tubes. Other work included installing the Signaal SEWACO V combat data system, new electronics, communications systems and electrics. The hangar was enlarged and made telescopic, and the flight deck extended to enable the ships to accommodate Lynx. Extensive automation enabled the complement to be reduced from 250 to 190 and the extra space resulted in considerably enhanced habitability.

Two quadruple Harpoon anti-ship missile launchers were installed, although initially only the first two ships could be fitted, because there was no FMS funding for the others. Later, however, the US Navy provided sufficient SWG-1A panels for all of the class to be retrofitted with Harpoon missiles. During this mid-life refit all six ships received the PDE 700 VDS.

Later improvements while in Dutch service included the installation of AN/SQR-18A passive towed array in *Evertsen* and *Isaac Sweers*. Also, all six ships were fitted with the characteristic IR suppressing funnel caps.

TRANSFER

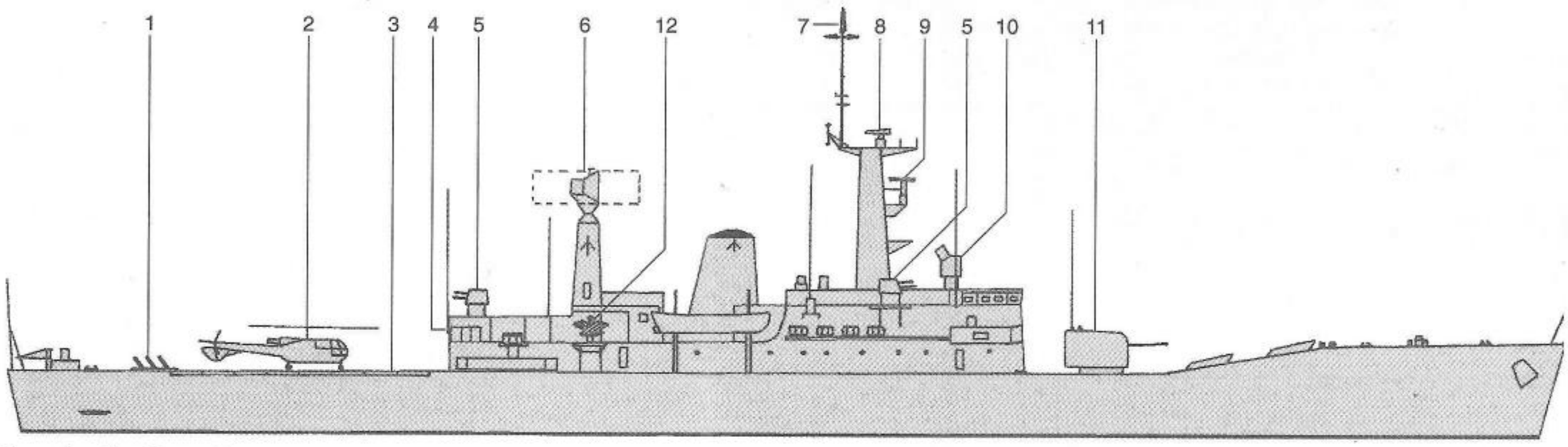
Only two ships, *Ahmad Yani* and *Slamat Riyadi* were transferred with a complete Harpoon capability, but it is reported that all six ships are now fully Harpoon capable. In addition, the AN/SQR-18A towed arrays were removed from *Evertsen* and *Isaac Sweers* prior to transfer. Although the ships had been converted while in Dutch service to operate Lynx helicopters, they were transferred with the smaller Wasp helicopters, also from Dutch Navy stocks.

INDONESIAN MODERNISATION

In 1994 the Indonesian Navy ordered three LIOD electro-optical (TV/IR/laser) fire-control systems from Signaal. These were fitted in 1995/96 by PT PAL, Soerabaya, to *Yos Sudarso* (353), *Oswald Siahaan* (354) and *Karel Satsuitubun* (356) as the fire-control director for the 76 mm gun. LIOD is also integrated with the SEWACO V tactical data system.

Oswald Siahaan *(354) was commissioned in 1967 as the Dutch* Van Nes *and was sold to Indonesia in 1988* (John Mortimer)

ZULFIQUAR (LEANDER)



Shamsher (Ian Sturton)
1 *UK pattern Mk 10 ASW mortar* **2** *SA 319B Alouette III helicopter* **3** *Flight deck* **4** *Hangar* **5** *Twin 25 mm guns* **6** *GEC-Marconi Type 966 air search radar* **7** *FH-12 HF DF* **8** *Plessey Type 993 surface search radar* **9** *Kelvin Hughes Type 1006 navigation radar* **10** *Plessey Type 904 (for 114 mm guns)* **11** *114 mm (4.5 in)/45 Mk 6 twin semi-automatic gun* **12** *Corvus decoy launcher*

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: Pakistan
Type: Leander

Class: ZULFIQUAR

Purchased: 2
Active: 2

Displacement:
standard: 2,500 t
full load: 2,962 t

Dimensions
Length: 109.7 m (360 ft) (wl); 113.4 m (372 ft) (oa)
Beam: 13.1 m (43 ft)

Draught: 4.5 m (14.8 ft) (keel); 5.5 m (18 ft) (screws)

Speed: 28 kts
Range: 4,000 n miles at 15 kts

Complement: 235 (15 officers)

SHIPS

ZULFIQUAR (F 262)		**SHAMSHER** (F 263)	
Builder	Yarrows, Glasgow, UK	**Builder**	Yarrows, Glasgow, UK
Laid down	1 May 1969	**Laid down**	30 Jan 1968
Launched	15 Oct 1970	**Launched**	15 Apr 1969
Commissioned (RN)	28 May 1972 *(Apollo)*	**Commissioned (RN)**	2 Apr 1971 *(Diomede)*
Commissioned (Pakistan)	14 Oct 1988	**Commissioned (Pakistan)**	15 Jul 1988

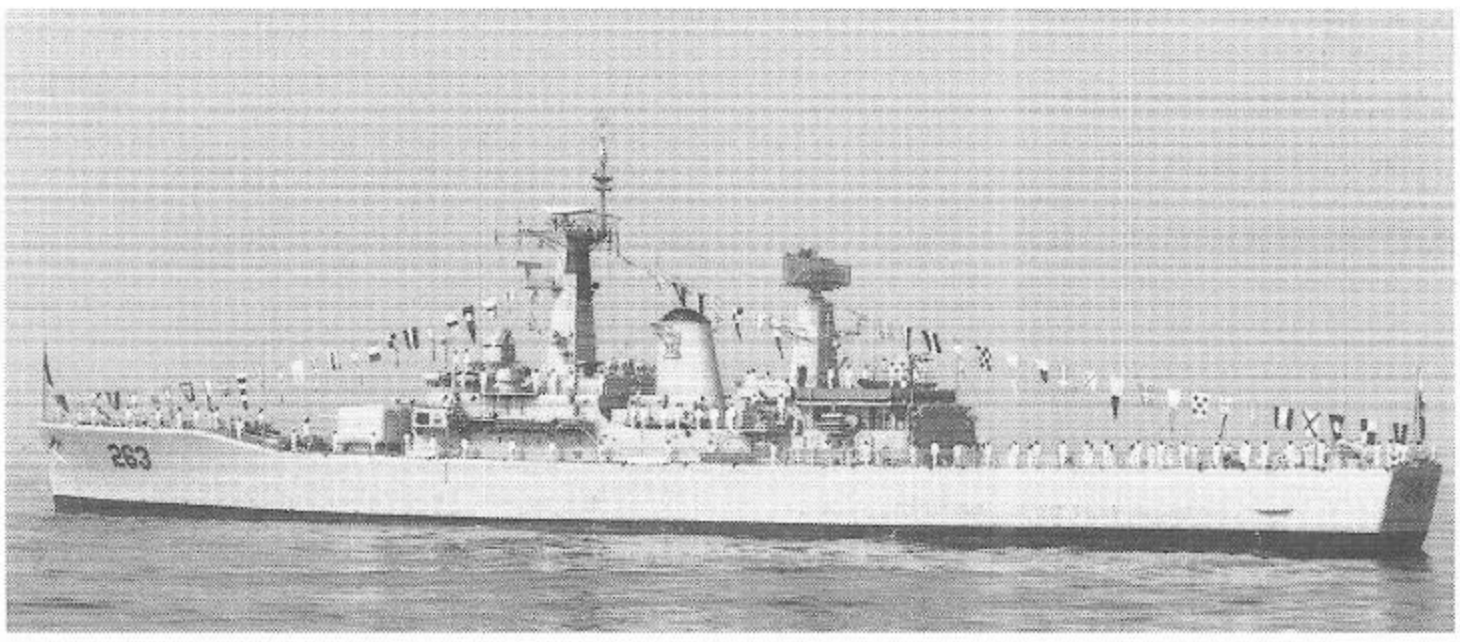
WEAPONS SYSTEMS

GUNS

Vickers 114 mm (4.5 in)/55 Mk 6 multipurpose gun

There is a twin 114 mm (4.5 in) Mk 6 mounting in 'A' position to provide quick-reaction short-range air defence, to engage surface targets including fast attack craft, and to provide gunfire support to ground forces. The weapon system consists of the gun mounting, the ammunition feed system, the remote power control system, and the captain-of-turret panel. The mounting includes two Mk V barrels, which are 6.22 m long, fitted with a muzzle brake and fume extractor, and have a life of 3,300 rounds EFC. The mounting is completely enclosed in a shield which protects it against the environment, blast and shrapnel. The loading system is hydraulically operated, with an autoloader which is manually fed by two loaders and has a capacity of six rounds. The hoist transfers them in two stages to the turret from where they are raised by a pivoting loading arm to the breech where they are inserted by a power rammer. After the shell is fired the case is extracted automatically and ejected through a chute in the front of the mounting.

Specifications
Calibre: 114 mm
Length of barrel: 45 calibres
Traverse: 360°
Elevation: 0 to +89°
Muzzle velocity: 746 m/s (2,447 ft/s)
Weight of projectile: 25.5 kg (56 lb)
Rate of fire: 14 rds/min/barrel



Shamsher *(F 263) with three twin Type 61 25 mm cannon*

Range:
anti-surface: 10.25 n miles (19 km)
anti-air: 12,500 m (41,000 ft)
Crew: 20

Manufacturer/Contractor
Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

Type 61 25 mm air defence cannon

When these ships were transferred from the UK their armament included one Seacat SAM launcher and a number of 20 mm cannon, but these have all been removed and replaced by three twin Type 61 25 mm mounts, a weapon which is already in use with the Pakistan Navy. This Chinese weapon is based on the Soviet 2-M-3 twin 25 mm mounting which was supplied to China where it entered production as Type 61; it arms 'Luda' class destroyers and various types of smaller craft. 2-M-3 consists of two guns installed one above the other in separate cradles and lying on their sides; they are fed from the right-hand side. The barrel is 1.5 m long and air-cooled with a flash suppressor and an exposed spring recuperator wrapped around the barrel near the breech. A hydraulic recoil buffer is on the underside of the gun. The weapon has a vertical wedge breech block and the breech casing contains both the breech mechanism and part of the loading mechanism. The ammunition is either in five-round clips or 65-round belts whose boxes are attached to the trunnions. The first round is loaded manually into the breech, the breech block rises and the gun fires when the firing pin strikes the cartridge percussion cap. Upon recoil the breech block opens and extractor arms propel the spent case along the loading tray and down a

chute to one side of the gun. The recoil forces activate the loading mechanism and allow succeeding rounds to be rammed into the breech automatically.

Specifications

2-M-3
Calibre: 25 mm
Length of barrel: 60 calibres
Traverse: Unlimited
Elevation: −10 to +85°
Traverse speed: 25°/s
(manual/hydraulic): 70°/s
Elevation speed: 15°/s
(manual/hydraulic): 40°/s
Rates of fire: 450 rds/min/barrel
Projectile: 0.28 kg HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m

ANTI-SUBMARINE MORTARS

Anti-Submarine 304.8 mm (12 in) Mortar Mk 10 Limbo

These ships retain the British-developed Limbo, triple-barrel 304.8 mm mortar system, which is mounted aft of the flight deck. The three barrels are installed in line on a massive metal mounting with a metadyne system for stabilising it in pitch and roll. The projectiles are loaded automatically from magazines alongside the mounting, the mortar tubes being laid horizontally with a pneumatic system moving rounds down the barrel. Fuze settings are set automatically through relays and uniselectors. The magazine has a capacity of 51 rounds. Training of the mortar is carried out automatically from the combat information centre using data from the ship's sonar system. The Limbo system fires its projectiles in a three-dimensional pattern. The projectiles can be set to explode at various depths using hydrostatic or impact fuzes. Limbo has a crew of seven.

Limbo is controlled by the MCS (Mortar Control System) Mk 10. The original system used vacuum-tube technology and during the 1960s systems in British service were updated with new solid-state electronics in the computer and sonar display system. The sonar is the Type 170 with square transducer and a frequency of 15 kHz.

Specifications

Weight: 35 t
Range: 900 m (984 yd)
Projectile: 177 kg (390 lb)
Explosive: 94 kg (207 lb)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

UA-8/UA-9/UA-13

These ships retain their British passive radar intercept systems, which are all elderly, analogue, manually operated equipments.

UA-8 covers the frequency band 2.4-4.1 GHz
UA-9 covers the frequency band 7-11.5 GHz
UA-13 is a DF equipment covering the frequencies 24-1,400 MHz.

ELECTRONIC COUNTERMEASURES (ECM)

Type 668 jammer

Type 668 is a British-made noise jammer from the 1960s. It covers the frequencies 2.5-4.1 GHz.

DECOYS

Graseby Type 182 towed torpedo decoy equipment

Type 182 towed torpedo decoy is designed to decoy both active and passive homing torpedoes, using signals electronically generated within the ship and fed, via the towing cable, to electroacoustic transducers within the towed body. The Type 182 produces two independently controllable output signals which are radiated simultaneously from the towed decoy. An amplitude modulated noise signal simulates the ship's propeller noise and causes passive-homing torpedoes to be seduced away from the ship towards the towed decoy. The second signal is a swept CW signal, which simulates sonar echoes, in order to confuse or jam the guidance system of active homing torpedoes, thus causing them to miss the ship. The frequency bands covered by both types of output are switchable to meet tactical scenarios and to enable concurrent operation of other sonar and communication equipments.

Specifications

Towed decoy:
diameter: 533 mm (21 in)
length: 2.01 m (6.6 ft)
weight: 74 kg (163 lb)
Towing cable:
length: 411 m (1,348 ft)
diameter: 14.48 mm (0.57 in)
weight: 269 kg (593 lb)

Manufacturer/Contractor

Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

Corvus chaff dispensing system

There are two Corvus 8-barrel decoy launchers. Corvus is a quick reaction, self-defence system firing chaff dispensing rockets to form a radar decoy screen around the vessel. The system comprises: two multibarrelled rocket launchers, launcher control and firing panel, and the 'window' dispensing rockets themselves. There are two modes of operation: distraction decoy; and centroid decoy. A cylindrical rotating structure carries eight launching tubes mounted in two sets of three, one above the other, and crossed at 90° in azimuth with two further tubes set above, and aligned midway between the other tubes, all at a fixed elevation of 30°. The maximum loading of 16 'window' rockets provides protection against three missile attacks, before reloading. The normal limits of the training arc for the launcher are between 60 and 120° but as the lower sets of rocket barrels are angled about the centreline of the rotating structure, the arc covered by the rockets is considerably greater.

Specifications

Training
Bearing arc (normal) ie launcher axis: 60-120°
Bearing arc (max) ie tube axis: 15-165°
Tube diameter: 195 mm (7.67 in)
Tube length: 1.6 m (5.25 ft)
Weight (empty): 25 kg (55 lb)
No of guides: 4, RH spiral

Manufacturer/Contractor

Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

MRS 3 system for 114 mm guns.

SONARS

Kelvin Hughes Type 162 M

The British Kelvin Hughes Type 162 M ('Cockchafer') side-looking target detection sonar is designed to detect and classify seabed targets, such as a bottomed submarine. There are three transducers: one faces downwards at 25° below the horizontal, while the other two face sideways to cover a 3° wide and 40° vertical sector. The transmitter delivers 40 W to the central, downward-looking transducer and 80 W each to the side-looking transducers. The set operates at 50 kHz and range scales are 270 m (300 yd), 550 m (600 yd) and 1,100 m (1,200 yd)

Manufacturer/Contractor

Kelvin Hughes, Watford, UK.

Type 170 B sonar

Type 170 B is the sonar used to control the Limbo Mk 10 ASW mortar; it was also produced in Canada as

RADARS

Set	Type 966	Type 993	Type 1226	Type 904 (two)
Company	GEC-Marconi	Plessey	Racal-Decca	Plessey
Role	Air search	Short-range, air/surface search	Navigation	Fire control (114 mm guns)
Band	A	E/F	I	I
Beam	12 × 40°	2 × 35°	1 × 18°/ 0.75 × 18°	2°
Peak power	450 kW	500 kW	25 kW	—
Gain	20 dB		31 dB/34 dB	—
Pulsewidth	3.8/10 µs	0.7/1.5 µs	0.8 or 0.25 µs/ 0.75 µs	0.1 µs
PRF	400/200 pps	500 pps	1,600/800 pps	3,000 pps
Scan rate	8/10 rpm	24 rpm	24 rpm	—

the AN/SQS-502. Operating frequency is 15-25 kHz and the system has a maximum operating range of about 1,800 m (2,000 yd) and a maximum depth of about 350 m (1,200 ft)

Type 184P active/passive hull-mounted search sonar

Type 184P was an in-service upgrade to Type 184M. Type 184P is a 360° scanning sonar, incorporating both active and passive modes of operation, which provides range, bearing and target Doppler data to the fire-control computer. The equipment provides a dual-frequency transmission and three receiver systems. The latter comprise: an all-round search and tracking PPI system with, in the Type 184P, 16 receiving channels, which gives greater bearing accuracy. The upgrading also involved inserting 31 digital filters in each of the four beam channels, enabling the system to measure Doppler speeds of up to ±40 kts. There is also a continuous torpedo warning system with its own display. A circular 32-stave transducer array is employed. The keel-mounted, retractable dome is 3.99 m long, 1,62 m wide and 1.55 m deep. Operating frequencies are 7.5 kHz and 9 kHz.

Manufacturer/Contractor

Graseby Marine (Graseby Dynamics Ltd), Watford, Hertfordshire, UK.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 19.2 × 13.1 m (63 × 43 ft)

HELICOPTERS

One Aerospatiale SA319B Alouette III light helicopter

Specifications

Dimensions:
main rotor diameter: 11.02 m (36.15 ft)
rotor disc area: 95.38 m² (1,026.6 sq ft)
length overall, rotors turning: 12.84 m (42.13 ft)
height to rotor head: 2.97 m (9.45 ft)
Weights:
empty, standard: 1,230 kg (2,711 lb)
max take-off weight: 2,200 kg (4,850 lb)
max speed (never-exceed) at sea level: 113 kts (210 km/h)
max cruising speed at sea level: 100 kts (185 km/h)
range with max fuel at sea level: 257 n miles (477 km)
Endurance: 3 h
Engine: One 649 kW (870 shp) HAL-built Turbomeca Artouste IIIB turboshaft, derated to 410 kW (550 shp) for max continuous operation
Accommodation: 7 (pilot plus 6 persons)
Sensors: 2 of the 8 helicopters have MAD
Weapons: 2 depth charges or one Type 244S torpedo

PROPULSION

Specifications

System: Steam turbines
Main machinery: 2 Babcock & Wilcox boilers; 38.7 kg/cm² (550 psi); 454°C (850°F); 2 White/English Electric turbines; 22.4 MW (30,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

Since its formation in 1947 the Pakistan Navy's surface fleet has consisted of a mixture of second-hand British and US destroyers and frigates. Recent acquisitions from the UK have included six Type 21 frigates and these two Leanders. Both *Diomede* and *Apollo* were Broad Beam Leanders, belonging to the unconverted group and had thus had no modernisation work done on them. They were transferred to the Pakistan Navy as *Zulfiquar* (14 October 1988) and *Shamsher* (15 July 1988) respectively.

MODERNISATION

The Wasp helicopter was not included in the transfer and the Pakistan Navy operates an Alouette III from these ships.

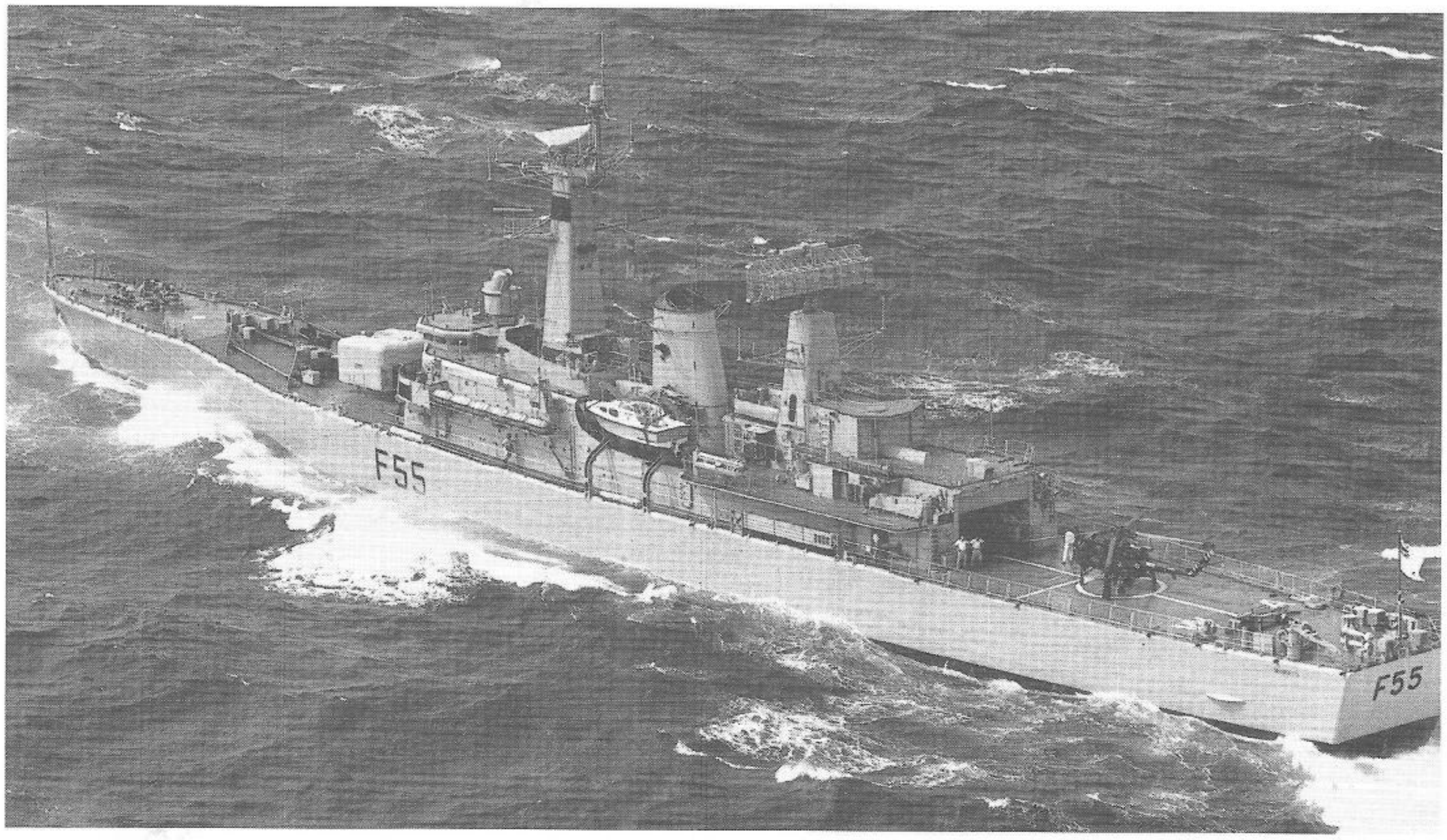
The ships were refitted in 1991-92 and among the work carried out was the removal of the GWS.22 Seacat launchers and the 20 mm guns, and their replacement by Chinese Type 61 twin 25 mm mounts.

OPERATIONAL

These ships are rather lightly armed, with only the twin 114 mm mounting and the three twin 25 mm cannon for air and surface engagements. For ASW operations there is the Limbo mortar and the Alouette helicopter, which has limited capabilities.

The Pakistan Navy's Zulfiquar *(F 262) is virtually unmodified from when it left the UK Royal Navy in 1988. Note the 'half-cheese' antenna of the Type 993 radar atop the foremast and the UA-13 conical DF array at the masthead* (H M Steele)

WELLINGTON (LEANDER)



Waikato *(F 55) is due to be paid off in 1999 at the latest* (Royal New Zealand Navy)

GENERAL SPECIFICATIONS

Operator: New Zealand
Type: Leander (Broad Beamed)

Class: WELLINGTON (FF)

Purchased: 4
Active: 3

Displacement:
standard: 2,474 t
full load: 2,945 t

Dimensions
Length: 113.4 m (372 ft)
Beam: 13.1 m (43 ft)
Draught: 5.5 m (18 ft)

Speed: 28 kts
Range: 5,500 n miles at 15 kts

Complement: 245 (15 officers) *(Canterbury);* 260 (19 officers) *(Wellington)*

SHIPS

WAIKATO (F 55)	
Builder	Harland & Wolff Ltd, Belfast, UK
Laid down	10 Jan 1964
Launched	18 Feb 1965
Commissioned	16 Sep 1966

CANTERBURY (F 421)	
Builder	Yarrow Ltd, Clydebank, UK
Laid down	12 Apr 1969
Launched	6 May 1970
Commissioned	22 Oct 1971

WELLINGTON (F 69)	
Builder	Vickers Armstrong Ltd, Newcastle-upon-Tyne, UK
Laid down	27 Oct 1966
Launched	29 Feb 1968
Commissioned (RN)	17 Oct 1969 *(Bacchante)*
Purchased (New Zealand)	1982

WEAPONS SYSTEMS

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited aft, either side of the hangar.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

Vickers 114 mm (4.5 in)/55 Mk 6 multipurpose gun

There is a twin 114 mm (4.5 in) Mk 6 mounting in 'A' position to provide quick-reaction short-range air defence, to engage surface targets including fast attack craft, and to provide gunfire support to ground forces. The weapon system consists of the gun mounting, the ammunition feed system, the remote power control system, and the captain-of-turret panel. The mounting includes two Mk V barrels, which are 6.22 m (20.4 ft) long, fitted with a muzzle brake and fume extractor, and have a life of 3,300 rounds EFC. The mounting is completely enclosed in a shield which protects it against the environment, blast and shrapnel. The loading system is hydraulically operated, with an autoloader which is manually fed by two loaders and has a capacity of six rounds. The hoist transfers them in two stages to the turret from where they are raised by a pivoting loading arm to the breech where they are inserted by a power rammer. After the shell is fired the case is extracted automatically and ejected through a chute in the front of the mounting.

Specifications
Calibre: 114 mm
Length of barrel: 45 calibres
Traverse: 360°
Elevation: 0 to +89°
Muzzle velocity: 746 m/s (2,448 ft/s)
Weight of projectile: 25.5 kg (52.3 lb)

Canterbury *(F 421) in 1996 approaching the end of a long refit. The newly installed Phalanx can be seen on the hangar roof, although the enlarged flight deck and hangar are not so obvious* (RNZN)

Rate of fire: 14 rds/min/barrel
Range:
anti-surface: 10.25 n miles (19 km)
anti-air: 12,500 m (41,012.5 ft)
Crew: 20

Manufacturer/Contractor
Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

Hughes Mk 15 Mod 11 CIWS Phalanx
A single Hughes Mk 15 Mod 11 Phalanx close in weapons system (CIWS) is mounted on the roof of the hangar aft, replacing the GWS.22 Seacat system previously carried. The Phalanx provides the innermost layer of defence against anti-ship missiles. The 20 mm M61A1 Vulcan, six-barrel, Gatling-principle gun has a cylindrical magazine with the feed mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds. This is the only known Phalanx installation in 'Leander' class frigates.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA (systems).

M2HB 12.7 mm (0.50 in) machine guns
Up to six M2HB 12.7 mm machine guns are carried and can be mounted on flexible mounts.

Specifications
Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rds/min
Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-air: 1,380 m (4,500 ft)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Argo AR-700 Phoenix
Argo AR-700 is an advanced modular ESM suite covering frequencies from 0.5 to 18 GHz, which is designed to counter most known radar threats. The Argo AR-700 is an IFM receiver, providing surveillance and radar warning over 2-18 GHz band. The antenna array consists of a mast-mounted ESM antenna assembly with two DF arrays, one omnidirectional unit and two monopulse units.

Specifications
AR-700
Frequency coverage: 0.5-18 GHz
High sensitivity: up to −67 dBm
Detection range: 200 n miles ships; 50 n miles aircraft
DF accuracy: 4° RMS; 2° RMS fine DF
Automatic tracking: 500 active signals in dense signal environment
Signal identification speed: <1 s

Manufacturer/Contractor
ARGOSystems Inc, Sunnyvale, California.

Telegon PST 1288 HVU
The PST 1288 is a direction-finding (DF) equipment from Telegon (TELEfunken GONiometer).

ELECTRONIC COUNTERMEASURES (ECM)

Type 668/669 jammers
Type 668 and Type 669 are British-made noise jammers from the 1960s and formed the basis of Outfit UA-8/9. They give coverage across the frequencies 2.5-4.1 GHz and 7-11.5 GHz.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers
There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

Graseby Type 182 towed torpedo decoy equipment
Type 182 towed torpedo decoy is designed to decoy both active and passive homing torpedoes, using signals electronically generated within the ship and fed, via the towing cable, to electroacoustic transducers within the towed body. The Type 182 produces two independently controllable output signals which are radiated simultaneously from the towed decoy. An amplitude modulated noise signal simulates the ship's propeller noise and causes passive-homing torpedoes to be seduced away from the ship towards the towed decoy. The second signal is a swept CW signal, which simulates sonar echoes, in order to confuse or jam the guidance system of active homing torpedoes, thus causing them to miss the ship. The frequency bands covered by both types of output are switchable to meet tactical scenarios and to enable concurrent operation of other sonar and communication equipments.

Specifications
Towed decoy:
diameter: 533 mm (21 in)
length: 2.01 m (6.6 ft)
weight: 74 kg (163 lb)
Towing cable:
length: 411 m (1,348 ft)
diameter: 14.48 mm (0.57 in)
weight: 269 kg (593 lb)

Manufacturer/Contractor
Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

NAUTIS command and weapon control system

NAUTIS (Naval AUTonomous Information System) is a command and weapon control system, which, as installed in the RNZN ships, uses five NAUTIC (Naval AUTonomous Intelligent Console) multifunction intelligent workstations. NAUTICs are based upon Intel iAPX-86 processors with 3 Mbyte RAM together with 2 Mbyte non-volatile magnetic bubble memory. Dual iAPX-286 microprocessors are used in Multibus configurations, while iAPX-186 microprocessors are used for intelligent interfaces. Each NAUTIC uses 150,000 lines of Ada-language software code. NAUTIC consoles are linked by a dual-redundant MIL-STD-1553B data highway.

An extensive system database is replicated in each console, and typically covers an area 2,000 × 2,000 n miles square (3,704 × 3,704 km). It includes radar and sonar tracks, route/search plans, user-designated tactical maps and synthetic charts. System capacity is 200 air, surface and submarine tracks and reference points with integral radar auto-tracking for up to 80 air and surface targets. The database can also include up to six user-designated tactical maps, 15 synthetic charts, 200 labelled reference points, 5,000 fully detailed underwater contacts and 32 labelled bearing lines. Manually initiated automatic radar tracking is possible for a minimum of 20 tracks.

Workstations accept various combinations of digital, synchro and analogue input/output for the whole range of sensors and weapons and interface options, including point-to-point, the data highway or a general purpose combat system highway. They also interface with optional elements, such as chart tables, plotter/printers and magnetic tape units, through point-to-point interfaces or the data highway. The NAUTICs are networked into a system designed to meet customer requirements with the workstations configured to meet specific tasks such as radar displays, automatic target tracking, tactical picture compilation, weapon direction and navigation.

Manufacturer/Contractor

GEC-Marconi Naval Systems, Combat Systems Division.

COMMUNICATIONS AND DATALINKS

Datalink

Link 11; Whittaker Electronics DataLink Set
IFF: Hazeltine AN/TPX-54(V) Mk XII IFF
HF: GEC-Marconi ICS 4/ARC 109.

WEAPONS CONTROL

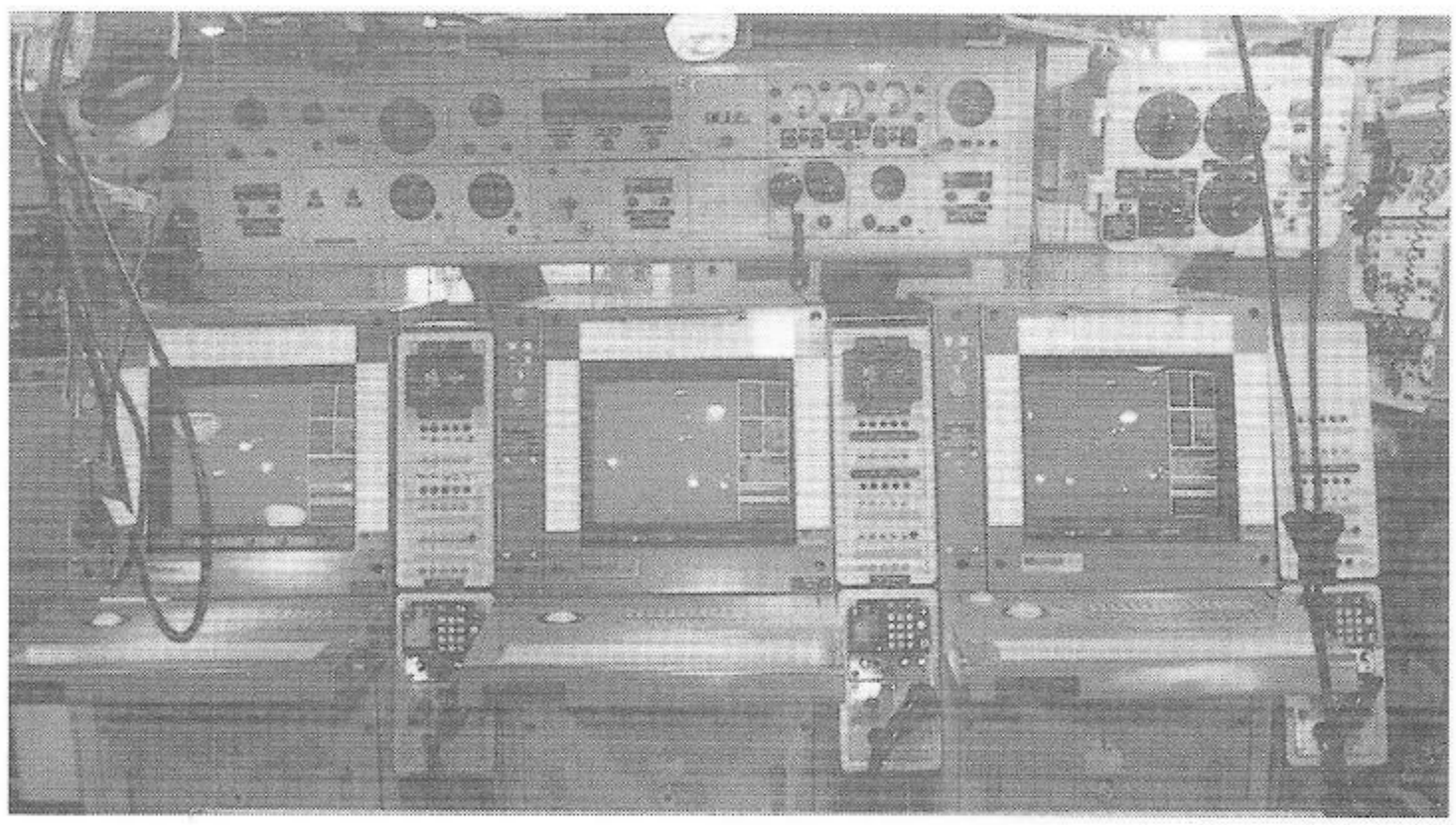
Lockheed Martin R-76C5 weapon control system

The R-76C5 is a gun fire-control system with distributed architecture system based upon seven RCA MIL-STD-1750A and Texas Instruments 9989 microcomputers within the consoles. The microcomputers are for gun control, ballistic calculations, radar data processing, data recording, data storage, interface and radar control. The software is written in the Assembler language. There are two consoles, one for Track and Gunfire Control (T/GFC), the other for Search and Designation (S/DC).

The associated TR-76 fire-control director is an I-band monopulse radar housed in a stabilised mounting with a TV tracker. Dual-monopulse tracking enables the use of missiles and guns simultaneously with data displayed on two A-scopes. The transmitter, with a peak power of 250 kW, employs a vacuum tube modulator allowing multiple waveforms and it features multiple pulsewidths of 0.25, 0.5 and 1.0 µs. The PRF is 1,000 to 3,000 pps and accuracy at 20 km is 10 m in range and 1 mrad angular. A 1 m² target can be detected at 21.5 n miles (40 km). The RNZN was the only customer for R-76C5, which is now out of production.

Manufacturer/Contractor

Lockheed Martin Government Systems.



Nautis consoles installed in Wellington *(F 69)* (GEC-Marconi Naval Systems)

RADARS

Set	LW 08	Type 993	Type 1006	TR 76
Company	Signaal	Plessey	Kelvin Hughes	RCA
Role	Air search	Air/surface search	Navigation	Fire control
Band	D	E/F	I	I
Beam	2.2 × csc² to 40°	2 × 35°	1 × 18°/ 0.75 × 18°	
Peak power	150 kW	500 kW	25 kW	250 kW
Gain	30 dB		31 dB/34 dB	
Pulsewidth	35/69 µs	0.7/1.5 µs	0.8 or 0.25 µs/ 0.75 µs	0.25, 0.5 and 1.0 µs
PRF	1,000/500 pps	500 pps	1,600/800 pps	1,000-3,000 pps
Scan rate	7.5/15 rpm	24 rpm	24 rpm	
Range	145 n miles (265 km) for 2 m² target	30-35 n miles	64 n miles (117 km)	21.5 n miles (40 km) for 1 m² target

SONARS

G 750 active/passive hull-mounted search sonar

The Graseby G 750 is a modernised and improved version of the Type 184M, providing accurate fire-control data from two independent automatic tracking systems whilst simultaneously maintaining all-round surveillance, independent Doppler search, and classification and continuous torpedo warning. Three separate processing and display systems are incorporated for: all-round search and tracking (PPI); Doppler; and passive search. The standard G 750 system uses a cylindrical 32-stave transducer to form a large number of beams. Range and bearing measurement is by in-beam scanning, obviating the need for separate expanded displays. Target range and bearing are measured by either a manually positioned marker technique, in which the circular markers are placed over the target echo, it being the marker position that is measured; or by echo gating, where the echo range and bearing are measured directly.

Provision is made for interfacing the G 750 sonar with computer-based ASW and tactical information systems to provide a source of range, bearing, and target Doppler data. Operational capabilities of the equipment include active detection of submarines throughout 360° and the ability to track two targets simultaneously. Similar detection coverage and tracking capabilities are available in respect of torpedo targets, with suitable outputs to torpedo warning and avoidance systems. There is also an active search capability over a 45° arc with facilities for determining target Doppler. Four 11° beams forming a 45° 'searchlight' are providing a 360° search facility capable of measuring target Doppler up to ±40 knots. The system is designed for operation in adverse reverberation conditions, with ripple or omnidirectional dual-frequency modulated and Doppler CW transmission modes. The system can be applied as an HF or LF variant. Targets can be tracked to a maximum range of 20 km.

Manufacturer/Contractor

Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

Kelvin Hughes Type 162 M

The British Kelvin Hughes Type 162 M ('Cockchafer') side-looking target detection sonar is designed to detect and classify seabed targets, such as a bottomed submarine. There are three transducers: one faces downwards at 25° below the horizontal, while the other two face sideways to cover a 3° wide and 40° vertical sector. The transmitter delivers 40 W to the central, downward-looking transducer and 80 W each to the side-looking transducers. The set operates at 50 kHz and range scales are 270 m (300 yd), 550 m (600 yd) and 1,100 m (1,200 yd)

Manufacturer/Contractor

Kelvin Hughes, Watford, UK.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 19.2 × 13.1 m (63 × 43 ft)

HELICOPTERS

The RNZN currently operates one Westland Wasp HAS Mk 1 five-seat general purpose naval helicopter from these two ships. However, it is known that a replacement is being sought, with the front runners being the Kaman SH-2 Sea Sprite and the Westland Lynx. *Wellington* and *Canterbury* are both having their hangars and flight decks enlarged to take the new helicopter.

Wasp HAS Mk 1

Specifications

Dimensions:
- **main rotor diameter:** 9.83 m (32.25 ft)
- **tail rotor diameter:** 2.29 m (7.5 ft)

Fuselage length: 9.24 m (30.33 ft)
Height to top of rotor hub: 2.72 m (8.92 ft)
Weights:
- **empty:** 1,566 kg (3,452 lb)
- **max take-off:** 2,95 kg (5,500 lb)

Performance:
- **max level speed (sea level):** 104 kts (193 km/h)
- **economic cruising speed:** 96 kts (177 km/h)
- **max range:** 263 n miles (488 km)

Power plant: 1—710 ehp (derated) Rolls-Royce/Bristol Nimbus 503 turboshaft
Avionics: PTR 170 and PV 141 UHF and UHF homing radio, and standby UHF
Weapons: 2 Mk 44 or one Mk 46 torpedoes, or two AS.12 anti-ship missiles

PROPULSION

Specifications

System: Steam turbine
Main machinery: 2 Babcock & Wilcox boilers; 38.7 kg/cm² (550 psi); 454°C (850°F); 2 White-English Electric turbines; 22.4 MW (30,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The Royal New Zealand Navy (RNZN) acquired a total of four Leanders: *Waikato* (F 55). To the original Leander design, this ship was ordered in June 1963 and arrived in New Zealand in May 1967.

Canterbury (F 148). A Broad Beam Leander, *Canterbury* was ordered in 1968 and delivered in 1971.

Wellington (F 69). A Broad Beam Leander, *Wellington* served in the RN for 13 years as *Bacchante,* and was sold to the RNZN in 1982.

Southland (F 104). The former *Dido, Southland* was one of the original production Leanders (in fact, the third to be completed). *Dido* was converted to Batch 1 (Ikara) standard and was sold to the RNZN in 1983, but was stricken and scrapped in 1995, even though its replacement, *Te Kaha,* the first of the RNZN ANZAC frigates will not enter service until 1997.

Of the three remaining ships, *Waikato* is scheduled to pay off in 1999 at the latest, having been replaced by the second ANZAC frigate. Modernisation and improvements are, therefore, being concentrated on *Canterbury* and *Wellington,* which are scheduled to remain in service beyond 2005.

MODERNISATION

Waikato was given limited refits in 1990 and again in 1994, during which the Seacat SAM system was removed, but it is unlikely that any further work will be done on a unit which is due to be stricken in two years time.

Current and future work will therefore be concentrated on *Canterbury* and *Wellington.* Numerous improvements were incorporated between 1984 and the latest refits. These included the installation of: Signaal LW 08 radar (replacing Type 965); Graseby G 750 hull-mounted sonar (in place of Type 177); ARGOSystems Phoenix AR-700 ESM (replacing UA-8/9); Telegon PST 1288 Advanced Shipborne high-frequency (HF) direction-finding (DF) system; LORAL Hycor Mk 36 SRBOC chaff launchers; and the RCA R-76C5 gunnery fire-control system (which replaced MRS 3), and Mk 32 torpedo tubes. The Nautis-F computer-aided message handling system has also been installed.

Canterbury completed a long refit at the Devonport Naval Base in Auckland, New Zealand in March 1996. The work done included removal of the Seacat SAM system and the associated Type 904 director and the installation of a Phalanx 20 mm CIWS on the hangar roof. New accommodation facilities are also being created for female crew. A five-console, full colour GEC-Marconi Nautis system is also being installed to match the system already installed in *Wellington,* and will enable a small reduction to be made in the crew numbers due to savings in operations room staff.

Other work includes a Whittaker Track Management system, IFF Mk 12, Link 11 and replacement of the HF communications system. The hangar and flight deck are also being enlarged to accommodate the new helicopter.

THE FUTURE

Canterbury and *Wellington* are scheduled to remain operational and compatible with the new 'Anzac' class frigate until 2005. Ferranti FMS 15/2 TACTASS may be fitted in due course.

Wellington *(F 69) served in the UK Royal Navy for 13 years before being purchased by New Zealand in 1983. Note the Signaal LW 08 air search radar on the mainmast, which replaced the British Type 965 in the mid-1980s* (G Toremans)

TYPE 21

OVERVIEW

The British Type 21 had its genesis in the mid-1960s when the UK Royal Navy started to look for a replacement for its Type 41 and Type 61 frigates. At the time there was strong political and industrial pressure to move away from the traditional system of in-house design and to relax the customarily stringent naval standards of design and construction. This, coupled with a promise of a cheaper project (which was never achieved), led to the adoption of the Type 21, which was designed by Vosper Thornycroft and Yarrow.

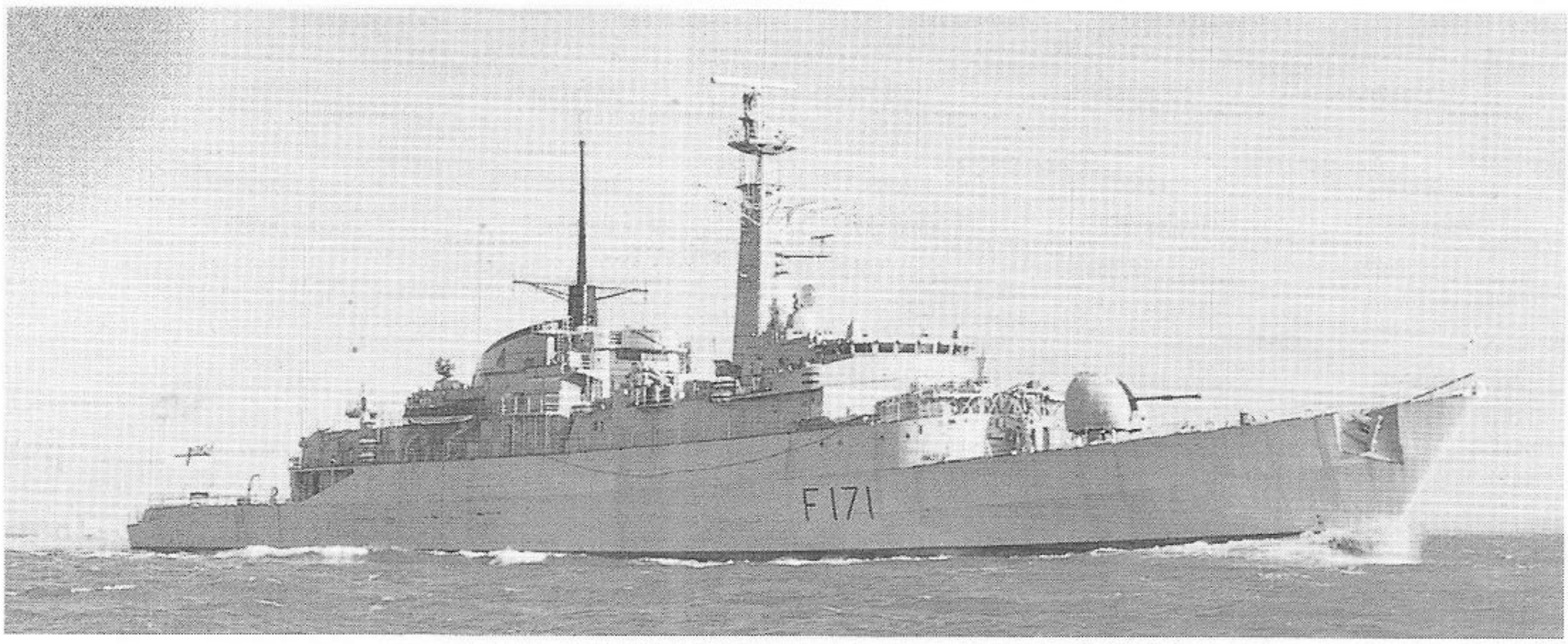
The result was one of the most attractive looking warships of its generation with a startling performance and excellent manoeuvrability, factors which concealed some very serious drawbacks. From the start, the design suffered from topweight problems, even though the entire superstructure was constructed of aluminium.

The weapons outfit was not particularly impressive, and reflected little advance on a 'Broad Beam Leander'. There was a 114 mm gun on the foredeck, a Seacat short-range missile system and a Wasp helicopter. The third and later ships added four Exocet launchers, which were retrofitted to the first two (but not until 1985), while only two ships, *Active* and *Alacrity,* were ever fitted with STWS-1 torpedo systems.

A considerable amount of ballast had to be shipped but the stability problem persisted. A proposal to replace Seacat by Seawolf was cancelled for that reason, as was a mid-life refit, scheduled for 1980.

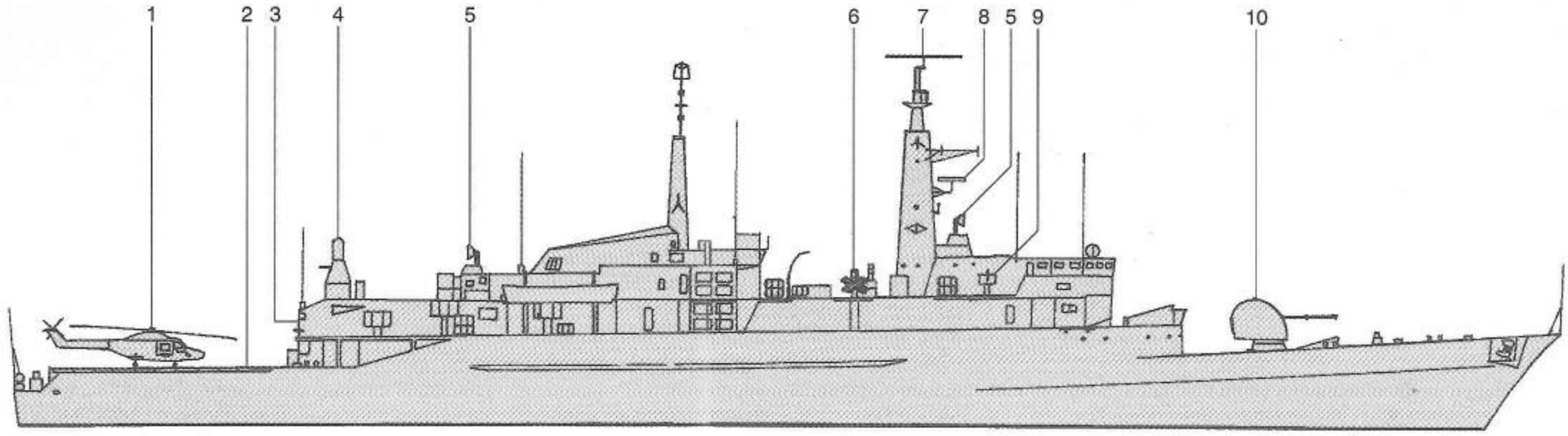
Six of the eight Type 21s participated in the Falklands (Malvinas) war in 1982, where two were lost through enemy action. In addition *Arrow* suffered structural damage and several others developed cracks in the upper deck, and the surviving six ships were fitted with strengthening plates from 1983 onwards.

The six survivors were given a further, but limited, refit in the late 1980s, most of the work involving modifications to the hull to reduce noise and vibration. With the end of the Cold War, however, the British were presented with the opportunity to sell off these ships and they were sold en bloc to Pakistan.



Amazon *(F 171) lead ship of the class was built by Vosper Thornycroft and entered service in 1967. It was transferred to Pakistan in 1993 and is now* Tariq *(D 181)*
(Vosper Thornycroft)

TARIQ (TYPE 21)



Tariq (Ian Sturton)
1 *Westland Lynx HAS Mk 3* **2** *Flight deck* **3** *Hangar* **4** *Hughes Mk 15 20 mm Phalanx CIWS* **5** *Selenia Type 912 fire control* **6** *Vickers Corvus chaff launcher* **7** *GEC-Marconi Type 992R air/surface search radar* **8** *Kelvin-Hughes Type 1006 navigation radar* **9** *Oerlikon 20 mm Mk 7A* **10** *Vickers 114 mm (4.5 in)/55 Mk 8 gun*

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: Pakistan
Type: Type 21

Class: TARIQ

Bought: 6
Active: 6

Displacement:
standard: 3,100 t
full load: 3,700 t

Dimensions
Length: 117 m (384 ft) (oa): 109.7 m (360 ft) (wl)
Beam: 12.7 m (41.7 ft)
Draught: 5.9 m (19.5 ft) (screws)

Speed: 30 kts (Olympus); 18 kts (Tynes)
Range: 4,000 n miles at 17 kts; 1,200 n miles at 30 kts

Complement: 175 (13 officers) (accommodation for 192)

SHIPS

TARIQ (D 181)

Builder	Yarrow (Shipbuilders), Glasgow, UK
Laid down	1 Sep 1971
Launched	18 Jan 1973
Commissioned (RN)	5 Sep 1975 (*Ambuscade*) (F 172))
Recommissioned (Pakistan)	28 Jul 1993

BABUR (D 182)

Builder	Vosper Thornycroft, Woolston, Hampshire, UK
Laid down	6 Nov 1969
Launched	26 Apr 1971
Commissioned (RN)	11 May 1974 (*Amazon*) (F 169))
Recommissioned (Pakistan)	30 Sep 1993

KHAIBAR (D 183)

Builder	Yarrow (Shipbuilders), Glasgow, UK
Laid down	28 Sep 1972
Launched	5 Feb 1974
Commissioned (RN)	29 Jul 1976 (*Arrow*) (F 173))
Recommissioned (Pakistan)	1 Mar 1994

BADR (D 184)

Builder	Yarrow (Shipbuilders), Glasgow, UK
Laid down	5 Mar 1973
Launched	18 Sep 1974
Commissioned (RN)	2 Jul 1977 (*Alacrity*) (F 174))
Recommissioned (Pakistan)	1 Mar 1994

TIPPU SULTAN (D 185)

Builder	Yarrow (Shipbuilders), Glasgow, UK
Laid down	30 Oct 1974
Launched	20 Nov 1975
Commissioned (RN)	19 Jul 1978 (*Avenger*) (F 185))
Recommissioned (Pakistan)	23 Sep 1994

SHAHJAHAN (D 186)

Builder	Vosper Thornycroft, Woolston, Hampshire, UK
Laid down	23 Jul 1971
Launched	23 Nov 1972
Commissioned (RN)	17 Jun 1977 (*Active*) (F 171))
Recommissioned (Pakistan)	23 Sep 1994

WEAPONS SYSTEMS

TUBES

STWS Mk 2 anti-submarine torpedo launching system

***Badr* (D 184) and *Shahjahan* (D186) only.** The British STWS Mk 2 (Shipborne Torpedo Weapon System) was fitted to all ships in the class while they were in British service, but were removed before transfer, except in these two ships. STWS Mk 2 consists of two triple tube launchers, a launch control and presetter unit which are linked to the launchers through local control panels. The launchers are manually trained to an angle of 45° using a training handle installed between the two lower tubes. They are then remotely operated. The tubes themselves are made of glass fibre-reinforced epoxide resin and mounted in a triangular configuration. STWS Mk 2 is designed to operate with the Mk 46 and the Sting Ray lightweight torpedoes. It has electrically operated muzzle doors while the presetter/launch controller features Motorola 30800 microprocessors. It also features a strengthened mounting, better access to the tubes and improvements in the diagnostic and heater systems.

Specifications

Length: 3.65 m (12 ft)
Height: 1.4 m (4.6 ft)
Width: 1.23 m (4.0 ft)
Weight: 1,560 kg (3,440 lb) (unloaded)

Manufacturer/Contractor

GEC-Marconi Underwater Systems Ltd.

TORPEDOES

No torpedoes accompanied the ships on transfer, but it is possible that the US Mk 46 already deployed in the 'Alamgir' (Gearing) class could be used.

GUNS

Vickers 114 mm (4.5 in)/55 Mk 8 multipurpose gun

The 'Tariq' class mounts a single 114 mm (4.5 in)/55 calibre Mk 8 gun in 'A' position. This weapon provides quick reaction short-range air defence, engages surface targets including fast attack craft, and provides gunfire support to ground forces. The weapon system consists of the gun mounting, the ammunition feed system, the remote power control system, and the captain-of-turret panel.

The barrel is 6.22 m (20.4 ft) long, is fitted with a muzzle brake and fume extractor, and has a life of 3,300 rounds EFC. The mounting is completely enclosed in a glass fibre shield which protects it against the environment, blast and shrapnel. The loading system is hydraulically operated, with an autoloader which is manually fed by two loaders and has a capacity of six rounds. The hoist transfers them in two stages to the

turret from where they are raised by a pivoting loading arm to the breech where they are inserted by a power rammer. After the shell is fired the case is extracted automatically and ejected through a chute in the front of the mounting.

Specifications
Calibre: 114 mm
Length of barrel: 55 calibres
Traverse: 340° at 40°/s
Elevation: −10 to +55° at 40°/s
Muzzle velocity: 868.7 m/s (2,850 ft/s)
Weight of projectile: 21 kg (46.3 lb)
Rate of fire: 25 rds/min
Range:
anti-surface: 11.9 n miles (22 km)
anti-air: 6,000 m (20,000 ft)
Crew: 4 (gun captain (CIC), loading supervisor, 2 loaders)

Manufacturer/Contractor
Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

Hughes Mk 15 CIWS Phalanx
A single Hughes Mk 15 CIWS Phalanx close in weapons system (CIWS) is mounted on the roof of the hangar aft to provide the innermost layer of defence against anti-ship missiles. The 20 mm M61A1, six-barrel, Gatling-principle gun has a cylindrical magazine with the feed mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA (system).

Oerlikon 20 mm cannon
Two or four single, manually operated Oerlikon 20 mm cannon are fitted.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +90°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Thomson-CSF DR 3000S ESM receiver
The DR 3000S tactical ESM receiver has been installed since the transfer to Pakistan, having replaced the MEL UAA-1 Abbey Hill. DR 3000S (S. = surface ship) conducts threat detection, direction-finding, identification and target designation of enemy radars over the C to J frequency bands. It monitors the tactical situation in a given area, and performs intelligence (ELINT) functions. The system has a high sensitivity range with a detection capability of nearly 100 per cent, while direction finding accuracy is of the order of 6°. Highly automated operation includes the use of artificial intelligence and allows for very short reaction times.

DR 3000S is available in two configurations; a single 40 kg (88.2 lb) masthead-mounted antenna or a two-unit hexagonal aerial, with six DF antennas. DR 3000S can be fitted with a high-precision DF option, using interferometers.

Specifications
Frequency: C to J-bands
Azimuth coverage: 360°
Elevation coverage: −10 to +45°
Sensitivity: −68 dBm
Dynamic range: Up to 60 dB
Radar modes: 4,000 in library

Manufacturer/Contractor
Thomson-CSF, Radars and Countermeasures Division, Elancourt, France.

DECOYS

Graseby Type 182 towed torpedo decoy equipment
The Type 182 was transferred with the ships. This is designed to decoy both active and passive homing torpedoes, using signals electronically generated within the ship and fed, via the towing cable, to electroacoustic transducers within the towed body. The Type 182 produces two independently controllable output signals which are radiated simultaneously from the towed decoy. An amplitude modulated noise signal simulates the ship's propeller noise and causes passive homing torpedoes to be seduced away from the ship towards the towed decoy. The second signal is a swept CW signal, which simulates sonar echoes in order to confuse or jam the guidance system of active homing torpedoes, thus causing them to miss the ship. The frequency bands covered by both types of output are switchable to meet tactical scenarios and to enable concurrent operation of other sonar and communication equipments.

Specifications
Towed decoy:
diameter: 533 mm (21 in)
length: 2,005 mm (79 in)
weight: 74 kg (163 lb)
Towing cable:
length: 411 m (1,348 ft)
diameter: 14.48 mm
weight: 269 kg (593 lb)

Manufacturer/Contractor
Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

Corvus chaff decoy launching system
There are two Corvus fixed launchers. Corvus is a simple, lightweight, quick reaction system for the self-defence of surface vessels against surface-to-surface and air-to-surface missiles. Window (chaff) dispensing rockets are fired to form a radar decoy screen around the vessel. Two modes of operation are available for the system. The two modes — distraction decoy and centroid decoy — differ in the azimuth angle at firing and the range at which window is released. A cylindrical rotating structure carries eight launching tubes mounted in two sets of three, one above the other, and crossed at 90° in azimuth with two further tubes set above, and aligned midway between the other tubes, all at a fixed elevation of 30°. A deck-mounted pedestal supports the rotating structure on its training bearing and also houses a self-contained electrical power conversion unit for the control circuits and the associated electrical equipment.

Specifications
Training
Bearing arc (normal) that is, launcher axis: 60-120°
Bearing arc (max) that is, tube axis: 15-165°
Launcher weight: 585 kg (1,290 lb)
Off-launcher equipment weight: 42 kg (93 lb)
Tube diameter: 195 mm (7.7 in)
Tube length: 1.6 m (5.24 ft)
Weight (empty): 25 kg (55 lb)
No of guides: 4, RH spiral

Manufacturer/Contractor
Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

Alacrity *(F 174) while in UK Royal Navy service. The British set great value on the high speed, rapid acceleration and good manoeuvrability* (Yarrow)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

CAAIS (Outfit DBA) action data automation

The Type 21s were transferred with their CAAIS (Computer Assisted Action Information System) systems still in place. CAAIS was known in the UK Royal Navy as Outfit DBA and was developed in the early 1960s, the first production system, DBA (2), entering service with HMS *Amazon* in 1974. CAAIS is a tactical picture compilation system, providing automatic tracking of air and surface targets, processing sonar and EW inputs, operating a digital datalink, designating targets, and providing torpedo control and vectored attack orders for ASW helicopters. Outfit DBA (3) is a mainframe system using the Ferranti FM1600B computer and Decca displays. The hardware includes a three-cabinet digital suite housing a 24-bit computer, operating at 200 Kips and with a 780 k memory, as well as a datalink terminal. In addition there are peripheral control units which include radar extraction units, encoder/decoders, display drive unit and the MMI control units. The last two elements support the display system which includes up to six CA 1600 horizontal displays. The programming language is Coral 66.

WEAPONS CONTROL

Ferranti WSA 4 fire-control/command and weapon control system

WSA 4 (Weapon System Automation Mk 4) fire-control system has a mainframe architecture based upon a single FM1600B computer and two Alenia (now Alenia) RTN-10X tracker radars with targets designated through the CAAIS. Two targets may be engaged simultaneously with the trackers. The system includes a control console with four operators. The console includes target acquisition units, one for each tracker radar each with a PPI display and an A/R scope. These two units have an MMI which includes flowline lamps and push buttons. The centre section houses the weapon control units.

The RTN-10X radar, designated Type 912 by the Royal Navy, is an I-band conical scan radar with a maximum range of 20 km. It features a slatted parabolic reflector and feed with integral trunnion box, the antenna coverage being −30 to +90°. The antenna includes a GEC-Marconi closed-circuit television camera. It has a 200 kW peak-power, frequency changeable, high-power magnetron transmitter.

The WSA 4 also includes the Vickers Lookout and Aiming Sight Mk 1 (also known as the Sight, Stabilised, Visual Data Transmitting (SSVDT) and the Target Designation Sight or TDS). It was designed to support the Vickers 4.5 in Mk 8 gun and the Shorts Seacat air defence missile (now removed). The weapon control units are for the gun and the missile, the latter including a closed-circuit television screen and an MMI which includes a joystick and flowline control unit.

RADARS

Set	Type 992R	Type 1006	Type 912 (RTN-10X)
Company	GEC-Marconi	Kelvin Hughes	Selenia
Role	Short-range, air target designator	Navigation	Fire control
Band	I	I	I/J
Range	air target: 90 n miles (165 km)	64 n miles	22 n miles (40 km)
Beam	1.25 × 15°	1 × 18°/0.75 × 18°	—
Peak power	2 MW	25 kW	200 kW
Gain	30 dB	31 dB/34 dB	—
Pulsewidth	2.0 µs	0.8 or 0.25 µs/0.75 µs	1.5 µs
PRF	750 pps	1,600/800 pps	450-550 pps
Scan rate	—	24 rpm	—

The gun section includes two electronic data displays for data in graphical and alphanumeric form. These displays show the role, bearing and angle of sight of the trackers, target locations, course and speeds. The tracker roles, gun control, shell and fuze types and firing parameters are selected by means of a light pen.

Manufacturer/Contractor

Ferranti International Plc, Defence Systems Integration, UK.

SONARS

Type 184P active/passive hull-mounted search sonar

Type 184P was a UK Royal Navy in-service upgrade to the Type 184M. Type 184P is a 360° scanning sonar, incorporating both active and passive modes of operation, which provides range, bearing and target Doppler data to the fire-control computer. The equipment provides a dual-frequency transmission and three receiver systems. The latter comprise: an all-round search and tracking PPI system with, in the Type 184P, 16 receiving channels, which gives greater bearing accuracy.

The upgrading also involved inserting 31 digital filters in each of the four beam channels, enabling the system to measure Doppler speeds of up to ±40 knots.

There is also a continuous torpedo warning system with its own display. A circular 32-stave transducer array is employed. The keel-mounted, retractable dome is 3.99 m (13.1 ft) long, 1.62 m (5.3 ft) wide and 1.55 m (5.1 ft) deep. Operating frequencies are 6 kHz, 7.5 kHz and 9 kHz.

Manufacturer/Contractor

Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

Type 162M sonar

Sonar Type 162M detects and classifies both mid-water and seabed targets, displaying port and starboard recordings simultaneously on a single straight-line recorder, which has a maximum range scale of 1,096 m (1,200 yd). Operation is simplified by entirely automatic gain control. The three strip transducers are all similar and employ 49.8 kHz barium titanate elements. Their beam pattern is fan-shaped, about 3° wide and 40° vertical angle; the side-looking elements have their axes 25° below the horizontal. A loudspeaker and a socket for headphones enable signals to be monitored aurally, if required; for example, to give warning of an approaching torpedo. The three range scales are 0-274 m, 0-548, 0-1,096 m (0 to 300, 0 to 600 and 0 to 1,200 yds), and accuracy is better than two per cent assuming a sound velocity of 1,500 m/s (4,920 ft/s).

Manufacturer/Contractor

AB Precision (Poole) Limited, Poole, Dorset, UK.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 19 × 12 m (62 × 40 ft)

Helicopters: The Pakistani Navy has purchased three Westland Lynx HAS Mk 3 ASW helicopters for use from these ships and has an option on three more.

HELICOPTERS

1 Westland Lynx HAS Mk 3

Specifications

Dimensions:
- **main rotor diameter:** 12.80 m (42.00 ft)
- **tail rotor diameter:** 2.21 m (7.25 ft)

Weights:
- **empty:** 2,740 kg (6,040 lb)
- **empty, equipped (ASW):** 3,343 kg (7,370 lb)

Performance:
- **cruising speed:** 120 kts
- **speed for max endurance:** 70 kts (130 km/h)
- **max rate of climb:** 661 m (2,170 ft)/min
- **time on station (ASW) 50 n miles (93 km) radius:** 2 h
- **max range:** 320 n miles (593 km)
- **max endurance:** 2 h 50 min

Power plant: 2 Rolls-Royce Gem 41-1 with max contingency rating of 835 kW (1,120 shp)

Crew: 2 (pilot and co-pilot/observer)

Radar: GEC-Marconi ARI5979 Seaspray Mk 3 lightweight search and tracking radar

Mission: CAE Electronics AN/ASQ-504(V) internal MAD

EW: Orange Crop ESM

ASW role: 2 A244/S 46 torpedoes

Anti-ship: 2 — 12.7 mm machine guns

PROPULSION

Specifications

System: Combined gas turbine or gas turbine (COGOG)

Main machinery: 2 Rolls-Royce Olympus TM3B gas turbines; 37.3 MW (50,000 hp) sustained; 2 Rolls-Royce Tyne RM1C gas turbines (cruising); 7.4 MW (9,900 hp) sustained

Shafts: 2

Propellers: cp

FURTHER INFORMATION

PROGRAMME

These six ships were acquired from the UK in 1993/94, *Tariq* (D 181) arriving in Karachi on 1 November 1993 and the last pair in January 1995. These ships replaced the five US Navy 'Garcia' and 'Brooke' class frigates, three 'Gearing' class destroyers and a 'Country' class destroyer. To replace such a miscellany of ships by one class of six, all built and equipped to a common standard, must have greatly eased the Pakistani Navy's logistical problems. Although classified as frigates while in British service they have been reclassified as destroyers by the Pakistan Navy and given 'D' pennant numbers.

MODERNISATION

Despite the well-known topweight problems, numerous changes have taken place in these ships and even more are scheduled. The projected changes include:

- Installing Harpoon missiles, which would be taken from the 'Alamgir' (Gearing) class destroyers. (These are to be installed in the gap abaft the foremast and not before the bridge in the place previously occupied by the Exocet launchers.)
- Remove the present Second World War-vintage Bofors 40 mm and replace by two GCM-AO3 (twin) 30 mm and two GAM-BO1 20 mm
- Remove Type 992R air search radar and install Signaal DA 08 in its place.
- Remove present STWS-2 in *Badr* (D 184) and *Shahjehan* (D 186) and fit all six ships with Bofors Type Tp45 single or quad launchers for Swedish torpedoes.
- Remove CAAIS and replace with CelsiusTech 9LV Mk 3 including Link Y.
- Fit Mk 36 SRBOC launchers
- Fit CSEE Najir Mk 2 or Sea Archer electro-optic director
- Fit Thomson Sintra ATAS
- Update hull-mounted sonar

The start date for this programme has yet to be announced. In addition, the availability of funds may not only limit the programme overall, but may also result in not all ships receiving identical refits.

Tippu Sultan *(D 185) under the Pakistani flag* (Jane's/H M Steele)

TYPE 22

OVERVIEW

Type 22 Batch 1. First of class Broadsword *(F 88) on builder's trials in 1978. Note four Exocet anti-ship missiles on the foredeck, Seawolf launcher before the bridge and Type 967 radar atop the foremast* (Yarrow)

The British had scored a major success with the effective and popular 'Leander' class, 16 of which entered service between 1963 and 1967, and the ten 'Broad Beam Leanders' which followed in 1969 to 1973. A Future Fleet Working Party concluded in 1966 that over the next two decades the RN would need three types of ship: an air-capable cruiser; an area air-defence ship; and a general purpose frigate. These became the 'Invincible' class, the Type 42 destroyer and the Type 22 frigate, respectively. In developing the latter it appeared that collaboration with the Dutch would be possible, but this failed to materialise, allegedly because the Dutch did not like Seawolf, while the British were unhappy about the Dutch suggestion that the hull length be constrained to 112 m (367 ft) to enable it to fit into the dry dock at Den Helder.

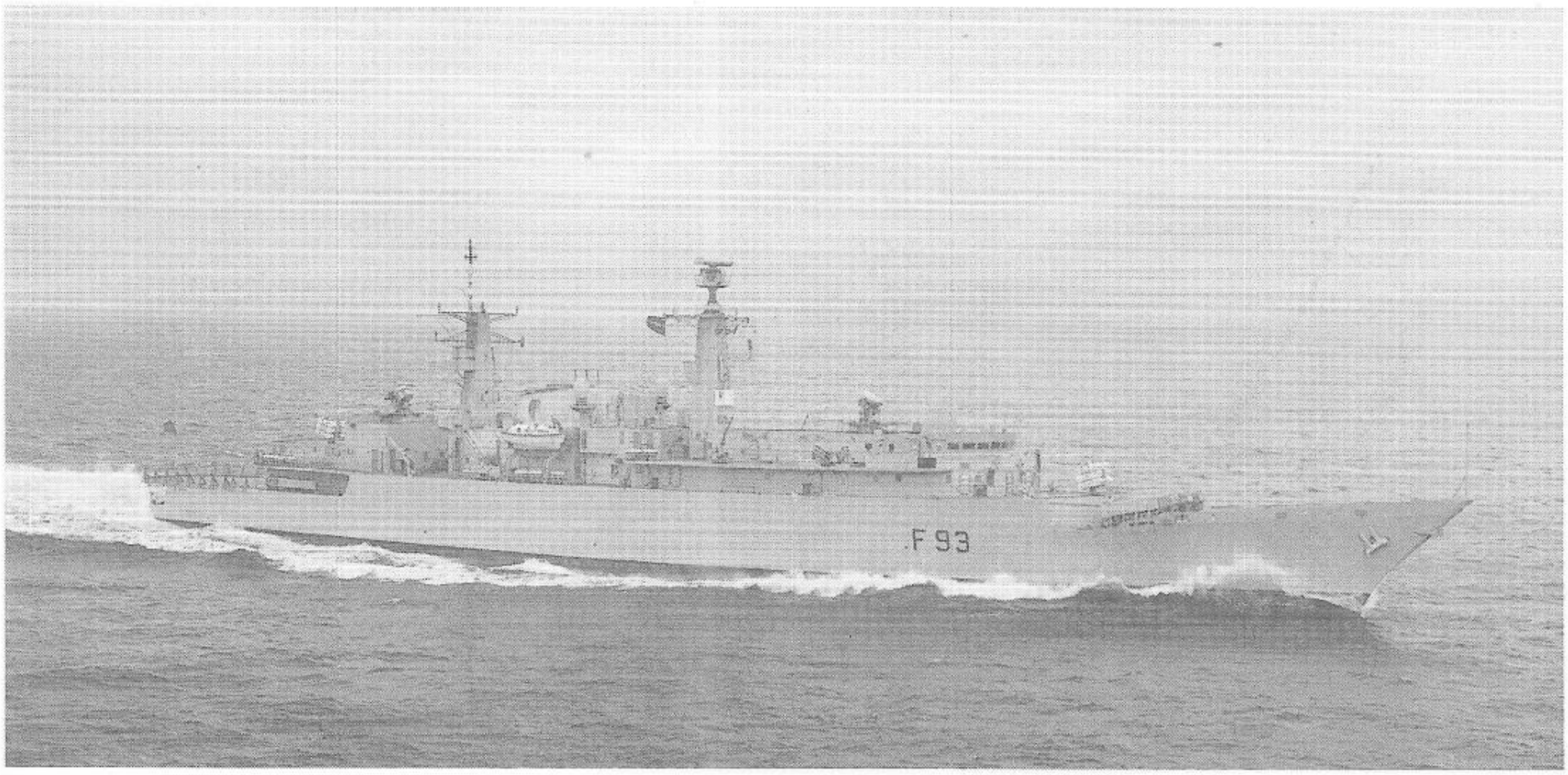
DESIGN

The hull is divided into four deck levels and is constructed of all-welded mild steel. The superstructure is also of steel, although a certain amount of aluminium is used, the reductions in topweight in those pre-Falklands (Malvinas) War days being considered to offset the known problems of spalling and fire damage. There is considerable freeboard and a substantial bulwark.

The four machinery rooms are laid out in tandem and positioned as far aft as possible to reduce shaft length, but balanced with the need for easy access for maintenance and equipment replacement. The propulsion system is as nearly as possible the same as that used in the Type 21 frigate and Type 42 destroyer, with the two Rolls-Royce Spey boost engines in the forward room and the two Rolls-Royce Tynes, plus the synchro self-shifting clutches and double-reduction gearboxes, in the after room. As built, the ships were powered by Rolls-Royce Spey SM1A boost engines, but the more powerful SM1C was installed and trialled in F 94 in early 1990 and will be installed in the remaining British ships in due course.

There are also two auxiliary machinery spaces, each containing a switchboard and two GEC generators each driven by a Paxman Ventura diesel.

The weapons fit of the Batch 1 ships comprised four MM 38 Exocet; two six-tube Seawolf SAM launchers and two 40 mm Bofors; two triple STWS-1 torpedo



Type 22 Batch 2. The first two ships of Batch II were 15 m (49 ft) longer than Batch I, with a long, almost clipper bow and a long deckhouse between the bridge and the mast reported to contain an EW installation (Yarrow)

Type 22 Batch 2. Coventry (F 98) was built as a replacement for a ship of the same name lost in the Falklands (Malvinas) war. The last four Batch II ships were 2.1 m (6.89 ft) longer than the first two. Note also the extended flight deck

launchers; and two Lynx ASW helicopters, armed with either Sting Ray torpedoes or Sea Skua anti-ship missiles.

Batch 2

The initial plan was to build some 12 Type 22s but it was soon decided that a greater length was needed in order to accommodate the Type 2031Z towed array and to provide for a larger operations room and Action Information Organisation (AIO). This resulted in the Batch 2 design and it was intended to build some 22 of this type.

Batch 3

The Falklands (Malvinas) War then intervened and once the war was over it was decided to restrict Batch 2 to six units and then to build a further four, based on the Batch 2 hull and propulsion, but with elements of the design recast in the light of the lessons of the South Atlantic conflict. This final group was designated Type 22 Batch 3.

MODERNISATION

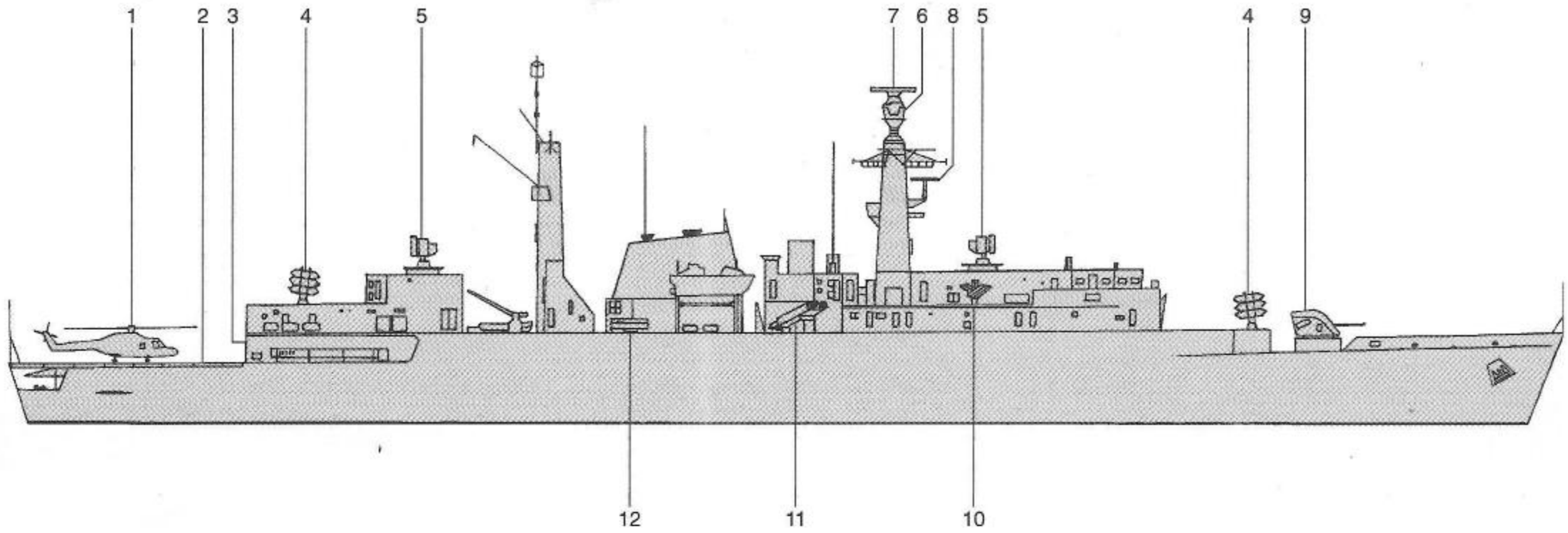
Seawolf GWS.25 is being progressively upgraded to Mod 4 standard, while Type 2016 sonar is being replaced by the Type 2050. In addition, the Bofors 40 mm/60 installed in Batch 2 have been replaced by Oerlikon 30 mm guns. The EW fit is also being updated and NATO Sea Gnat is now the standard launcher for a variety of distraction and seduction decoys.

SALES

All four Batch 1 ships have been sold to Brazil. *Broadsword* was taken over in May 1995, *Brilliant* and *Brazen* in August 1996 and *Battleaxe* in April 1997.

Type 22 Batch 3. Cumberland (F 85) Batch 3 ships are the same as the last four Batch 2 ships, but have a 114 mm gun in place of the Exocets on the foredeck and eight Harpoons (not installed in this shot) in the break in the deckhouse abaft the bridge (Yarrow)

'GREENHALGH' (TYPE 22 BATCH 1)



Greenhalgh (Ian Sturton)
1 *Westland SAH-11 Super Luynx* **2** *Flight deck* **3** *Hangar* **4** *BAe six-tube Seawolf GWS 25 Mod 4 launcher* **5** *GEC-Marconi Type 911 fire control (for SAM)* **6** *Outfit UAA-2 radar intercept* **6** *GEC-Marconi Type 967 air/surface search radar* **8** *Kelvin Hughes Type 1006 navigation radar* **9** *Bofors SAK 57 57 mm/70 Mk 2 gun* **10** *Sea Gnat IR/chaff launcher* **11** *Aerospatiale MM 40 Exocet twin launcher* **12** *Plessey STWS Mk 2 324 mm torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: Brazil
Type: Type 22 Batch 1

Class: GREENHALGH

Purchased: 4
Active: 4

Displacement:
standard: 3,556 t
full load: 4,000 t

Dimensions:
Length: 131.2 m (430.0 ft)(oa); 125 m (410 ft)(wl)
Beam: 14.8 m (48.4 ft)
Draught: 6 m (19.9 ft) (screws)

Speed: 30 kts; 18 kts on Tynes
Range: 4,500 n miles at 18 kts on Tynes

Complement: 273 (30 officers)

SHIPS

GREENHALGH (D 31)
Builder Yarrow Shipbuilders, Clydebank, UK
Laid down 7 Feb 1975
Launched 12 May 1976
Commissioned (RN) 3 May 1979 (*Broadsword* (F 88))
Commissioned (Brazil) 30 Jun 1995

DODSWORTH (D 32)
Builder Yarrow Shipbuilders, Clydebank, UK
Laid down 25 Mar 1977
Launched 15 Dec 1978
Commissioned 15 May 1981 (*Brilliant* (F 90))
Commissioned (Brazil) 31 Aug 1996

BOSISIO (D 33)
Builder Yarrow Shipbuilders, Clydebank, UK
Laid down 18 Aug 1978
Launched 4 Mar 1980
Commissioned 2 Jul 1982 (*Brazen* (F 91))
Commissioned (Brazil) 31 Aug 1996

RADEMAKER (D 34)
Builder Yarrow Shipbuilders, Clydebank, UK
Laid down 4 Feb 1976
Launched 18 May 1977
Commissioned (RN) 28 Mar 1980 (*Battleaxe* (F 89))
Commissioned (Brazil) 30 Apr 1997

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 40 anti-ship missiles

As built for the RN and as sold to Brazil, these four ships had four MM 38 Exocet launchers mounted on the foredeck. Since transfer, however, these weapons have been removed and new MM 40 launcher-containers mounted in the waist, where they displaced the single 20 mm gun mounts. In their new position they face outwards at an angle of about 60° to the centreline and at +12° to the horizontal.

There are two versions of MM 40, designated Blocks 1 and 2. Block 2 missiles feature a new J-band (10-20 GHz) seeker with improved ECCM performance, associated electronics and a new guidance computer, although no further details are currently available. The new electronics permit the missile to optimise its sea-skimming height, allowing it to operate in conditions to Sea State 7 even in severe ECM conditions. The fire-control system has also been adapted with the development of the Cat-Visac console which can operate with two types of the Exocet missile simultaneously. The new fire-control system allows improved target selectivity, attacks upon multiple targets by diverging and converging salvos.

Targets for the missiles are acquired by the ship's sensors, and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence which can take up to 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change in the course of its flight. Once the missile has cleared the launcher-container, the sustainer carries it into the cruise phase and it then travels towards the general location of the target at a height of about 100 m (330 ft) which is low enough to reduce the chance of detection but adequate for target acquisition. Once the target is detected, the missile descends to 9-15 m (30 - 50 ft) in the approach phase before descending to 8 m (26.2 ft) (2-5 m (6.5-16.4 ft) in a calm sea) for a sea-skimming terminal phase. A salvo may be fired in 12-20 seconds.

Specifications

MM 40 Block 1
Length: 5.78 m (19.0 ft)
Diameter: 35 cm (14 in)
Wing span: 1.13 m (3.7 ft)
Weight: 855 kg (1,885 lb)
Speed: Mach 0.9
Range: 2-38 n miles (4-70 km)
Warhead: 165 kg (363.8 lb) HE frag
Fuze: Delay impact/proximity
Guidance: Inertial and active radar

MM 40 Block 2
Length: 5.80 m (19.02 ft)
Diameter: 35 cm (14 in)
Wing span: 1.13 m (3.7 ft)
Weight: 870 kg (1,918 lb)
Speed: Mach 0.9
Range: 2-40.5 n miles (4-75 km)
Warhead: 155 kg (342 lb) HE frag
Fuze: Impact/proximity
Guidance: Inertial and active radar

Manufacturers/Contractors

Aerospatiale Missiles, Paris Cedex, France (prime).
Luchaire Défense, Versailles Cedex, France (warhead).

Seawolf GWS.25 Mod 4

There are two GWS.25 Mod 4 Seawolf systems, with the six-tube launchers mounted before the bridge and on the hangar roof.

GWS.25 Mod 4 consists of an air search radar, two trackers, a missile, 32-round magazine, six-tube launcher and a command subsystem. The air search radar is the GEC-Marconi Type 967 D-band system whose waveguide antenna is mounted back to back with that of the Type 968 surface search antenna. The rounds are lifted by hydraulic hoist to ready-use magazines near the launcher and are then moved manually

on a trolley to the launcher and placed on the launcher rails. The launch tubes, three either side of the pedestal, have clam-shell front and rear shutters, which open automatically for firing.

The GEC-Marconi Type 911 tracker has unspecified improvements over the set used in the Mod 3 system, but it is a dual-frequency radar with two antennas: one for I-band transmission, the other for millimetric-wave (L/M-bands) transmission. The I-band element is used for long-range tracking and high-angle engagements. Its signal processing includes fast Fourier transform techniques to ensure effective operation in severe clutter. It is designed to provide accurate tracking at close range and at low levels. This facility is assisted by separate illumination of the upper and lower parts of the antenna. The computer is the FM1600E. The tracker is normally dedicated to a launcher and uses time-division multiplexing to control two missiles and to track both target and missile. The tracking loop also incorporates electronic angle tracking to minimise antenna movement when correcting missile line of sight guidance for small angles.

The command subsystem associated with each tracker includes a command transmitter, a Ferranti data handling system based upon the Ferranti FM1600E, a guiding shaping unit and operator consoles. The process is completely automatic, but with manual override, and it is able to analyse sensor data, to establish a track, to conduct threat analysis then allocate target priorities. Targets are detected by the air search radar and assigned through the ship's command system to the Seawolf command subsystem. There the threat is evaluated and the target is assigned to a tracker-launcher combination. Both slew towards the target, the tracker searches in elevation until it acquires and locks on to the target to establish a radar line of sight. When the target is within range, one missile is automatically launched, although frequently a second will follow it moments later. After launch the missile is acquired by the wide-angle antenna and gathered into the target line of sight. Its position relative to the centre of the tracking beam is monitored by the radar, and the ship-borne guidance computer generates the necessary steering commands to keep the missile in the centre of the beam until it intercepts the target. The missile's rearward-facing antennas help to provide a good ECCM capability. The television camera is used for low-level tracking with flares showing the missile's location.

Specifications
GWS.25 Mod 4
Length: 2 m (6.56 ft)
Diameter: 18 cm (7.0 in)
Wing span: 70 cm (27.5 in)
Weight: 82 kg (180 lb)
Speed: Mach 2+
Range: 2.7 n miles (5 km)
Guidance: CLOS
Warhead: Royal Ordnance 14 kg (30.87 lb) fragmentation high-explosive warhead with Thorn EMI impact-proximity fuze.

Manufacturer/Contractor
British Aerospace, London, UK.

TORPEDOES

STWS Mk 2 anti-submarine torpedo launching system
These ships are fitted with two sets of triple 324 mm Plessey STWS Mk 2 (Shipborne Torpedo Weapon System) torpedo tubes which are mounted abreast the stack. Each group consists of a triple-tube launcher, a launch control, and a presetter unit, which are linked to the launchers through local control panels. On the possibility of action the launchers are manually trained to an angle of 45° using a training handle installed between the two lower tubes, but thereafter they are remotely operated. The tubes themselves are made of glass fibre-reinforced epoxide resin and mounted in a triangular configuration. STWS 2 is designed to operate with the Mk 46 and the Sting Ray lightweight torpedoes. It has electrically operated muzzle doors while the presetter/launch controller features Motorola 30800 microprocessors. It also features a strengthened mounting, better access to the tubes and improvements in the diagnostic and heater systems.

Specifications
Length: 3.65 m (12 ft)
Height: 1.4 m (4.6 ft)
Width: 1.23 m (4.0 ft)
Weight: 1,560 kg (3,440 lb) (unloaded)

Manufacturer/Contractor
GEC-Marconi Underwater Systems Ltd, Waterlooville, Hampshire, UK.

Sting Ray lightweight anti-submarine weapon
Sting Ray lightweight ASW torpedo can be used in deep or shallow waters, using its multiband, multibeam sonar. The narrowband capability gives good Doppler discrimination against slow or quiet targets, while the broadband capability provides target discrimination, range and bearing resolution. The acoustic beam sweeps the whole volume of the water from the surface to the maximum operating depth. The computer can be reprogrammed 'through the skin' whenever updated software is required, with the programs adapting themselves to the tactical and environmental conditions in which the torpedo operates. The computer also controls the signals, beam form, speed and trajectory of the weapon.

Power is provided by a Chloride seawater-activated magnesium-silver chloride battery. The reaction is controlled by recirculating hot, part-spent seawater using a pump while simultaneously controlling the amount of cold seawater reaching the battery. Power is produced 1.5 seconds after the weapon enters the water. The propulsion system uses a Lucas DC electric motor driving two contrarotating propulsors housed in a duct to form the pump-jet. The control surfaces are actuated by an electrohydraulically driven proportional control system developed by BAe Dynamics Group.

On entering the water the torpedo sets up a programmed search pattern designed to maximise the chances of target detection. On acquiring the target, the computer and active sonar sensors make it almost impossible for the target to evade attack. The software of the guidance/homing system enables it to filter out background noise and decoys, and to intercept the target rather than perform a conventional tailchase attack. Maximum speed is about 45 knots with an estimated endurance of some eight minutes at that speed.

Specifications
Length: 2.59 m (8.5 ft)
Diameter: 324 mm (12.75 in)
Weight: 267 kg (589 lb) (in air)
Warhead: 35 kg (77 lb)
Speed: 45 kts (estimated)
Range: 6 n miles (11 km) (estimated)
Endurance: Approximately 8 minutes
Depth: 750 m (2,500 ft)

Manufacturer/Contractor
GEC-Marconi Underwater Weapons Systems Ltd.

GUNS

Bofors SAK 57 L/70 Mk 2
Since arriving in Brazil the four Exocet MM 38 launcher-containers have been removed from the foredeck and replaced by a single Bofors SAK 57 mm/70 Mk 2 mount. This weapon is intended to engage air and surface targets, and to provide gunfire in support of troops ashore. It is housed inside a 'stealthy' shield.

Specifications
Calibre: 57 mm (2.24 in)
Length of barrel: 70 calibres
Traverse: 360° at 55°/s
Elevation: −10 to +77° at 40°/s
Crew: 3
Range: 9 n miles (17 km)
Rate of fire: 220 rds/min
Projectile weight: 2.4 kg (5.3 lb)

ELECTRONIC WARFARE SYSTEMS

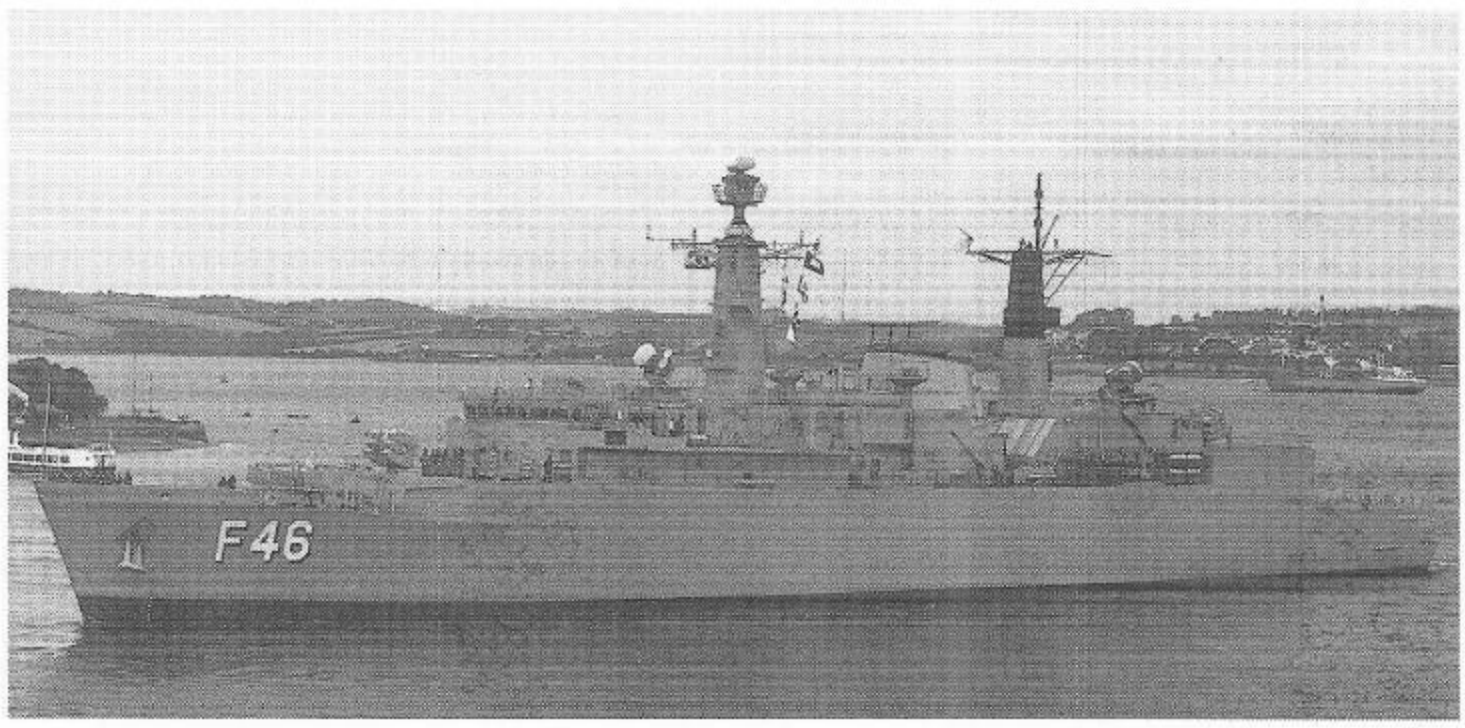
ELECTRONIC SUPPORT MEASURES (ESM)

UAA-2 (Abbey Hill) ESM system
UAA-2 is a passive reception, signal analysis and direction-finding system using IFM receivers. Frequency range has never been released but is almost certainly 1 to 18 GHz. The intercept and DF antennas are a series of radome-covered horns mounted under the foremast masthead radar. Accuracy of measurement is reported to be ±1.5 MHz in frequency and 3° in bearing. The intercept part is combined with a threat identification system and is presumably integrated with the Type 670 ('Heather') jammer. UAA-2 is an upgraded version of UAA-1 and features solid-state electronics in its front end, an improved threat library and an increase in the number of warner channels.

Manufacturer/Contractor
Thorn EMI Electronics, Sensors Group, Crawley, UK.

ELECTRONIC COUNTERMEASURES (ECM)

Type 670
Type 670 is a jammer system, nicknamed 'Heather'. It is a somewhat elderly equipment and the fact that ships are fitted with the more up-to-date Type 675 for particular missions suggests that it may not be capable of dealing with the latest threats. Type 670 is characterised by a rectangular radome, located either side of a container abaft the stack.



Greenhalgh *(F 46) under the Brazilian flag, but before the changes to the armament. Sensors are also unchanged but SCOT satellite terminals have been removed leaving their platforms (just forward of the stack) empty* (Jane's H M Steele)

DECOYS

Outfit DLB

Outfit DLB consists of four Hunting Engineering 130 mm 'Sea Gnat' six-barrel launchers which are grouped in two pairs on either side of the bridge structure. The control unit, by Thorn EMI, provides for the launching of the most effective combination of rounds for distraction and centroid/seduction giving the type, speed and direction of the threat, the ship's speed and heading as well as wind direction and speed.

The munitions involved are the Mk 214 RF seduction, Mk 216 RF distraction rounds, and Mk 218 IR seduction rounds.

Manufacturers/Contractors

Thorn EMI/AB Precision Ltd (control unit).
Hunting Engineering (launchers).
Chemring Ltd (munitions).

Graseby Type 182 towed torpedo decoy

The Type 182 towed torpedo decoy is designed to decoy both active and passive homing torpedoes, using signals electronically generated within the ship and fed, via the towing cable, to electroacoustic transducers within the towed body. The Type 182 produces two independently controllable output signals which are radiated simultaneously from the towed decoy. An amplitude-modulated noise signal simulates the ship's propeller noise and causes passive-homing torpedoes to be seduced away from the ship towards the towed decoy. The second signal is a swept CW signal, which simulates sonar echoes, in order to confuse or jam the guidance system of active homing torpedoes, thus causing them to miss the ship. The frequency bands covered by both types of output are switchable to meet tactical scenarios and to enable concurrent operation of other sonar and communication equipments.

Specifications

Towed decoy:
diameter: 533 mm (21 in)
length: 2,005 mm (79 in)
weight: 74 kg (163 lb)
Towing cable:
length: 411 m (1,348 ft)
diameter: 14.48 mm
weight: 269 kg (593 lb)

Manufacturer/Contractor

Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Outfit DBA(1) (CAAIS) action data automation

In RN service the Type 22 Batch 1 ships had the Outfit DBA (also known as CAAIS Computer Assisted Action Information System) action data automation system, which had been developed in the early 1960s and entered service in 1974 with the Leander Batch 3 frigates. The system was still in the ships on transfer to Brazil and it should be noted that the Brazilian Navy already uses the export version, CAAIS 400/450, in the 'Niteroi' and 'Inhauma' class frigates.

CAAIS is a tactical picture compilation system, providing automatic tracking of air and surface targets, processing sonar and EW inputs, operating a digital datalink, designating targets, and providing torpedo control and vectored attack orders for ASW helicopters. The hardware includes a three-cabinet digital suite housing a 24-bit computer, operating at 200 Kips and with a 780 k memory, as well as a datalink terminal. In addition there are peripheral control units which include radar extraction units, encoder/decoders, display drive unit and the MMI control units. The datalink, known as Link X in NATO navies, is a serial transmission, medium-speed (1,200 baud) link suitable for HF and UHF channels. The programming language is Coral 66.

Manufacturer/Contractor

Ferranti Naval Systems Ltd.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 10; Link 14 (receive)

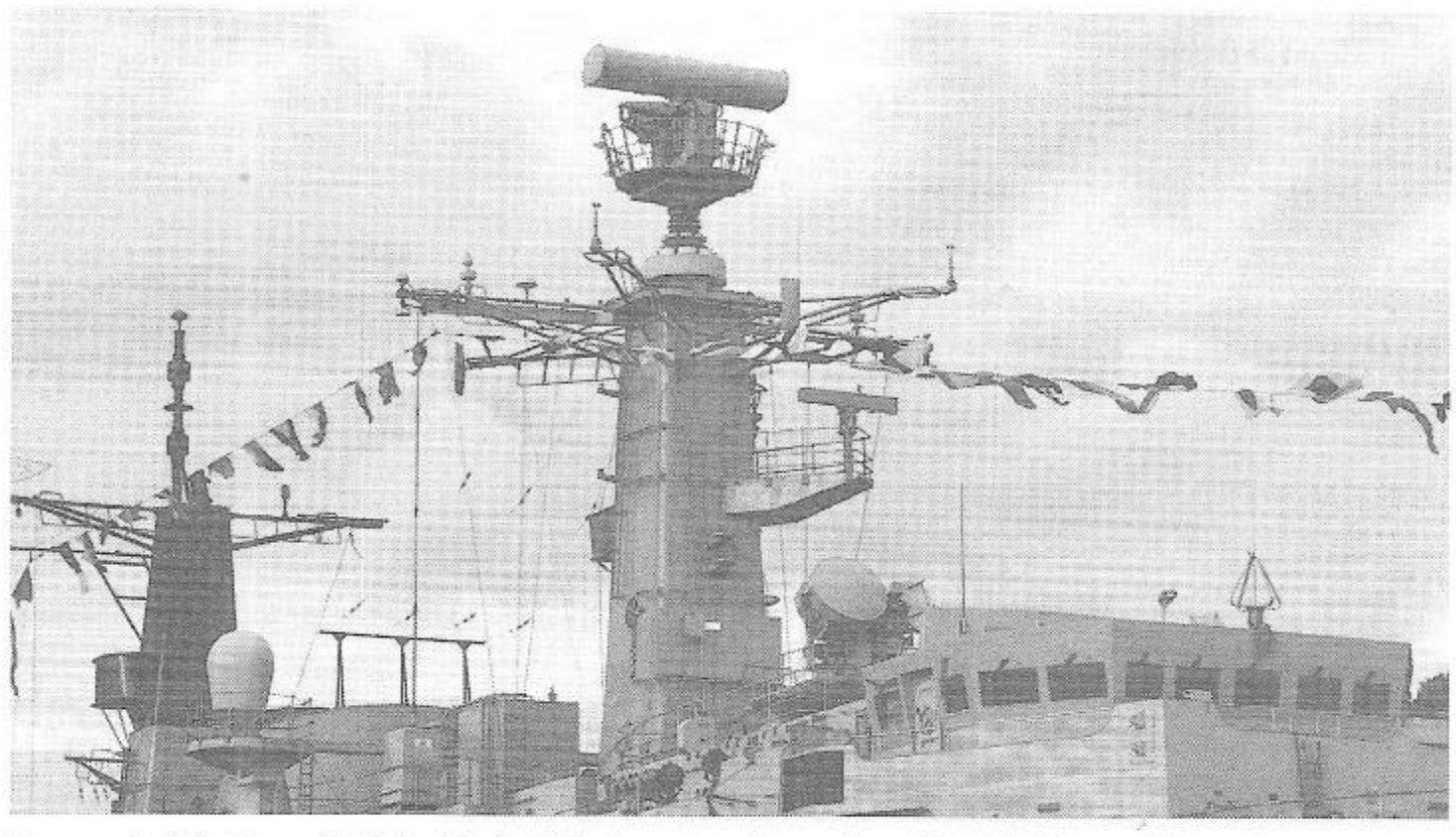
SONAR

Type 2016 sonar

The hull-mounted Type 2016 is installed in all Batch 1 ships. This is an active/passive sonar which is reported to have a range of 10 km. It operates at 5.5, 6.5 and 7.5 kHz and features a cylindrical, retractable, stabilised array with 1.83 m (6 ft) diameter with 64 staves. It uses computerised signal processing based on a Ferranti FM 1600B.

Manufacturer/Contractor

Plessey, UK.



Foremast of Battleaxe (F 89) *while in British service. At masthead is GEC-Marconi Type 967 air/surface search radar. Immediately underneath the masthead platform is the UAA-2 (Abbey Hill) array surrounding the mast like a collar. The antenna on the small platform offset to port is the Kelvin Hughes Type 1007* (Jane's/David Miller)

RADARS

Type	Type 967*	Type 968*	Type 1006/1007	Type 911 (2)
Company	GEC-Marconi	GEC-Marconi	Kelvin Hughes	GEC-Marconi
Role	Long-range search/ acquisition	Low-level air search and target acquisition	Navigation	Fire control
Band	D (1,260-1,360 MHz)	E/F (2,950-3,040 MHz)	I	I; L/M
Beam	4.6 × 69°	2 × 30°	1 × 18°/0.75 × 18°	
Peak power	50-60 kW	3 MW	25 kW	
Gain			31 dB/34 dB	
Pulsewidth	6 µs	2 µs	0.8 or 0.25 µs/0.75 µs	
PRF	7,320 pps	750 pps	1,600/800 pps	
Scan rate	30 rpm	30 rpm	24 rpm	
Typical range			64 n miles	

Note:
* Antennas for Types 967 and 968 radars are mounted back to back.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 20.5 × 14.8 m (67 × 49 ft)

HELICOPTERS

Westland SAH-11 (HAS.21) twin-engined multipurpose helicopter

Specifications

Dimensions:

main rotor: 12.80 m (42.00 ft)
tail rotor diameter: 2.21 m (7.25 ft)
length overall: 15.165 m (49.75 ft)
height overall, rotors stopped: 3.48 m (11.42 ft)

Weights:

operating, empty, equipped, ASW: 3,343 kg (7,370 lb)
reconnaissance (crew of 2): 3,277 kg (7,224 lb)
ASW classification and strike: 3,472 kg (7,654 lb)
ASV search and strike: 3,414 kg (7,526 lb)
search and rescue (crew of 3): 3,416 kg (7,531 lb)
dunking sonar search and strike: 3,650 kg (8,047 lb)
max take-off weight, Gem Mk 41: 4,763 kg (10,500 lb)

Performance:

continuous cruising speed: 125 kts (232 km/h; 144 mph)
speed for max endurance: 70 kts (130 km/h)
hovering ceiling out of ground effect: 2,575 m (8,450 ft)
max range: 320 n miles (593 km)
max endurance: 2 h 50 min

Power plant: 2 Rolls-Royce Gem 41 — 2 turboshafts, with max contingency rating of 835 kW (1,120 shp)
Accommodation: 2 (pilot and co-pilot/observer on side-by-side seats)
Radar: GEC-Marconi ARI5979 Seaspray Mk 1 light-weight search and tracking radar.
ESM: Racal MIR 2
EW: Racal Kestrel EW suite
Mission: ASW versions have dipping sonar and/or MAD.
Weapons: ASW armament two Mk 44, Mk 46, homing torpedoes, one each on an external pylon on each side of fuselage, and six marine markers; or two Mk 11 depth charges. Alternatively, up to four Sea Skua semi-active homing missiles.

PROPULSION

Specifications

System: Combined gas turbine or gas turbine (COGOG)
Main machinery: 2 Rolls-Royce Olympus TM3B gas turbines; 37.3 MW (50,000 hp) sustained; 2 Rolls-Royce Tyne RM1C gas turbines; 7.4 MW (9,900 hp) sustained
Shafts: 2
Propellers: 2 Stone Manganese Model 119XX, 5-bladed, controllable-pitch (inward turning).
Ship's services: 4 Paxman Ventura diesels/four GEC generators; 1 MW

FURTHER INFORMATION

PROGRAMME

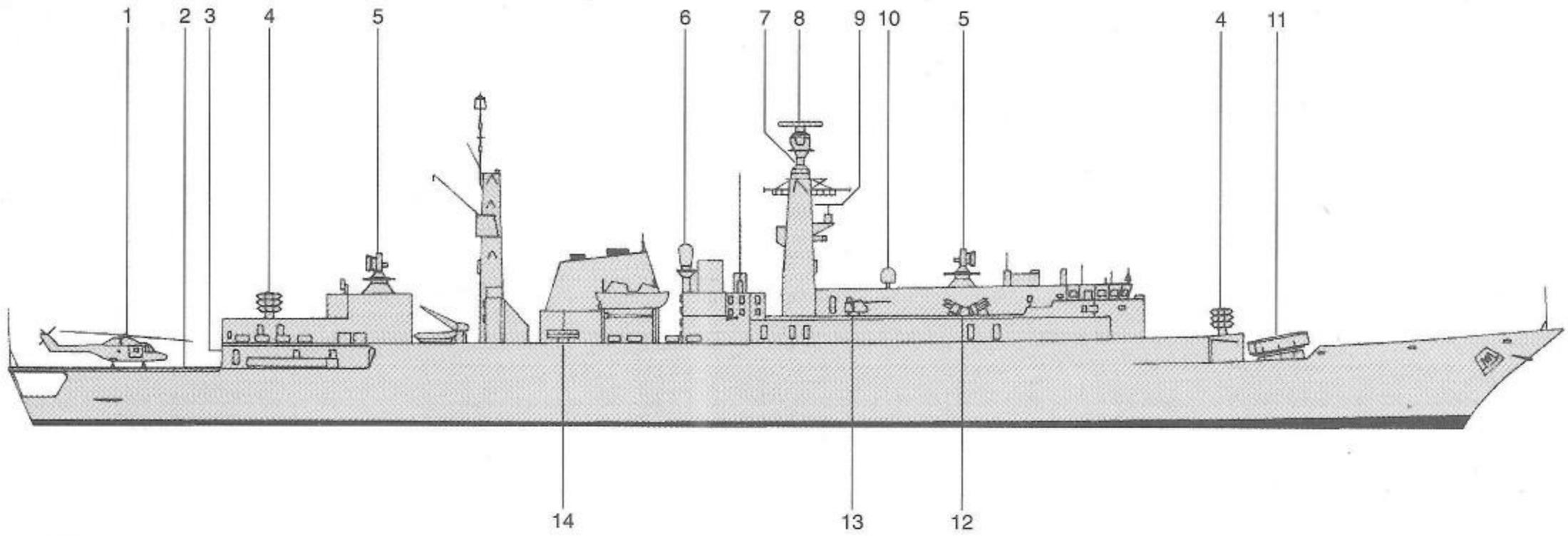
The four British 'Broadsword' class (Type 22 Batch 1) frigates entered service with the RN between 1979 and 1982, and then, after little more than a decade of service, including participation by *Broadsword* (F 88) and *Brilliant* (F 90) in the 1982 Falklands (Malvinas) War, the entire group was sold to Brazil. The contract with the Brazilian Navy was signed on 18 November 1994 and the ships were duly transferred: *Greenhalgh* (former *Broadsword*) — 1995; *Dodsworth* (former *Brilliant*) — 1996; *Bosisio* (former *Brazen* (1996) and *Rademaker* (former *Battleaxe)* — 1997. This purchase of British ships resulted in the cancellation of the Brazilian Navy's previous plan to lease a number of units of the ex-US 'Knox' class.

MODERNISATION

The accommodation was modified in UK service to take 65 officers under training while, since transfer to Brazil, the 57 mm gun has been mounted in 'A' position, the MM 38 Exocets removed and new MM 40 launcher-containers mounted in the waist.

Greenhalgh *(F 46). The Brazilian Navy had been offered a number of ex-US Navy 'Knox' class frigates when they received the offer of the much more modern and capable Type 22 Batch I ships* (Jane's/HM Steele)

BOXER (TYPE 22, BATCH 2)



Type 22 (Batch 2) (Ian Sturton)
1 *Westland Lynx HMA Mk 8* **2** *Flight deck* **3** *Hangar* **4A** *F92-93 Seawolf GWS 25 Mod 4* **4B** *F94-96, F98. Seawolf GWS 25 Mod 3* **5** *GEC-Marconi Type 911 fire control* **6** *Satcom. SCOT* **7** *Outfit UAA-2 radar intercept* **8** *Type 967/968 air/surface search radar (Type 967M) in F 94)* **9** *Kelvin Hughes Type 1007 navigation radar* **10** *Marisat* **11** *Aerospatiale MM 38 Exocet anti-ship missiles* **12** *Outfit DLB (NATO Sea Gnat)* **13** *BMARC GCM-A03 30 mm/75 cannon* **14** *Triple Plessey STWS Mk2 tubes*

GENERAL SPECIFICATIONS

Operator: United Kingdom
Type: TYPE 22 Batch 2

Class: BOXER

Built: 6
Active: 6

Displacement:
standard: 4,100 t
full load: 4,800 t

Dimensions

	F 92 - F 93	F 94, F 95, F 96, F 98
Length (overall)	146.06 m (479.2 ft)	148.1 m (485.9 ft)
Beam	14.8 m (48.5 ft)	14.8 m (48.5 ft)
Draught	6.4 m (21 ft)	6.4 m (21 ft)

Speed: 30 kts; 18 kts on Tynes
Range: 4,500 n miles at 18 kts on Tynes

Complement: 273 (30 officers) (accommodation for 296)

SHIPS

BOXER (F 92)
Builder Yarrow Shipbuilders, Glasgow, UK
Laid down 1 Nov 1979
Launched 17 Jun 1981
Commissioned 14 Jan 1984

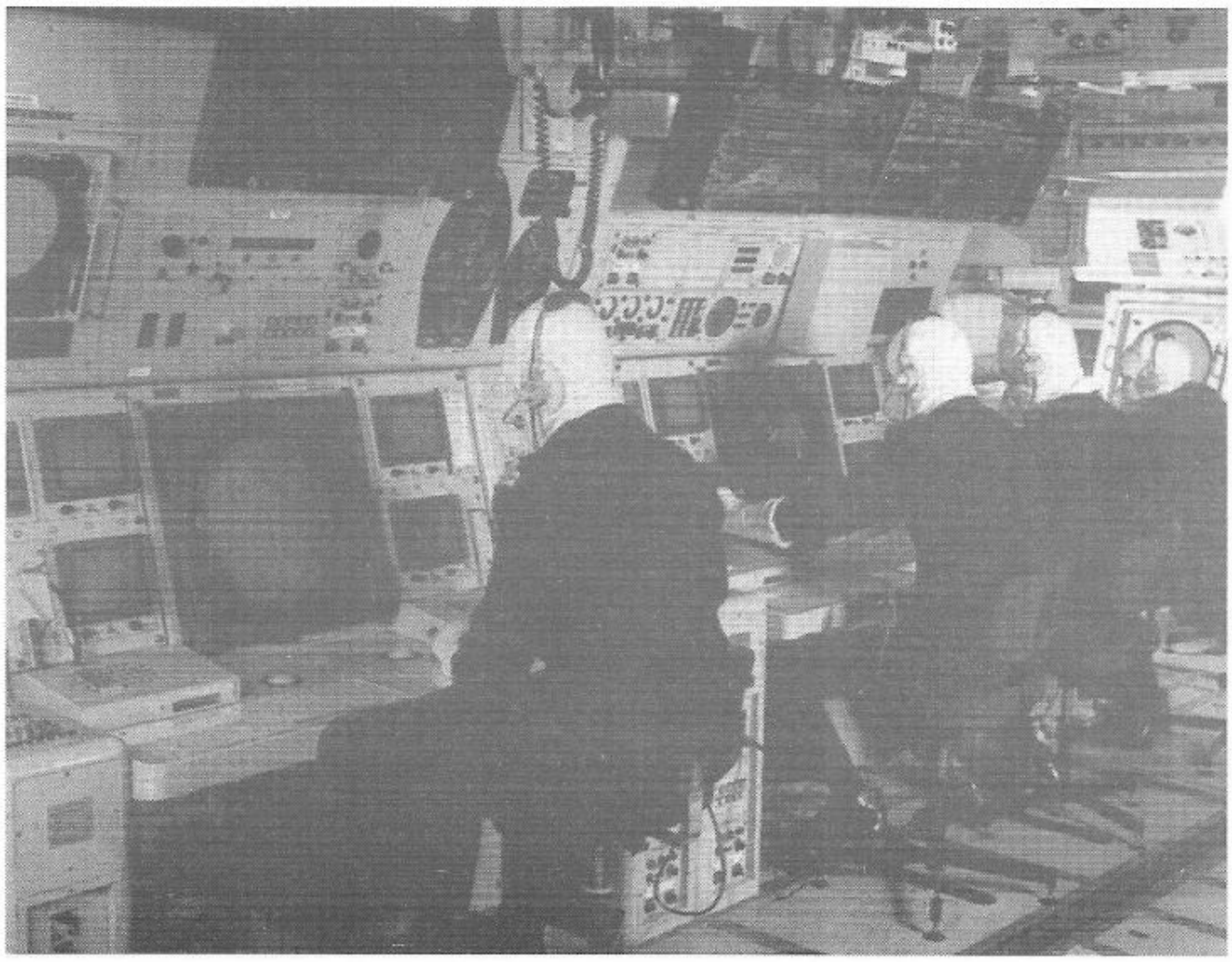
BEAVER (F 93)
Builder Yarrow Shipbuilders, Glasgow, UK
Laid down 20 Jun 1980
Launched 8 May 1982
Commissioned 18 Dec 1984

BRAVE (F 94)
Builder Yarrow Shipbuilders, Glasgow, UK
Laid down 24 May 1982
Launched 19 Nov 1983
Commissioned 4 Jul 1986

LONDON (F 95)
Builder Yarrow Shipbuilders, Glasgow, UK
Laid down 7 Feb 1983
Launched 27 Oct 1984
Commissioned 5 Jun 1987

SHEFFIELD (F 96)
Builder Swan Hunter Shipbuilders, Wallsend-on-Tyne, UK
Laid down 29 Mar 1984
Launched 26 Mar 1986
Commissioned 26 Jul 1988

COVENTRY (F 98)
Builder Swan Hunter Shipbuilders, Wallsend-on-Tyne, UK
Laid down 29 Mar 1984
Launched 8 Apr 1986
Commissioned 14 Oct 1988



Operations room in Boxer *(F 92)*

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 38 medium-range anti-ship missile

Ship-launched MM 38 Exocets are carried in two twin launcher-containers sited on the foredeck and pointing across the centreline at the opposite beam. These launcher-containers are inclined at an angle of 12° to the horizontal. In addition to the launcher installations there is a control console and there is a co-ordinate converter to interface the missile with the ship's sensors.

Targets are acquired by the ship's search radar and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence. This involves turning on the thermal battery, releasing the mechanical safety locks, igniting the booster and, finally, breaking the umbilical cord; the total process takes some 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change of course during its flight.

The attack consists of three phases:

Cruise phase. The cruise phase starts as the missile clears the container and the missile, powered by the sustainer motor, flies towards the general location of the target at a height of about 100 m (328 ft) which is low enough to reduce the chance of detection but adequate for target acquisition. This phase can be as long as 22 km and ends when the seeker acquires the target. The seeker is a Dassault Electronique ADAC (Auto Directeur Anti-Clutter) active monopulse radar, working in the I-band (8-10 GHz), which has a typical range of 13 n miles (24 km) against FACs.

Approach phase. On detecting the target the missile descends to 9-15 m (29.5-49 ft) in the approach phase.

Terminal phase. During this final phase the missile descends to 8 m (26 ft) (2-5 m (6.5-16 ft)) in a calm sea) for a sea-skimming run in to the target.

A salvo may be fired in 12-20 seconds.

Specifications

(MM 38)
Length: 5.21 m (17.09 ft)
Diameter: 35 cm (13.7 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s.
Booster: 100 kg (220 lb) SNPE Epervier boost motor, burn time of 2.4 s.
Warhead: Luchaire 165 kg (363 lb) fragmentation warhead
Fuzes: Delayed impact fuze and autopilot-controlled proximity fuze

Manufacturer/Contractor

Aerospatiale Missiles.

SURFACE-TO-AIR MISSILES (SAM)

Seawolf GWS.25

Overview

Batch 2 ships are all fitted with the Seawolf SAM system launched from two six-tube launchers. As built, F 92 and F 93 were fitted with GWS.25 Mod 0, but this has now been upgraded to GWS.25 Mod 4. The remaining four ships (F94, F 95, F 96 and F 98) were built with and (currently) retain GWS.25 Mod 3.

Seawolf GWS.25 Mod 3

GWS.25 Mod 3 consists of an air search radar, two trackers, a missile, 32-round magazine, six-tube launcher and a command subsystem. The air search radar is the GEC-Marconi Type 967 D-band system whose waveguide antenna is mounted back to back with that of the Type 968 surface search antenna. The rounds are lifted by hydraulic hoist to ready-use magazines near the launcher and are then moved manually on a trolley to the launcher and placed on the launcher rails. The launch tubes, three either side of the pedestal, have clam-shell front and rear shutters, which open automatically for firing.

The GEC-Marconi Type 911 Mod 1 tracker is a dual-frequency radar with two antennas: one for I-band transmission, the other for millimetric-wave (L/M-bands) transmission. The I-band element is used for long-range tracking and high-angle engagements. Its signal processing includes fast Fourier transform techniques to ensure effective operation in severe clutter. It is designed to provide accurate tracking at close range and at low levels. This facility is assisted by separate illumination of the upper and lower parts of the antenna. The computer is the FM1600E. The tracker is normally dedicated to a launcher and uses time-division multiplexing to control two missiles and to track both target and missile. The tracking loop also incorporates electronic angle tracking to minimise antenna movement when correcting missile line of sight guidance for small angles.

The command subsystem associated with each tracker includes a command transmitter, a Ferranti data handling system based upon the Ferranti FM1600E, a guiding shaping unit and operator consoles. The process is completely automatic, but with manual override, and it is able to analyse sensor data, to establish a track, to conduct threat analysis then allocate target priorities. Targets are detected by the air search radar and assigned through the ship's command system to the Seawolf command subsystem. There the threat is evaluated and the target is assigned to a tracker-launcher combination. Both slew towards the target, the tracker searches in elevation until it acquires and locks on to the target to establish a radar line of sight. When the target is within range, one missile is automatically launched, although frequently a second will follow it moments later. After launch the missile is acquired by the wide-angle antenna and gathered into the target line of sight. Its position relative to the centre of the tracking beam is monitored by the radar, and the ship-borne guidance computer generates the necessary steering commands to keep the missile in the centre of the beam until it intercepts the target. The missile's rearward facing antennas help to provide a good ECCM capability. The television camera is used for low-level tracking with flares showing the missile's location.

GWS.25 Mod 4

GWS.25 Mod 4 is an upgraded Mod 0, and is essentially a Mod 3, but with an upgraded Type 911 tracker, which has unspecified improvements compared to that in the Mod 3 system, and a Ferranti FM1600E computer.

Specifications

GWS.25
Length: 2 m (6.5 ft)
Diameter: 18 cm (7 in)
Wing span: 70 cm (27.5 in)
Weight: 82 kg (181 lb)
Speed: Mach 2+
Range: 2.7 n miles (5 km)
Guidance: CLOS
Warhead: Royal Ordnance 14 kg (31 lb) fragmentation high explosive warhead with Thorn EMI impact-proximity fuze.

Manufacturer/Contractor

British Aerospace, UK.

TORPEDOES

STWS Mk 2 anti-submarine torpedo launching system

These ships are fitted with two sets of triple 324 mm Plessey STWS Mk 2 (Shipborne Torpedo Weapon System) torpedo tubes. Each group consists of a triple-tube launcher, a launch control, and a presetter unit, which are linked to the launchers through local control panels. On the possibility of action the launchers are manually trained to an angle of 45° using a training handle installed between the two lower tubes, but thereafter they are remotely operated. The tubes themselves are made of glass fibre-reinforced epoxide resin and mounted in a triangular configuration. STWS 2 is designed to operate with the Mk 46 and the Sting Ray lightweight torpedoes. It has electrically operated muzzle doors while the presetter/launch controller features Motorola 30800 microprocessors. It also features a strengthened mounting, better access to the tubes and improvements in the diagnostic and heater systems.

Specifications

Length: 3.65 m (12.0 ft)
Height: 1.4 m (4.6 ft)
Width: 1.23 m (4.0 ft)
Weight: 1,560 kg (3,440 lb) (unloaded)

Manufacturer/Contractor

GEC-Marconi Underwater Weapons Systems Ltd.

Sting Ray lightweight anti-submarine weapon

Sting Ray lightweight ASW torpedo can be used in deep or shallow waters, using its multiband, multibeam sonar. The narrowband capability gives good Doppler

Seawolf SAM is launched from Brave *(F 94)*

Brave *(F 94). On the bridge roof are : a large section of radar absorbing material (RAM); GEC-Marconi Type 911 (for Seawolf) and a Marisat satcom antenna. Atop the foremast is a Marconi Type 967 air/surface search antenna, and below the platform is the circular UAA-2 (Abbey Hill) ESM array. Just forward of the stack is one of two SCOT satellite antennas and abreast the mainmast and pointing outwards is Type 670 jammer* (HMS Osprey/UK MoD)

discrimination against slow or quiet targets, while the broadband capability provides target discrimination, range and bearing resolution. The acoustic beam sweeps the whole volume of the water from the surface to the maximum operating depth. The computer can be reprogrammed 'through the skin' whenever updated software is required, with the programs adapting themselves to the tactical and environmental conditions in which the torpedo operates. The computer also controls the signals, beam form, speed and trajectory of the weapon.

Power is provided by a Chloride seawater-activated magnesium-silver chloride battery. The reaction is controlled by recirculating hot, part-spent seawater using a pump while simultaneously controlling the amount of cold seawater reaching the battery. Power is produced 1.5 seconds after the weapon enters the water. The propulsion system uses a Lucas DC electric motor driving two contrarotating propulsors housed in a duct to form the pump-jet. The control surfaces are actuated by an electrohydraulically driven proportional control system developed by BAe Dynamics Group.

On entering the water, the torpedo sets up a programmed search pattern designed to maximise the chances of target detection. On acquiring the target, the computer and active/sonar sensors make it almost impossible for the target to evade attack. The software of the guidance/homing system enables it to filter out background noise and decoys, and to intercept the target rather than perform a conventional tailchase attack. Maximum speed is about 45 knots with an estimated endurance of some eight minutes at that speed.

Specifications
Length: 2.59 m (8.5 ft)
Diameter: 324 mm
Weight: 267 kg (588 lb) (in air)
Warhead: 35 kg (77 lb)
Speed: 45 kts (estimated)
Range: 6 n miles (11 km) (estimated)
Endurance: Approximately 8 min
Depth: 750 m (2.460 ft)

Manufacturer/Contractor
GEC-Marconi Underwater Weapons Systems Ltd.

GUNS

Royal Ordnance/Oerlikon GCM-A03-2 twin 30 mm mountings
There are two twin GCM-A03-2 twin 30 mm mounts, one either side of the forward deckhouse, just forward of the foremast.

The GCM-A03-2 is a locally operated mounting with an open operator's position and two boxes of ammunition each with 250 rounds. It has a GEC-Marconi Avionics (formerly Ferranti) GSA Mk 201 gyro gunsight. It weighs 2.05 tonnes without ammunition and the swept area is 2.52 m (55 ft).

The gun is the Oerlikon KCB, a single barrel, 75 calibre gas-operated, air-cooled, link-belt fed weapon with feeding from either side. The weapon is 3.52 m (11.5 ft) long, 2.37 m (7.8 ft) high, 2.18 m (7.15 ft) wide and weighs 156 kg (344 lb). The GCM-A mountings all incorporate a substantial amount of high-strength, light alloys and plastic to reduce weight. They are gyrostabilised and electrically powered with the weapon operated hydraulically but manual operation is possible in the event of power loss.

The guns share a cradle and are 350 mm apart. The elevating gear is between the trunnion supports and the training gear on the left of the small platform upon which the mounting rests. A generator is in the front of the mounting and the operator's position is on the right. Each gun has a box of ammunition fitted rigidly to the trunnion supports and linked to the gun by a flexible feeding system.

Specifications
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Round: 870 g
Rate of fire: 650 rds/min/barrel
Range:
anti-surface: 1.5 n miles (3 km)
anti-air: 3,500 m (11,483 ft)

Mounting
Traverse: 360°
Elevation: −13 to +75°
Traverse speed: 80°/s
Elevation speed: 60°/s (all mountings)

Manufacturers/Contractors
Royal Ordnance, Medium Calibre Gun Division.
Oerlikon Contraves AG, Switzerland.

20 mm Oerlikon mountings
Two single GAM-BO1 20 mm mounts are fitted, on the upper deck, either side of the stack. GAM-BO1 uses a swivel fork with the sidewalls having the trunnion bearings. The cradle is made of light alloy and the weapon's working parts are enclosed in a protective case whose top opens to ease maintenance and installation. The sight, shoulder rests and back support strap are all attached to the sight bracket which is adjustable for height. Usually these mountings have an optical ring sight but they can also be fitted with a lead computing sight. The ammunition box with 200 rounds is attached to the front of the mounting and the belt is fed from the right side of the gun, with spent cartridge cases being ejected between the sidewalls of the cradle into a separate compartment, while the links are collected in a bag on the other side of the mounting.

Specifications
(GAM-BO1)
Elevation: 55°
Gun Model: KAA
Calibre: 20 mm
Length of barrel: 85 calibres
Effective range:
anti-surface: 2,500 m (2,700 yd)
anti-air: 4,000 ft (1,200 m)
Rate of fire: 1,000 rds/min
Round weight: 320-345 g
Projectile: 110-125 g

Manufacturers/Contractors
Royal Ordnance. Medium Calibre Gun Division (mounting).
Oerlikon Contraves AG, Defence, Switzerland.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

AN/SSQ-72 Classic Outboard

The Batch 2 ships are fitted with the AN/SSQ-72 Classic Outboard tactical electronic warfare suite, which operates in the communications frequency bands, providing a shipboard capability for signal exploitation at over-the-horizon ranges. AN/SSQ-72 incorporates spread spectrum receivers for detection and demodulation of both frequency-hopping and direct sequence, pseudo-random noise signals. High-speed signal processing is provided for demodulation, analysis and signal recognition of a wide variety of both conventional and spread spectrum signal types. The elements of the AN/SSQ-72 system include:

AN/SRD-19A, comprising a number of VHF direction-finding Adcock-type arrays, which are located at the head of the mainmast. There are also a number of deck-edge antennas, which are electronically switched to form receiving beams.

AN/SLR-16A countermeasures receiver, operating in the HF band.

It is possible that the additional accommodation abaft the bridge may be used as the operations centre for the AN/SSQ-72 system.

Manufacturer/Contractor

Lockheed Sanders, Nashua, New Hampshire, USA.

UAA-2 (Abbey Hill) ESM system

UAA-2 is a passive reception, signal analysis and direction-finding system using IFM receivers. Frequency range has never been released but is almost certainly 1 to 18 GHz. The intercept and DF antennas are a series of radome-covered horns mounted under the foremast masthead radar. Accuracy of measurement is reported to be ±1.5 MHz in frequency and 3° in bearing. The intercept part is combined with a threat identification system and is presumably integrated with the Type 670 ('Heather') jammer. UAA-2 is an upgraded version of UAA-1 and features solid-state electronics in its front end, an improved threat library and an increase in the number of warner channels.

Manufacturer/Contractor

Thorn EMI Electronics, Sensors Group, Crawley, UK.

ELECTRONIC COUNTERMEASURES (ECM)

Type 670

Type 670 is a jammer system, nicknamed 'Heather'. It is a somewhat elderly equipment and the fact that ships are fitted with the more up-to-date Type 675 for particular missions suggests that it may not be capable of dealing with all the latest threats. Type 670 is characterised by a rectangular radome, located either side of a container abaft the stack.

Manufacturer/Contractor

Thorn EMI Electronics, Sensors Group, Crawley, UK.

Type 675(2) radar detection and jamming system

Type 675(2) is installed in some Batch 2 ships, where it replaces Type 670. Type 675 is an active/passive EW system designed to counter a wide range of operational threats, particularly those of radar-guided missiles. The system counters and confuses surveillance and missile homing radars by the use of selective jamming techniques for both area and point defence. Azimuth coverage is 360° with an elevation cover of 50° and a detection range of up to 500 km. Two antenna mounts, both with mechanical steering to give full azimuth and elevation coverage, ensure uninterrupted all-round view. Each mount carries a direction-finding receiving antenna together with transmit antennas. Received signals are analysed to identify those which may pose a threat and the selected signals are processed to allow generation of the jamming signal.

High-power transmitter subsystems, matched to the antenna, provide jamming capability against several types of target simultaneously. A comprehensive ECM library stores the appropriate countermeasures to a range of potential threats and, on receipt of a warning from the ESM system, the ECM processor selects the appropriate jamming mode to give fast response.

The main equipment cabinets can be situated below decks or installed in containers for mounting on the upper deck or superstructure, as has been done in a number of British ships serving in the Gulf. Such containers provide for easy removal and refit to other ships. In the British Navy the Type 675 is also known as 'Millpost' while an export variant is designated 'Guardian' by the company.

Manufacturer/Contractor

Thorn EMI Electronics Ltd, Sensors Group, Crawley, UK.

DECOYS

Outfit DLB

Outfit DLB consists of four Hunting Engineering 130 mm 'Sea Gnat' six-barrel launchers which are grouped in pairs on either side of the bridge structure. The control unit, by Thorn EMI, provides for the launching of the most effective combination of rounds for distraction and centroid/seduction giving the type, speed and direction of the threat, the ship's speed and heading as well as wind direction and speed.

The munitions involved are the Mk 214 RF seduction, Mk 216 RF distraction rounds, and Mk 218 IR seduction rounds.

Manufacturers/Contractors

Thorn EMI/AB Precision Ltd (control unit).
Hunting Engineering (launchers).
Chemring Ltd (munitions).

Graseby Type 182 towed torpedo decoy

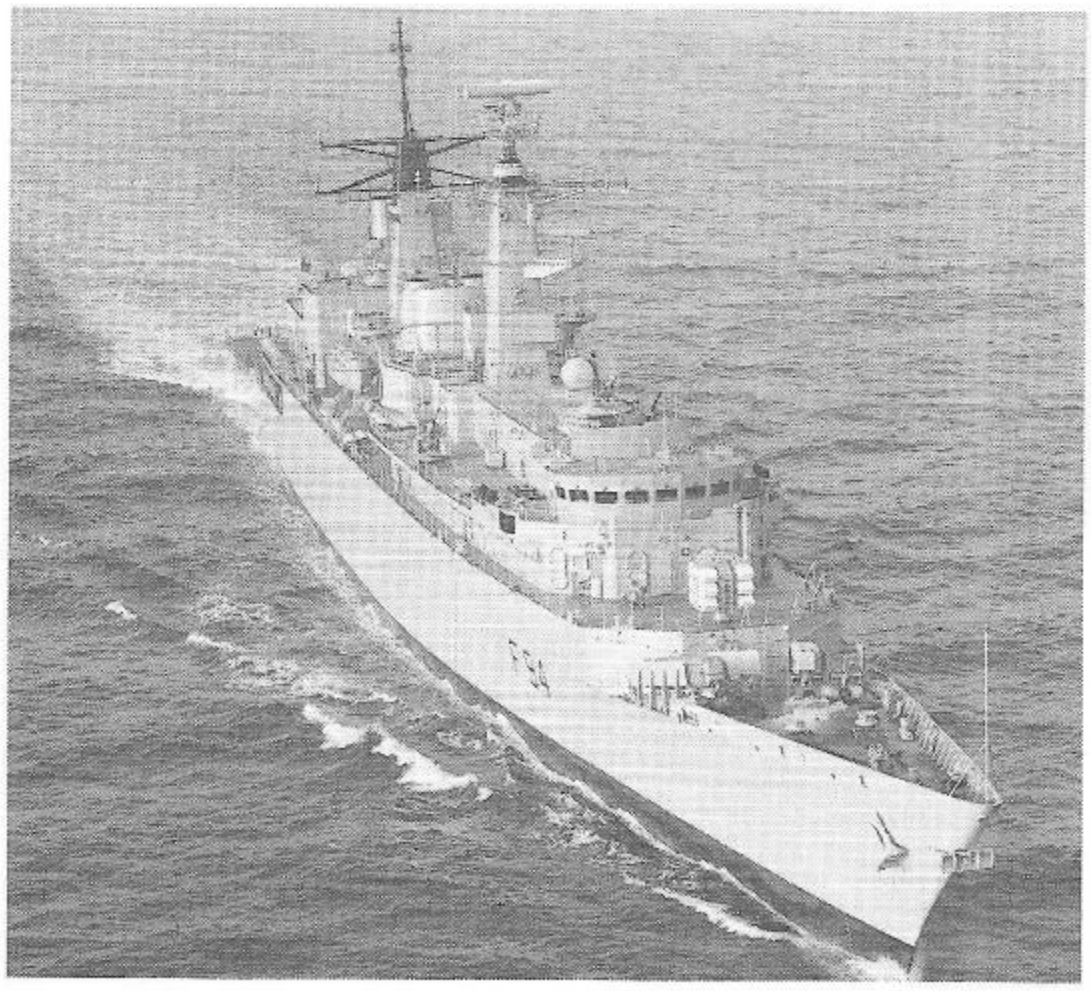
The Type 182 towed torpedo decoy is designed to decoy both active and passive homing torpedoes, using signals electronically generated within the ship and fed, via the towing cable, to electroacoustic transducers within the towed body. The Type 182 produces two independently controllable output signals which are radiated simultaneously from the towed decoy. An amplitude modulated noise signal simulates the ship's propeller noise and causes passive-homing torpedoes to be seduced away from the ship towards the towed decoy. The second signal is a swept CW signal, which simulates sonar echoes, in order to confuse or jam the guidance system of active-homing torpedoes, thus causing them to miss the ship. The frequency bands covered by both types of output are switchable to meet tactical scenarios and to enable concurrent operation of other sonar and communication equipments.

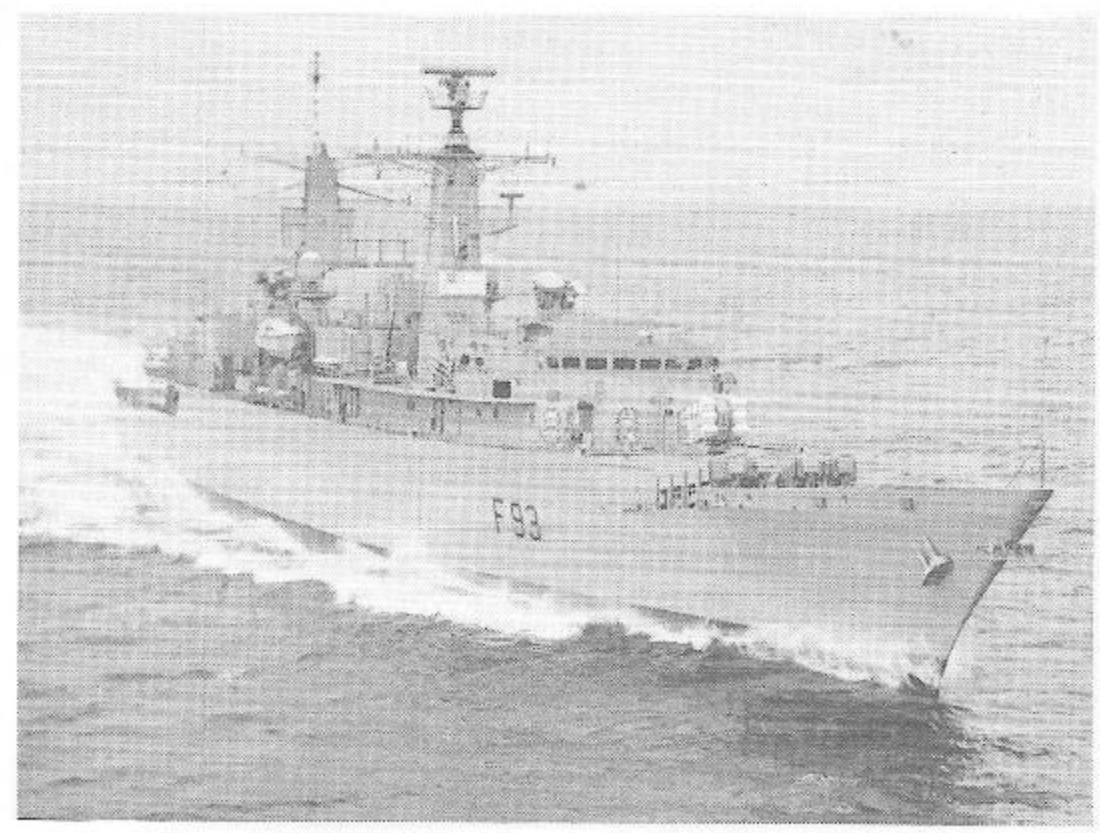
Specifications

Towed decoy:
diameter: 533 mm
length: 2,005 mm
weight: 74 kg (163 lb)
Towing cable:
length: 411 m (1,348 ft)
diameter: 14.48 mm
weight: 269 kg (593 lb)

Manufacturer/Contractor

Graseby Marine (Graseby Dynamics Ltd), Watford, UK.





There are two sub-groups within Batch 2. The first two ships Boxer *(F 92) and* Beaver *(F 93) (above) were 16.9 m (55.8 ft) longer than Batch 1, with the remaining four ships, including* Brave *(F 94) (left), being not quite as long at 146.5 m (480.5 ft)* (Yarrow)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Ferranti CACS 1

The Computer Assisted Command System 1 (CACS 1) was the first of a family of new command systems for the Royal Navy, installed for the first time in Type 22 Batch 2 frigates. The architecture is based on dual F2420 computers, connected by a distributed highway to several display positions, each of which contains its own Argus M700/20 microprocessor system to optimise operator effectiveness and minimise angle point failures. The consoles are based on the new GEC-Marconi Series 9 display system which, with greatly increased quality and capacity, supersedes the Mk 8 display technology, used in ADAWS. There is extensive use of video retiming and scan compression techniques. The principal input device is the light pen, replacing most of the rolling ball and keyboard functions. CACS employs an all-vertical display concept which, besides offering the operator a more comfortable and efficient working position, overcomes severe ship-fitting constraints and the problems associated with conventional horizontal dual-operator displays. The most significant advance from the user's viewpoint is the implementation of the 'prompt' interface for operator communication with the system.

COMMUNICATIONS AND DATALINKS

Datalinks:
Link 11
Link 14

Satellite communications:
Matra Marconi SCOT 1C Satcom
Marisat

WEAPONS CONTROL

The following weapons control systems are installed:

Seawolf. GWS.25 Mod 4 (F 92, F 93)
Seawolf. GWS.25 Mod 3 (F 94, F 95, F 96, F 97)
Exocet. GWS.50 (all)

RADARS

Type	Type 967*	Type 968*	Type 967M**	Type 1006	Type 911 (two)
Maker	GEC-Marconi	GEC-Marconi	GEC-Marconi	Kelvin Hughes	GEC-Marconi
Role	Long-range search/ acquisition	Low-level air search and target acquisition	Long-range air search	Navigation	Fire control
Band	D (1,260-1,360 MHz)	E/F (2,950-3,040 MHz)		I	I; L/M
Beam	4.6 × 69°	2 × 30°		1 × 18°/0.75 × 18°	
Peak power	50-60 kW	3 MW		25 kW	
Gain				31 dB/34 dB	
Pulsewidth	6 µs	2 µs		0.8 or 0.25 µs/ 0.75 µs	
PRF	7,320 pps	750 pps		1,600/800 pps	
Scan rate	30 rpm	30 rpm		24 rpm	
Typical range				64 n miles	

Notes:
* Antennas for Types 967 and 968 radars are mounted back to back
** Type 967M replaces Type 967 in *Brave* (F 97) only

SONARS

Type 2016 sonar

The bow-mounted Type 2016 is installed in the earlier Batch 2 ships. This is an active/passive sonar which is reported to have a range of 10 km. It operates at 5.5, 6.5 and 7.5 kHz and features a cylindrical, retractable, stabilised array with (6 ft (1.8 m) diameter with 64 staves. It uses computerised signal processing based on a Ferranti FM 1600B.

Type 2050 sonar

The bow-mounted Type 2050 sonar is mounted in the later Batch 2 ships and may also replace the Type 2016 in earlier ships. This digital equipment uses distributed data processing with Ferranti Digital Signal Processing (DSP) cards and multiple Ferranti Argus M700 processors. The provision of extensive data processing facilities and improved man/machine interfaces allows one operator to control the complete system. The equipment interfaces with the combat system data highway, feeding data to the Ferranti CACS action-information system. Type 2050 operates at 4.5 to 7.5 kHz, using 64 5.5° beams.

Manufacturer/Contractor

Thomson-Marconi Sonar Systems UK Ltd, Stockport, UK (prime system contractor).

Type 2031Z towed array sonar system

All Batch 2 ships are fitted with Type 2031Z towed array sonar. Using the innovative 'Curtis' architecture developed by Professor Curtis at the UK Admiralty Research Establishment in Portland, Dorset, the 2031Z electronic signal processing suite has, because of its compactness, a considerably lower installed cost than other systems, and yet provides a multi-octave broad and narrowband analysis facility capable of tracking the most elusive threats. The array itself is towed behind the ship and has a very low self-noise characteristic and is considerably longer than that used by any other self-contained sonar. It provides good bearing accuracy, even down to the very low-frequency end of the acoustic spectrum. The combination of an advanced signal processing architecture and a high-performance towed array ensures that the system is a dual-capability sensor, able to fulfil both the tactical and surveillance role. A 2031Z-equipped frigate can, therefore, act as an ASW picket or close escort.

Manufacturers/Contractors

Ultra Electronics Ocean Systems, Weymouth, UK (inboard electronics suite).
Basys Marine, Barnstaple, Devon, UK (towed array).
Clarke Chapman, Gateshead, UK (winching equipment).

AVIATION

AVIATION FACILITIES

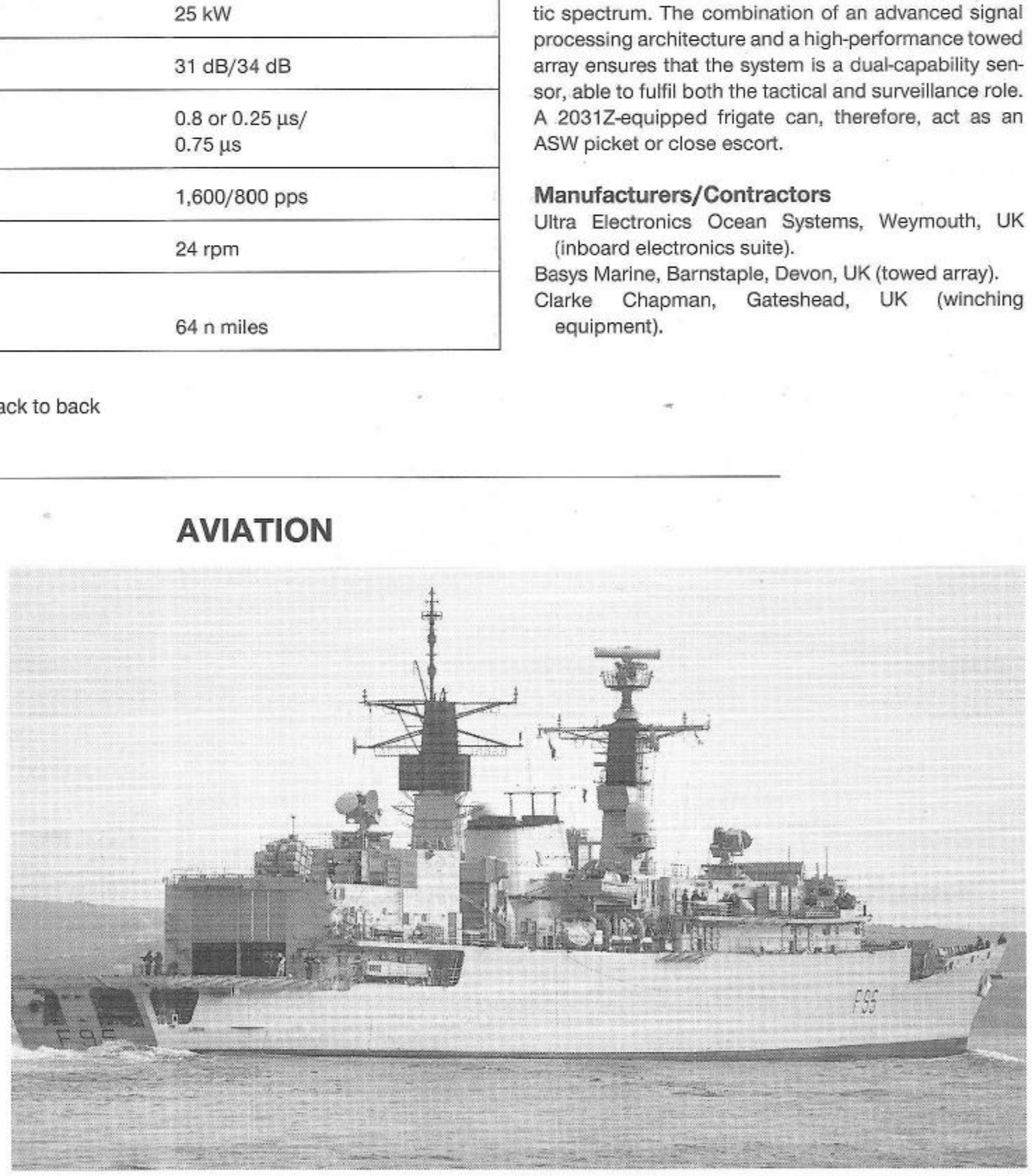
Specifications

Flight deck: The last four Batch 2 ships are 2.04 m (6.7 ft) longer in order to enlarge the flight deck, the dimensions being:

F 92, F 93 — 20.7 × 14.8 m (68 × 48.5 ft)
F 94-96, F 98 — 23.0 × 14.0 m (75.5 × 45.9 ft)

HELICOPTERS

F 92, F 93: 2 Westland Lynx HMA 3/8
F 94-96, F 98: 2 Westland Lynx HMA 3/8 or
1 Westland Sea King HAS 5 or
1 EH.101 Merlin HAS 1 (in due course).



London *(F 95). The after Seawolf launcher and Type 911 fire director are on the hangar roof. The antenna arrays at the head of the mainmast are related to the Outboard SIGINT system*
(Jane's/HM Steele)

PROPULSION

Specifications
System: Combined gas turbine or gas turbine (COGOG)
Main machinery: 2 Rolls-Royce Olympus TM3B gas turbines; 37.3 MW (50,000 hp) sustained or 2 Rolls-Royce Spey SM1C (F 94); 32.8 MW (44,000 hp) sustained; 2 Rolls-Royce Tyne RM1C gas turbines; 7.4 MW (9,900 hp) sustained
Shafts: 2
Propellers: cp

FURTHER INFORMATION

DESIGN

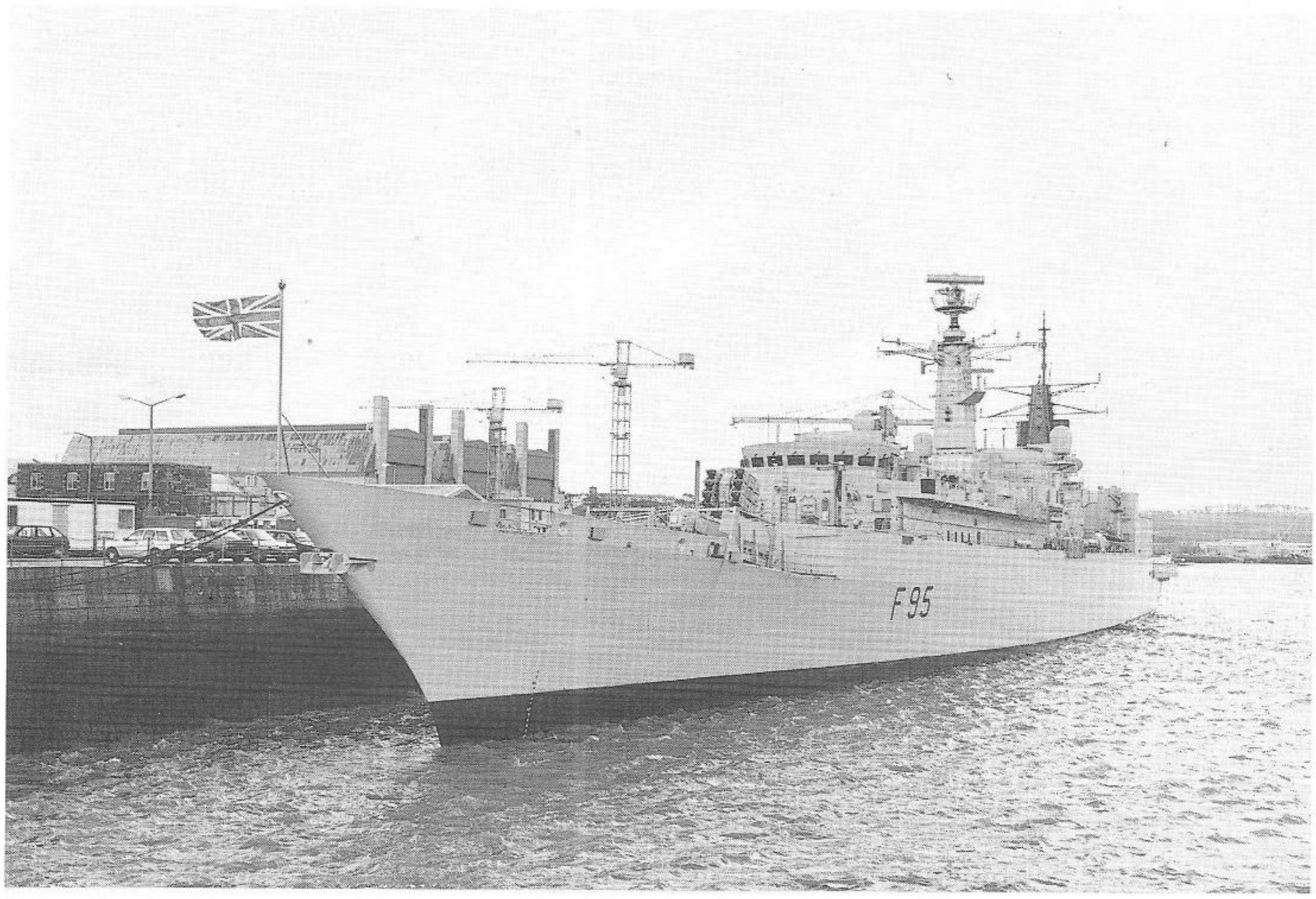
The Batch 2 ships were lengthened on build, primarily in order to give more space for EW equipment. The last four Batch 2 are slightly longer than the first two and have enlarged flight decks to enable them to accommodate either one Sea King now, or one EH.101 Merlin when it enters service.

OPERATIONAL

This class is primarily designed for ASW operations and is capable of acting as OTC (Officer in Tactical Command).

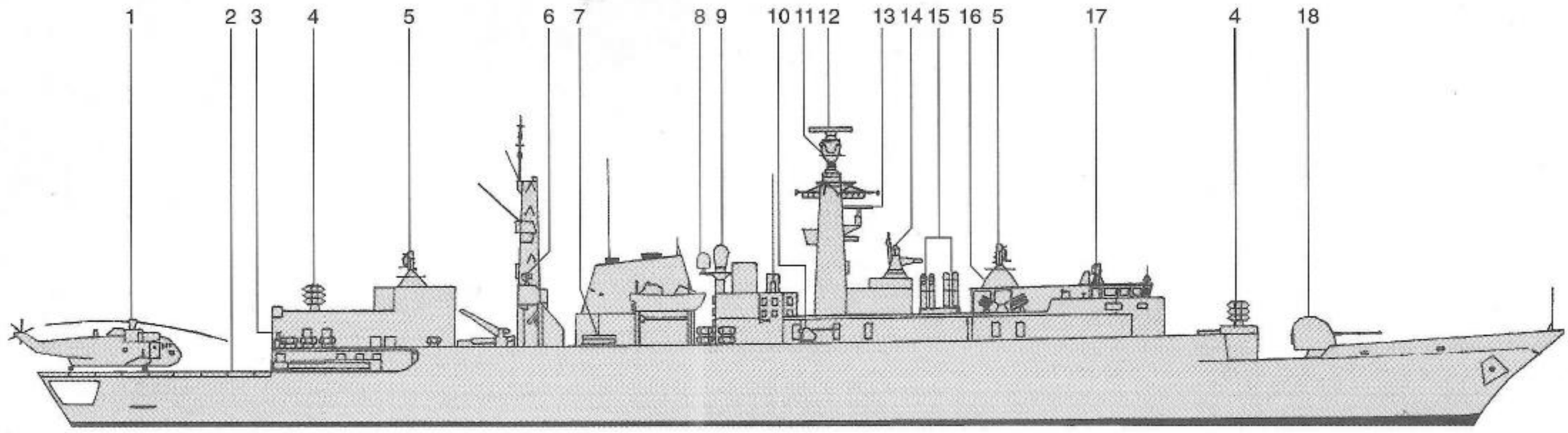
DEPLOYMENT

The Batch 2 frigates form the 1st Frigate Squadron, based at Devonport.



London *(F 95) at the completion of its 1995 refit at Devonport Royal Dockyard* (DML)

CORNWALL (TYPE 22, BATCH 3)



Type 22 (Batch 3) (Ian Sturton)

1 *Westland Sea King HAS5* **2** *Flight deck* **3** *Hangar* **4** *BAe Seawolf GWS 25 Mod 3* **5** *GEC-Marconi Type 911 (part of Seawolf system)* **6** *Type 675(2) jammer* **7** *Plessey STW-2 triple 324 mm torpedo tubes* **8** *Marisat* **9** *SCOT 1C Satcom* **10** *DES/Oerlikon 30 mm/75* **11** *VAA-2 radar intercept* **12** *Marconi Type 967 air/surface search* **13** *Kelvin Hughes Type 1007 navigation radar* **14** *Signaal/GE 30 mm 7-barrel Goalkeeper CIWS* **15** *McDonnell Douglas Harpoon Block 1C* **16** *Outfit DLB (NATO Sea Gnat)* **17** *BA & GSA 8A Sea Archer* **18** *Vickers 114 mm (4.5 in)/55 Mk 8 gun*

GENERAL SPECIFICATIONS

Operator: UK
Type: TYPE 22 Batch 3

Class: CORNWALL

Built: 4
Active: 4

Displacement:
standard: 4,200 t
full load: 4,900 t

Dimensions:
Length: 148.1 m (485.9 ft)
Beam: 14.8 m (48.5 ft)

Draught: 6.4 m (21.0 ft)

Speed: 30 kts; 18 kts on Tynes
Range: 4,500 n miles at 18 kts on Tynes

Complement: 250 (31 officers) (accommodation for 301)

SHIPS

CORNWALL (F 99)
Builder Yarrow Shipbuilders, Glasgow, UK
Laid down 14 Dec 1983
Launched 14 Oct 1985
Commissioned 23 Apr 1988

CUMBERLAND (F 85)
Builder Yarrow Shipbuilders, Glasgow, UK
Laid down 12 Oct 1984
Launched 21 Jun 1986
Commissioned 10 Jun 1989

CAMPBELTOWN (F 86)
Builder Cammell Laird, Birkenhead, UK
Laid down 4 Dec 1985
Launched 7 Oct 1987
Commissioned 27 May 1989

CHATHAM (F 87)
Builder Swan Hunter Shipbuilders, Wallsend-on-Tyne, UK
Laid down 12 May 1986
Launched 20 Jan 1988
Commissioned 4 May 1990

Cornwall *(F 99), first of the Batch 3s. On the same, longer hull as the first two Batch 2s, the Batch 3s have a significantly different weapons fit. There is a Vickers 114 mm gun on the foredeck, displacing the Exocets, which are replaced by eight Harpoons located on the upper deck forward of the foremast. This picture also shows the two GPEODs on the bridge roof* (Jane's/HM Steele)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84C Harpoon

Eight Harpoon anti-ship missile canisters are mounted in a gap in the forward deckhouse, created by deleting the EW room. There are two groups of four launchers each, with one group pointing to either beam. The missiles are Block 1C versions, with certain additional options over earlier blocks, including the ability to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications (Block 1C)

Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st.
Booster: Thiokol or Aerojet rocket; 5,400 kg (11,907 lb) thrust for about 2.9 s.
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

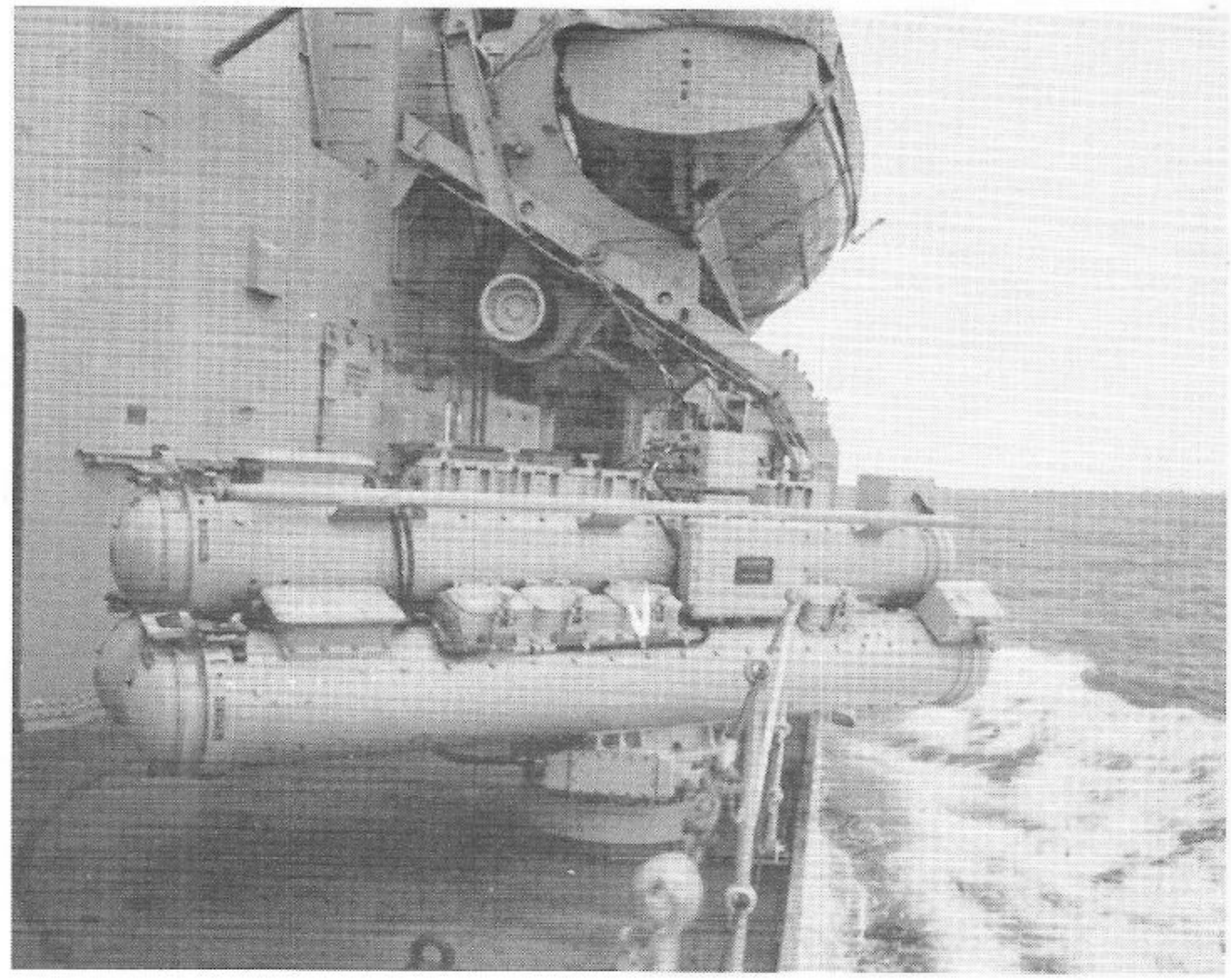
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

Seawolf GWS.25 Mod 3

GWS.25 Mod 3 consists of an air search radar, two trackers, a missile, 32-round magazine, six-tube launcher and a command subsystem. The air search radar is the GEC-Marconi Type 967 D-band system whose waveguide antenna is mounted back to back with that of the Type 968 surface search antenna. The rounds are lifted by hydraulic hoist to ready-use magazines near the launcher and are then moved manually on a trolley to the launcher and placed on the launcher rails. The launch tubes, three either side of the pedestal, have clam-shell front and rear shutters, which open automatically for firing.

The GEC-Marconi Type 911 Mod 1 tracker is a dual-frequency radar with two antennas: one for I-band transmission, the other for millimetric-wave (L/M-bands) transmission. The I-band element is used for long-range tracking and high-angle engagements. Its signal processing includes fast Fourier transform techniques to ensure effective operation in severe clutter. It is designed to provide accurate tracking at close range and at low levels. This facility is assisted by separate illumination of the upper and lower parts of the antenna. The computer is the FM1600E. The tracker is normally dedicated to a launcher and uses time-division multiplexing to control two missiles and to track both target and missile. The tracking loop also incorporates electronic angle tracking to minimise antenna movement when correcting missile line of sight guidance for small angles.

The command subsystem associated with each tracker includes a command transmitter, a Ferranti data handling system based upon the Ferranti FM1600E, a guiding shaping unit and operator consoles. The process is completely automatic, but with manual override, and it is able to analyse sensor data, to establish a track, to conduct threat analysis then allocate target priorities. Targets are detected by the air search radar and assigned through the ship's command system to the Seawolf command subsystem. There the threat is evaluated and the target is assigned to a tracker-launcher combination. Both slew towards the target, the tracker searches in elevation until it acquires and locks on to the target to establish a radar line of sight. When the target is within range, one missile is automatically launched, although frequently a second will follow it moments later. After launch, the missile is acquired by the wide-angle antenna and gathered into the target line of sight. Its position relative to the centre of the tracking beam is monitored by the radar, and the shipborne guidance computer generates the necessary steering commands to keep the missile in the centre of the beam until it intercepts the target. The missile's rearward-facing antennas help to provide a good ECCM capability. The television camera is used for low-level tracking with flares showing the missile's location.



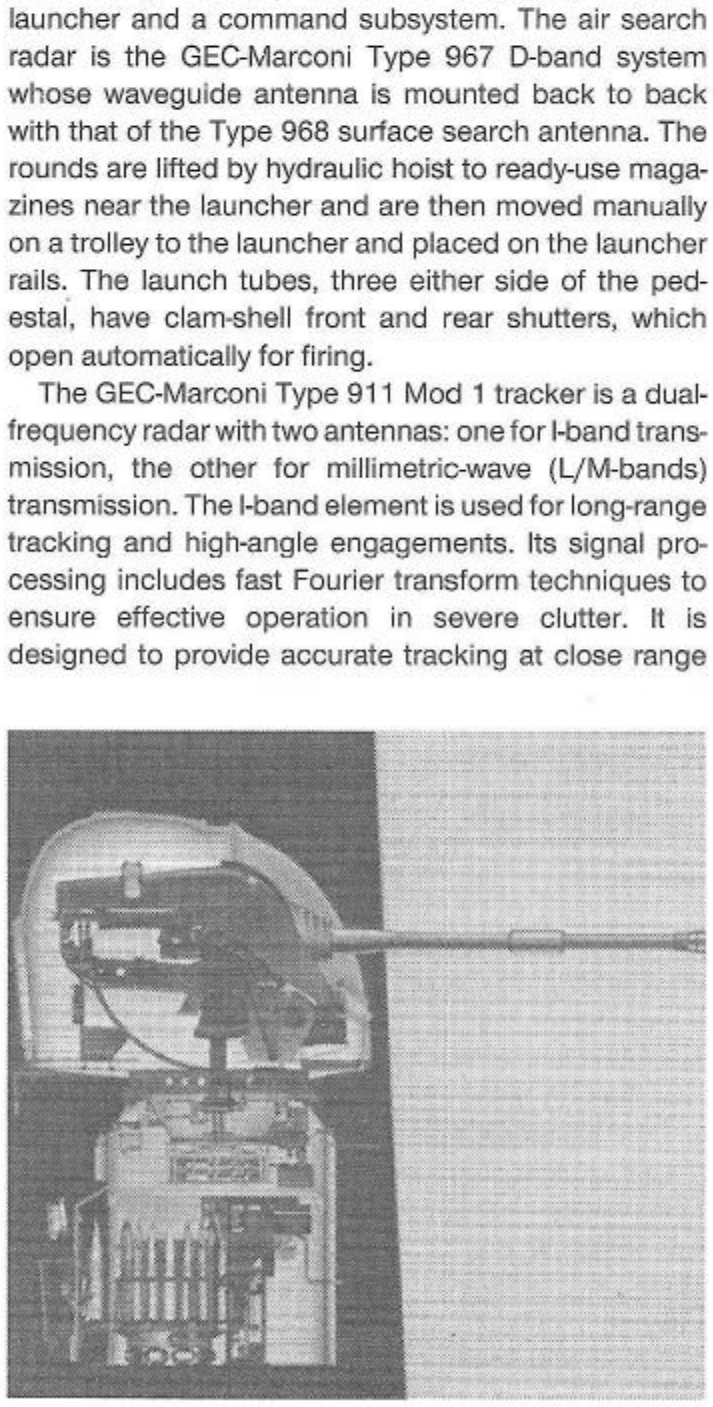
STWS 2 324 mm torpedo launcher aboard a Type 22 frigate

Specifications (GWS.25)

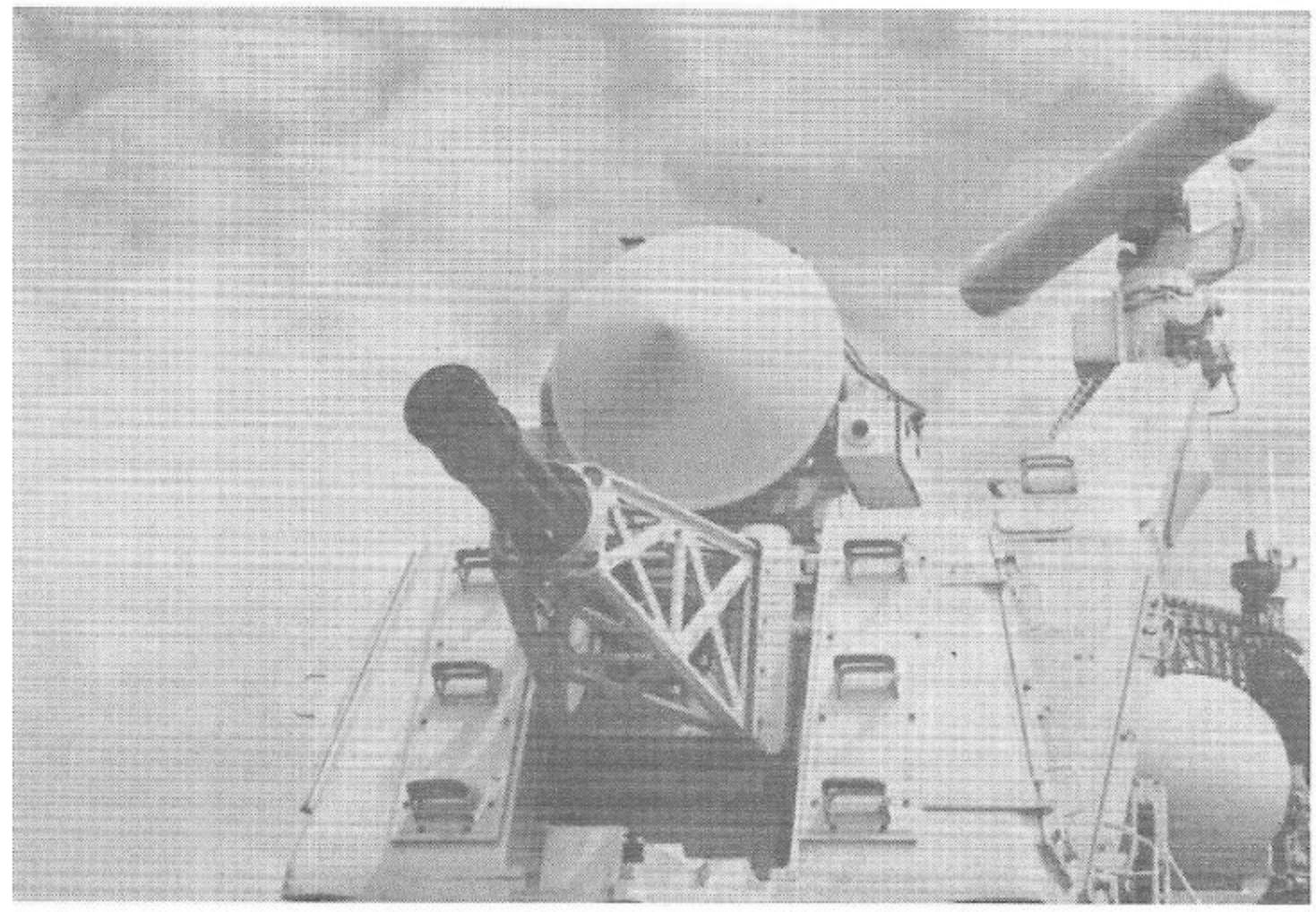
Length: 2 m (6.5 ft)
Diameter: 18 cm (7 in)
Wing span: 70 cm (27.5 in)
Weight: 82 kg (181 lb)
Speed: Mach 2+
Range: 2.7 n miles (5 km)
Guidance: CLOS
Warhead: Royal Ordnance 14 kg (31 lb) fragmentation high explosive warhead with Thorn EMI impact-proximity fuze.

Manufacturer/Contractor

British Aerospace, UK.



Cutaway of the Vickers 114 mm (4.5 in)/55 Mk 8



Close-up of Signaal/GE Goalkeeper CIWS

TORPEDOES

STWS Mk 2 anti-submarine torpedo launching system

These ships are fitted with two sets of triple 324 mm Plessey STWS Mk 2 (Shipborne Torpedo Weapon System) torpedo tubes. Each group consists of a triple-tube launcher, a launch control, and a presetter unit, which are linked to the launchers through local control panels. On the possibility of action the launchers are manually trained to an angle of 45° using a training handle installed between the two lower tubes, but thereafter they are remotely operated. The tubes themselves are made of glass fibre-reinforced epoxide resin and mounted in a triangular configuration. STWS 2 is designed to operate with the Mk 46 and the Sting Ray lightweight torpedoes. It has electrically operated muzzle doors while the presetter/launch controller features Motorola 30800 microprocessors. It also features a strengthened mounting, better access to the tubes and improvements in the diagnostic and heater systems.

Specifications
Length: 3.65 m (12.0 ft)
Height: 1.4 m (4.6 ft)
Width: 1.23 m (4.0 ft)
Weight: 1,560 kg, (3,440 lb) (unloaded)

Manufacturer/Contractor
GEC-Marconi Underwater Systems Ltd, UK.

Sting Ray lightweight anti-submarine weapon

Sting Ray lightweight ASW torpedo can be used in deep or shallow waters, using its multiband, multibeam sonar. The narrowband capability gives good Doppler discrimination against slow or quiet targets, while the broadband capability provides target discrimination, range and bearing resolution. The acoustic beam sweeps the whole volume of the water from the surface to the maximum operating depth. The computer can be reprogrammed 'through the skin' whenever updated software is required, with the programs adapting themselves to the tactical and environmental conditions in which the torpedo operates. The computer also controls the signals, beam form, speed and trajectory of the weapon.

Power is provided by a Chloride seawater-activated magnesium-silver chloride battery. The reaction is controlled by recirculating hot, part-spent seawater using a pump while simultaneously controlling the amount of cold seawater reaching the battery. Power is produced 1.5 seconds after the weapon enters the water. The propulsion system uses a Lucas DC electric motor driving two contrarotating propulsors housed in a duct to form the pump-jet. The control surfaces are actuated by an electrohydraulically driven proportional control system developed by BAe Dynamics Group.

On entering the water the torpedo sets up a programmed search pattern designed to maximise the chances of target detection. On acquiring the target, the computer and active/sonar sensors make it almost impossible for the target to evade attack. The software of the guidance/homing system enables it to filter out background noise and decoys, and to intercept the target rather than perform a conventional tailchase attack. Maximum speed is about 45 knots with an estimated endurance of some eight minutes at that speed.

Specifications
Length: 2.59 m (8.5 ft)
Diameter: 324 mm
Weight: 267 kg (588 lb) (in air)
Warhead: 35 kg (77 lb)
Speed: 45 kts (estimated)
Range: 6 n miles (11 km) (estimated)
Endurance: approximately 8 min
Depth: 750 m (2,460 ft)

Manufacturer/Contractor
GEC-Marconi Underwater Systems, UK.

Sea Archer 30 (GSA 8)

GUNS

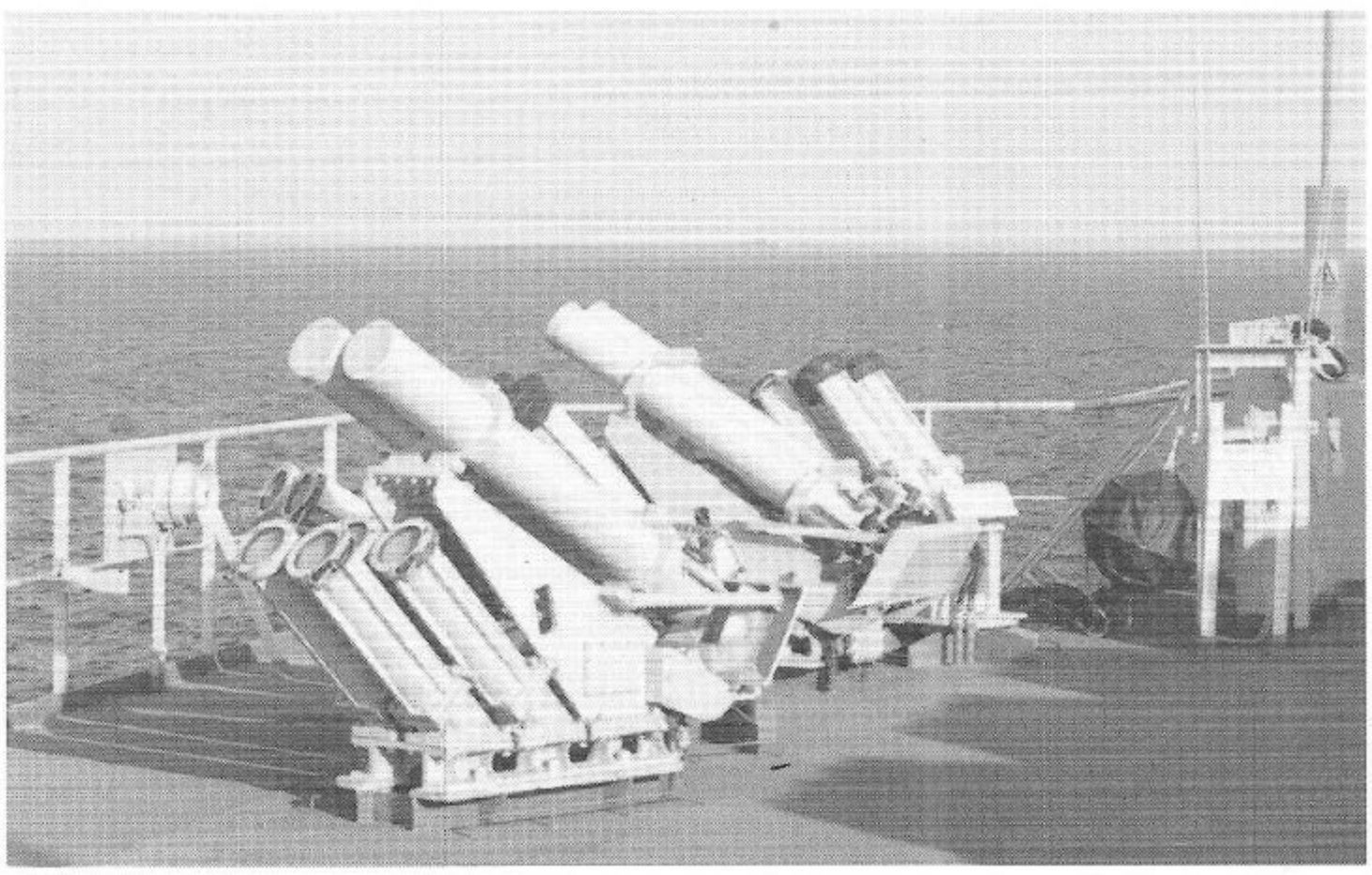
Vickers 114 mm (4.5 in)/55 Mk 8 multipurpose gun

The Type 22 Batch 3 mounts a single 114 mm (4.5 in)/55 calibre Mk 8 gun in 'A' position. This weapon provides quick-reaction short-range air defence, engages surface targets including fast attack craft, and provides gunfire support to ground forces. The weapon system consists of the gun mounting, the ammunition feed system, the remote power control system, and the captain-of-turret panel.

The barrel is 6.22 m (20.4 ft) long, is fitted with a muzzle brake and fume extractor, and has a life of 3,300 rounds EFC. The mounting is completely enclosed in a glass fibre shield which protects it against the environment, blast and shrapnel. The loading system is hydraulically operated, with an autoloader which is manually fed by two loaders and has a capacity of six rounds. The hoist transfers them in two stages to the turret from where they are raised by a pivoting loading arm to the breech where they are inserted by a power rammer. After the shell is fired the case is extracted automatically and ejected through a chute in the front of the mounting.

Specifications
Calibre: 113 mm
Length of barrel: 55 calibres
Traverse: 340° at 40°/s
Elevation: −10 to +55° at 40°/s
Muzzle velocity: 868.7 m/s (2,850 ft/s)
Weight of projectile: 21 kg (69 lb)
Rate of fire: 25 rds/min
Range:
anti-surface: 11.9 n miles (22 km)
anti-air: 6,000 m (20,000 ft)
Crew: 4 (gun captain (CIC), loading supervisor, 2 loaders)

Manufacturer/Contractor
Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

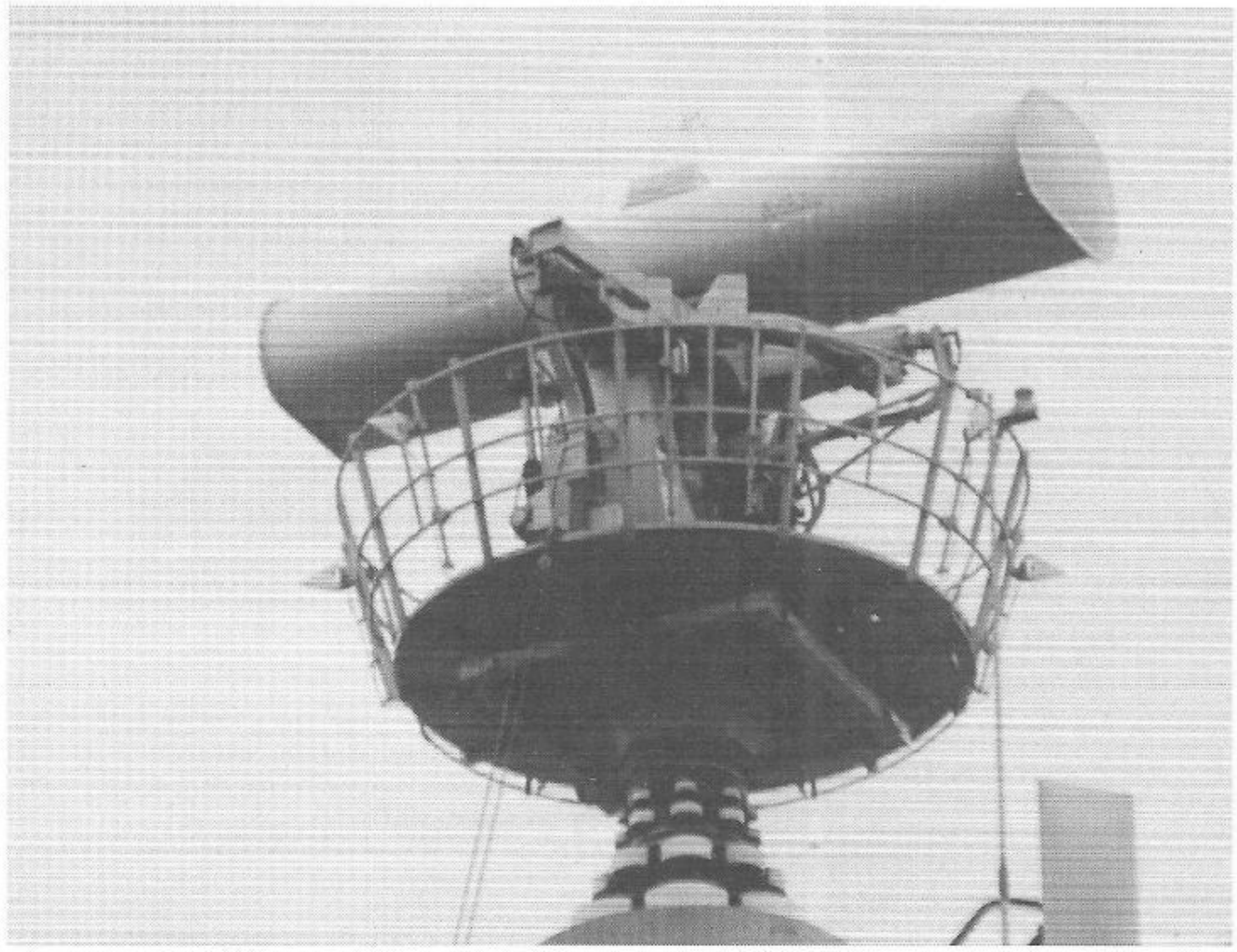


Outfit DLB, the UK Royal Navy version of NATO Sea Gnat (Jane's/Peter Saracino)

Signaal/Hughes SGE-30 30 mm Goalkeeper close in weapons system

One Signaal/Hughes 30 mm 7-barrelled Gatling Goalkeeper close in weapons system is mounted at the forward end of the hangar roof. Goalkeeper is an autonomous, fully automatic system, consisting of a Hughes Sea Vulcan 30 gun, I-band search radar, I/K-band tracking radar, TV camera, and ancillaries. The Sea Vulcan 30 is based upon the electrohydraulically powered GAU-8/A 30 mm seven-barrel, Gatling gun, with each barrel firing once during each revolution of the barrel cluster. The gun is very reliable, with 33,000 mean rounds between stoppages. The mounting has an ammunition capacity of 1,190 rounds carried in a linkless system using a feed and storage drum, which is claimed to be sufficient for several target engagements before reloading is necessary. The warhead kill capability of Goalkeeper against anti-ship missiles is achieved by use of MPDS rounds which have high-density, tungsten-alloy penetrators. For 'soft' targets, HEI and TP types of ammunition can be used.

The I-band search radar uses a 2,050 × 280 mm



Type 967 antenna with VAA-2 (Abbey Hill) ESM array below platform

linear array antenna with an integrated sidelobe suppression antenna. The antenna rotates at 60 rpm and has a horizontal beamwidth of 1.7° and a vertical beamwidth of 60°. The radar is powered by a water-cooled, synthesiser-driven, TWT transmitter with high-output power for greater frequency and PRF flexibility in the face of ECM threats.

Specifications:

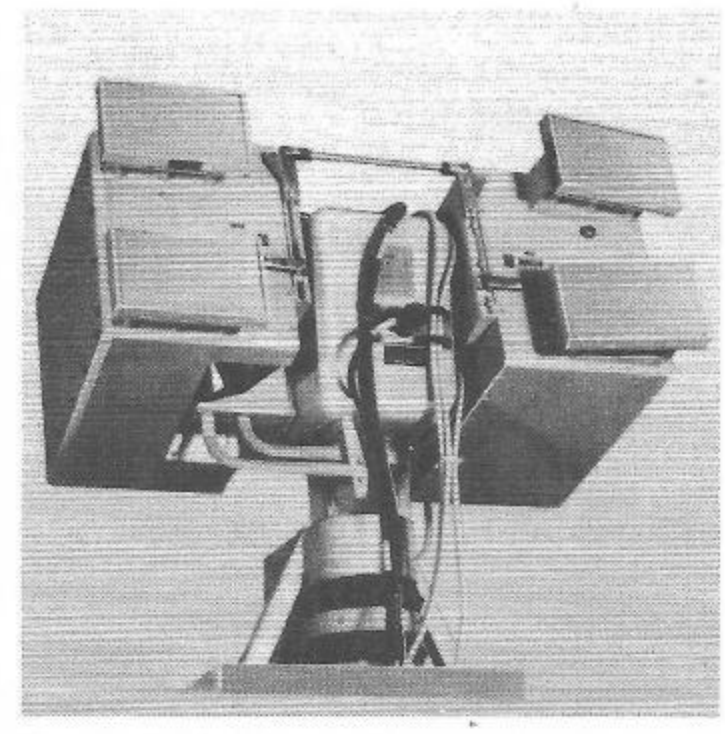
Calibre: 30 mm
Muzzle velocity: 1,020 m/s (3,346 ft/s)(TP, HEI); 1,150 m/s (3,773 ft/st) (APDS)
Traverse: 360°
Elevation: −25 to +85°
Mounting weight: 6,800 kg (14,994 lb)
Crew: 0
Range: 1.61 n miles (200 m to 3 km)
Rate of fire: 4,200 rds/min
Ammunition: 369 g (TP, HEI, HEISD, API, MPDS)

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands (system/radar).

MSI DS 30B 30 mm gun mounting

There are two 30 mm gun mountings on the main deck below the foremast. The weapon itself is an Oerlikon KCB 30 mm cannon, which is positively locked and gas operated, with a belt-feed mechanism fixed to the cradle. The left-hand feed KCB-B02 is used in the DS 30B mounting. The ribbed barrel has constant rifling with 18 grooves and a 6° clockwise constant turn. The weapon includes a muzzle brake, axial recoil buffer and mechanical ignition system. The KCB normally fires in automatic mode only but in the DS 30B, a single shot capability has been included.



Type 674(2) jammer array

The mounting is a locally controlled, power-driven and line of sight-stabilised unit designed to allow a variety of sensor and weapon packages to be fitted. The pedestal contains the stabilisation and training machinery and the open gunner's position is on the right of the mounting with the 160-round magazine on the left. The mounting incorporates alloys to reduce magnetic signature and has clean lines to meet NBC washdown requirements. An integral battery pack provides up to 10 minutes of operation in the event of ship power failure.

Specifications

Mounting (DS 30B)
Traverse: 230° (operational)
Elevation: −25 to +70°
Traverse speed: 55°/s
Elevation speed: 55°/s
Crew: 1

Gun (KCB)
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 650 rds/min
Ammunition weight: 870 g (31 oz)

Manufacturer/Contractor

MSI Defence Systems Ltd.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

UAA-2 (Abbey Hill) ESM systems

UAA-2 is a passive reception, signal analysis and direction-finding system using IFM receivers. Frequency range has never been released but is almost certainly 1 to 18 GHz. The intercept and DF antennas are a series of radome-covered horns mounted under the foremast masthead Type 967/968 radar. Accuracy of measurement is reported to be ±1.5 MHz in frequency and 3° in bearing. The intercept part is combined with a threat identification system and is presumably integrated with the Type 670 (see below) jammer. UAA-2 is an upgraded version of UAA-1 and features solid-state electronics in its front end, an improved threat library and an increase in the number of warner channels.

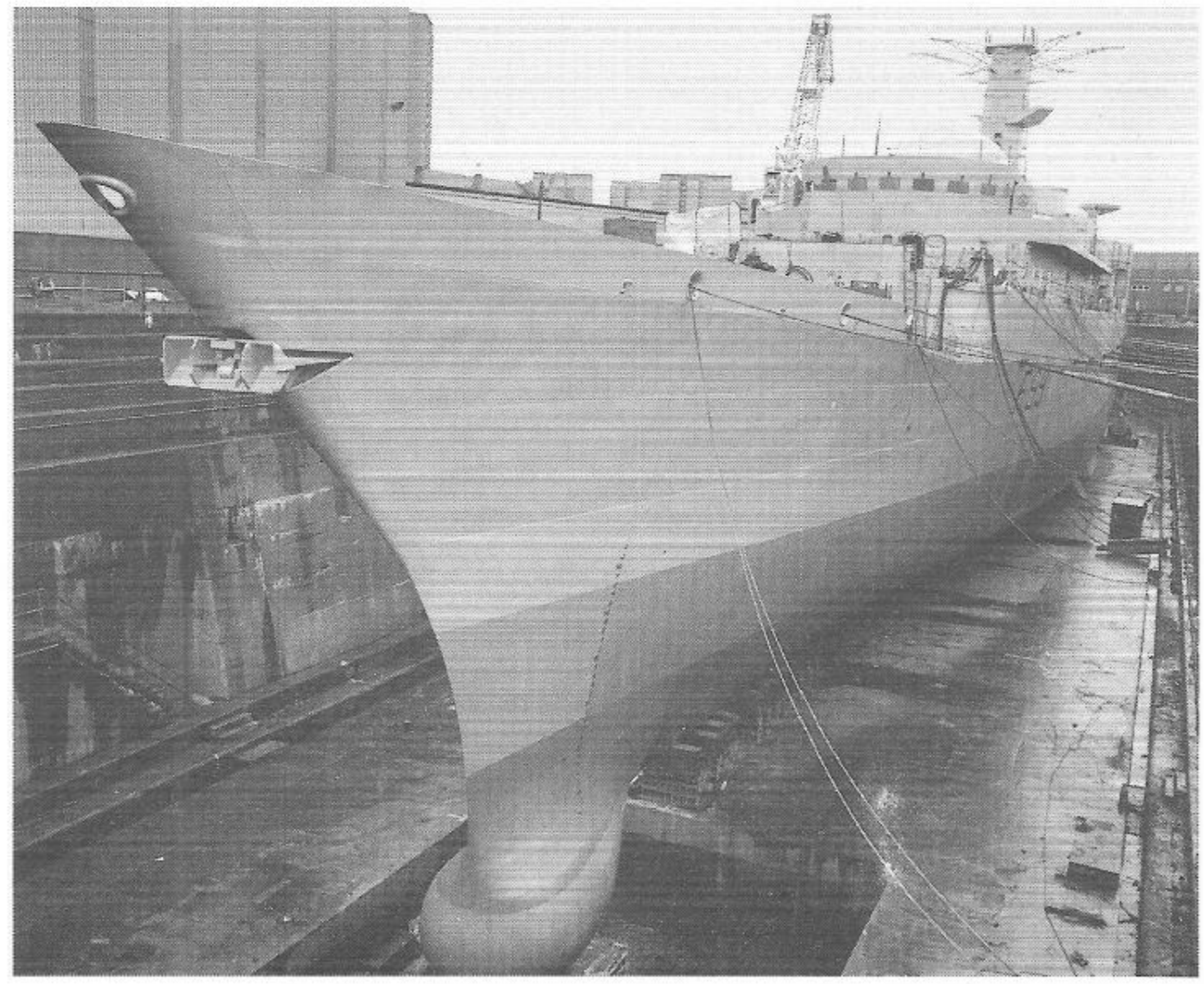
Manufacturer/Contractor

Thorn EMI Electronics, Sensors Group, Crawley, UK.

ELECTRONIC COUNTERMEASURES (ECM)

Type 675(2) radar detection and jamming system

Type 675(2) appears to have replaced Type 670 in all Batch 3 ships. Type 675 is an active/passive EW system designed to counter a wide range of operational threats, particularly those of radar-guided missiles. The system counters and confuses surveillance and missile homing radars by the use of selective jamming



Cornwall *(F 99), being fitted out, displays its Type 2016 sonar dome. This picture makes obvious the need for such a sharply raked bow to keep the anchor chain clear of the vulnerable dome; such ships also drop anchor while going astern* (Yarrow)

Pilot's view of Cornwall's (F 99) flight deck which is large enough to take the EH.101 Merlin when it enters service (Jane's/H M Steele)

techniques for both area and point defence. Azimuth coverage is 360° with an elevation cover of 50° and a detection range of up to 500 km. Two antenna mounts, both with mechanical steering to give full azimuth and elevation coverage, ensure uninterrupted all-round view. Each mount carries a direction-finding receiving antenna together with transmit antennas. Received signals are analysed to identify those which may pose a threat and the selected signals are processed to allow generation of the jamming signal.

High-power transmitter subsystems, matched to the antenna, provide jamming capability against several types of target simultaneously. A comprehensive ECM library stores the appropriate countermeasures to a range of potential threats and, on receipt of a warning from the ESM system, the ECM processor selects the appropriate jamming mode to give fast response.

The main equipment cabinets can be situated below decks or installed in containers for mounting on the upper deck or superstructure, as has been done in a number of British ships serving in the Gulf. Such containers provide for easy removal and refit to other ships. In the British Navy the Type 675 is also known as 'Millpost' while an export variant is designated 'Guardian' by the company.

Manufacturer/Contractor
Thorn EMI Electronics Ltd, Sensors Group, Crawley.

DECOYS

Outfit DLB

Outfit DLB consists of four Hunting Engineering 130 mm 'Sea Gnat' six-barrel launchers which are grouped in pairs on either side of the bridge structure. The control unit, by Thorn EMI, provides for the launching of the most effective combination of rounds for distraction and centroid/seduction giving the type, speed and direction of the threat, the ship's speed and heading as well as wind direction and speed.

The munitions involved are the Mk 214 RF seduction, Mk 216 RF distraction rounds, and Mk 218 IR seduction rounds.

Manufacturers/Contractors
Thorn EMI/AB Precision Ltd (control unit).
Hunting Engineering (launchers).
Chemring Ltd (munitions).

Graseby Type 182 towed torpedo decoy

The Type 182 towed torpedo decoy is designed to decoy both active and passive homing torpedoes, using signals electronically generated within the ship and fed, via the towing cable, to electroacoustic transducers within the towed body. The Type 182 produces two independently controllable output signals which are radiated simultaneously from the towed decoy. An amplitude modulated noise signal simulates the ship's propeller noise and causes passive-homing torpedoes to be seduced away from the ship towards the towed decoy. The second signal is a swept CW signal, which simulates sonar echoes, in order to confuse or jam the guidance system of active homing torpedoes, thus causing them to miss the ship. The frequency bands covered by both types of output are switchable to meet tactical scenarios and to enable concurrent operation of other sonar and communication equipments.

Specifications
Towed decoy:
diameter: 533 mm (21 in)
length: 2,005 mm (79 in)
weight: 74 kg (163 lb)
Towing cable:
length: 411 m (1,348 ft)
diameter: 14.48 mm
weight: 269 kg (593 lb)

Manufacturer/Contractor
Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

CACS 5

Computer Assisted Command System 5 (CACS 5) was developed specially for the four Batch 3 Type 22 frigates. It is designed to interface, via the Command System Highway, with the new range of weapons incorporated in these ships, including the Harpoon surface-to-surface missile system, GSA8 gun system and Goalkeeper CIWS.

The architecture is based on a partially federated system, using a single Ferranti F2420 computer, with a second as an operating standby. The F2420 has a 1.9 million word memory and an operating speed of 2.3 Mips. All elements of the system are interconnected by the MIL-STD 1553B Command System Highway (CSH). Each of some 26 display positions contains three Argus M700/20 microprocessors to optimise operator effectiveness and minimise angle point failures. The consoles are based on the GEC-Marconi Series 9 display system and there is extensive use of video retiming and scan compression techniques. The principal input device is the light pen, replacing most of the rolling ball and keyboard functions.

CACS employs an all-vertical display concept.

Manufacturer/Contractor
GEC-Marconi Naval Systems Ltd, Combat Systems Division, Addlestone, Surrey.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11; Link 14.
Satcom: two Matra Marconi SCOT 1C Satcoms; MARISAT
Integrated communications system: ICS-3 integrated communications system.

WEAPONS CONTROL

Guided missile control systems

GWS.60. Harpoon
GWS.25 Mod 3. F 94 to F 96, F 98. Seawolf
GWS.25 Mod 4. F 92, F 93. Seawolf
(See under 'Weapons Systems' above.)

GSA8A electro-optical fire-control system

Type 22 Batch 3 frigates have two General Purpose Electro-Optic Directors (GPEOD, but referred to in speech as 'Gee-pod'), which are located on the bridge roof. These two directors are used to detect and track air and surface targets, and engage them with the 114 mm gun. The system operates in four modes: surveillance; air defence; surface engagement; and shore bombardment. There are four units in the system: the GPEOD, a console, a director electronic unit (DEU), a predictor unit and a director power unit. The system can also accept external track data from sources such as the ship's tracking radars.

The lightweight director provides smooth and accurate tracking with low-vibration and noise levels, using direct drive motors, inductosyns for accurate position feedback and the latest digital servo technology. High-acceleration rates (90°/s² in elevation and traverse) together with software-based slew control ensures fast reactions.

The sensor package includes a thermal imager, a television camera and a laser rangefinder. The thermal imager features the SPRITE detector, TICM (Thermal Imaging Common Modules) and a closed-cycle cooling engine. The TI operates in the 8-12 µm range with CCIR 625-line output and has a 3-17° field of view. There is a large object lens and a zoom facility. The TV camera is the Radamec Naval Mk 3 based upon the HK 202, and is a daylight, monochrome unit with fields of view of 3-18°. It is a CCD camera with Peltier cooler and a resolution of 450,000 pixels. The DEU contains the precision digital servos and Passive Angle Tracking System (PATS).

Manufacturer/Contractor

BAe Systems and Equipment Ltd.

Cumberland *(F 85). This ship has the full array of sensors and communications, including (just forward of the stack) two SCOT satellite antennas with a Marisat antenna between them* (Jane's/H M Steele)

RADARS

Type	Type 967*	Type 968*	Type 1006/1007	Type 911 (2)
Company	GEC-Marconi	GEC-Marconi	Kelvin Hughes	GEC-Marconi
Role	Long-range search/ acquisition	Low-level air search and target acquisition	Navigation	Fire control
Band	D (1,260-1,360 MHz)	E/F (2,950-3,040 MHz)	I	I; L/M
Beam	4.6 × 69°	2 × 30°	1 × 18°/0.75 × 18°	
Peak power	50-60 kW	3 MW	25 kW	
Gain			31 dB/34 dB	
Pulsewidth	6 µs	2 µs	0.8 or 0.25 µs/0.75 µs	
PRF	7,320 pps	750 pps	1,600/800 pps	
Scan rate	30 rpm	30 rpm	24 rpm	
Typical range			64 n miles	

Note:
* Antennas for Types 967 and 968 radars are mounted back to back

SONARS

Type 2016 sonar

The bow-mounted Type 2016 is installed in the earlier Batch 3 ships. This is an active/passive sonar which is reported to have a range of 10 km. It operates at 5.5, 6.5 and 7.5 kHz and features a cylindrical, retractable, stabilised array with 1.83 m (6 ft) diameter with 64 staves. It uses computerised signal processing based on a Ferranti FM 1600B.

Manufacturer/Contractor

Thomson-Marconi Sonar Systems UK Ltd, Stockport, UK.

Type 2050 sonar

The bow-mounted Type 2050 sonar is mounted in the later Batch 3 ships. This digital equipment uses distributed data processing with Ferranti Digital Signal Processing (DSP) cards and multiple Ferranti Argus M700 processors. The provision of extensive data processing facilities and improved man/machine interfaces allows one operator to control the complete system. The equipment interfaces with the combat system data highway, feeding data to the Ferranti CACS action-information system. Type 2050 operates at 4.5 to 7.5 kHz, using 64 5.5° beams.

Manufacturer/Contractor

Thomson-Marconi Sonar Systems UK Ltd, Stockport, UK.

Type 2031Z towed array sonar system

All Batch 3 ships are fitted with Type 2031Z towed array sonar. Using the innovative 'Curtis' architecture developed at the UK Admiralty Research Establishment in Portland, Dorset, the 2031Z electronic signal processing suite has, because of its compactness, a considerably lower installed cost than other systems, and yet provides a multi-octave broad and narrowband analysis facility capable of tracking the most elusive threats. The array itself is towed behind the ship and has a very low self-noise characteristic and is considerably longer than that used by any other self-contained sonar. It provides good bearing accuracy, even down to the very low-frequency end of the acoustic spectrum. The combination of an advanced signal processing architecture and a high-performance towed array ensures that the system is a dual-capability sensor, able to fulfil both the tactical and surveillance role. A 2031Z-equipped frigate can, therefore, act as an ASW picket or close escort.

Manufacturers/Contractors

Ultra Electronics Ocean Systems, Weymouth (inboard electronics suite).
Basys Marine, Barnstaple, Devon, UK (towed array).
Clarke Chapman, Gateshead (winching equipment).

AVIATION

AVIATION FACILITIES

General: These four ships were constructed to handle two Westland Lynx, one Westland Sea King or one EH.101 Merlin. They thus have the larger hangar and flight deck.
Flight deck: 23.0 × 14.0 m (75.7 × 48.5 ft)

HELICOPTERS

2 Westland Lynx HMA 3/8, or 1 Westland Séa King HAS 5, or EH 101 Merlin HAS 1 when it enters service.

PROPULSION

Specifications
System: Combined gas turbine or gas turbine (COGOG)
Main machinery: 2 RR Spey SM1A gas turbines; 22 MW (29,500 hp) sustained; 2 Rolls-Royce Tyne RM3C gas turbines; 8 MW (10,680 hp) sustained
Shafts: 2
Propellers: cp

FURTHER INFORMATION

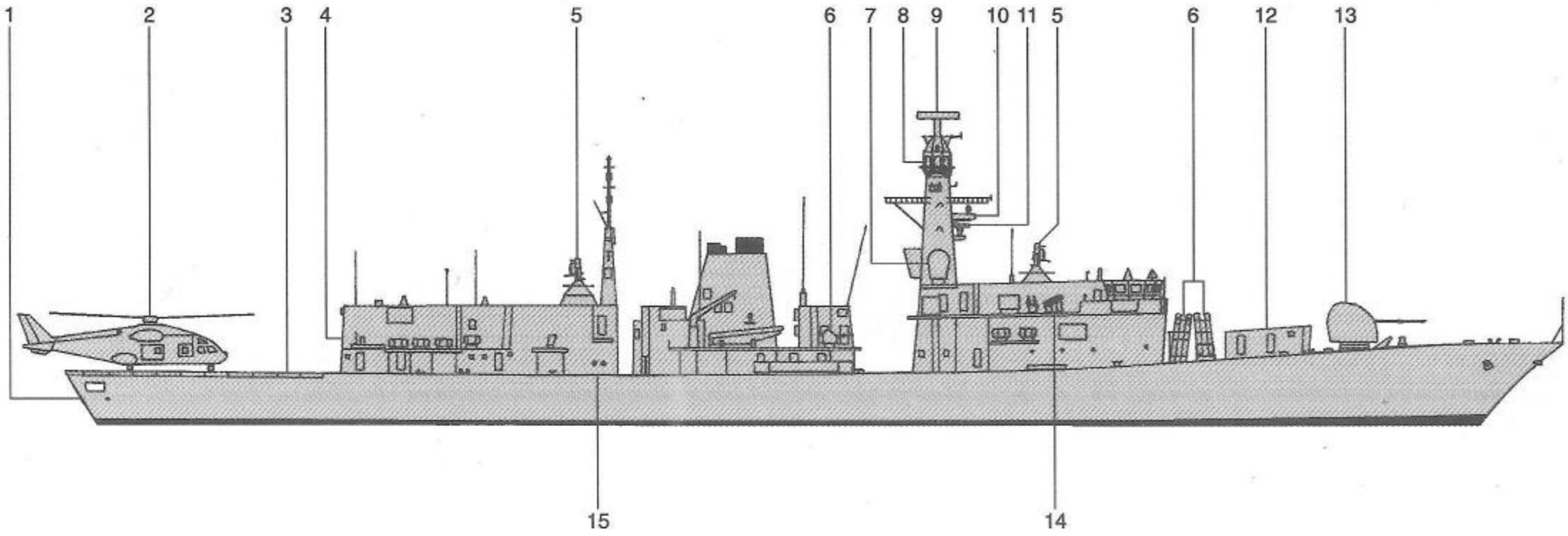
DESIGN

The Batch 3 ships have the same hull as the last four Batch 2 ships but with weapons and sensors rearranged on the upper deck to enable some of the lessons of the Falklands (Malvinas) War to be implemented. This included a 114 mm (4.5 in) gun on the foredeck, which displaced the four Exocet SSMs, which were replaced by eight Harpoons. A Goalkeeper CIWS was also included in the ship's armaments as a final defence should the Seawolf missile fail to deal with incoming aircraft or missiles.

Batch 3 ships have facilities for a Flag officer and his staff.

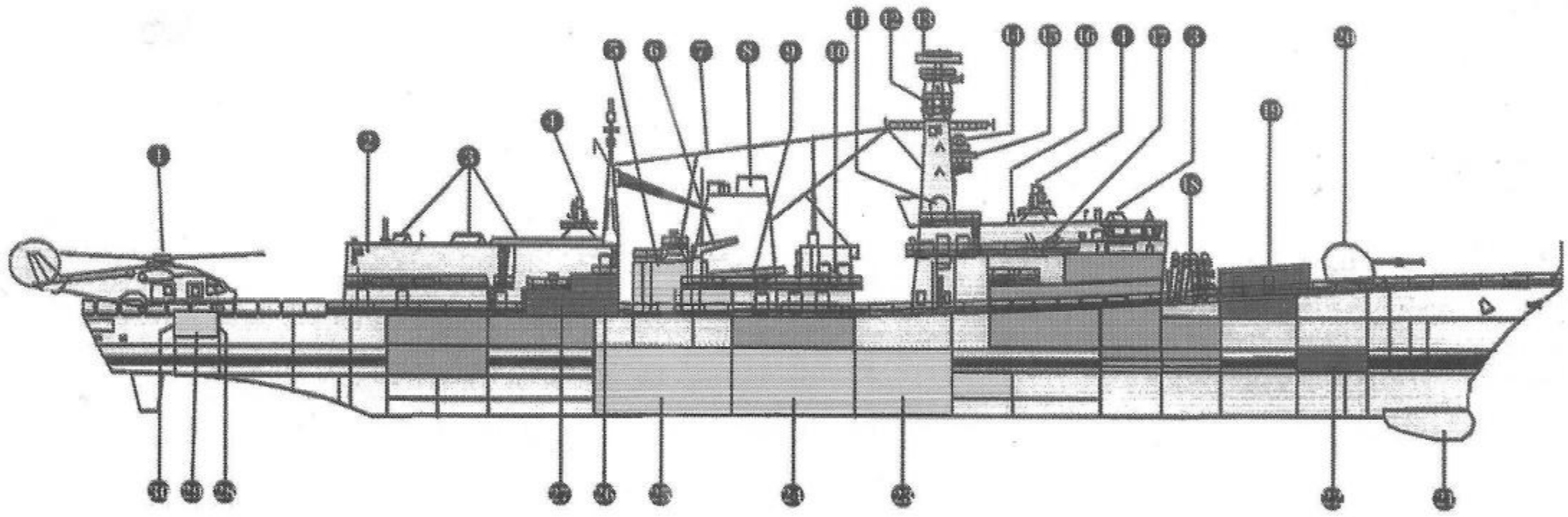
Cornwall *(F 99). Note the satellite platforms are empty*

DUKE (TYPE 23)



Norfolk (Ian Sturton)
1 *Type 2031Z towed sonar array (not in all)* **2** *EHI-101 Merlin (currently Westland Lynx HMA 8)* **3** *Flight deck* **4** *Hangar* **5** *GEC-Marconi Type 911 fire control* **6** *Oerlikon/DES 30 mm/75 Mk 1* **7** *Matra-Marconi SCOT 1D Satcom* **8** *Racal UAF-1 Cutlass intercept* **9** *Plessey Type 996(I) 3D air/surface search* **10** *BAe GSA 8B/GPEOD electro-optic director* **11** *Kelvin Hughes Type 1007 navigation radar* **12** *McDonnell Douglas Harpoon (two four-tube launchers)* **13** *Vickers 114 mm (4.5 in)/55 Mk 8 gun* **14** *Outfit DLB (Sea Gnat) six tube launcher* **15** *Two Cray Marine 533 mm (21 in) torpedo tubes*

Machinery
Accommodation
Magazines



1 *EH-101 ASW helicopter* **2** *Hangar* **3** *Radar absorbing material (RAM)* **4** *GEC-Marconi Type 911 fire-control radars* **5** *Upper auxiliary machinery room* **6** *Crane* **7** *High-frequency (HF) antenna* **8** *Infra-red exhaust filters* **9** *Avon Sea Rider RIB (two)* **10** *30 mm/75 DES guns (two)* **11** *SCOT 1D satellite dish (two)* **12** *Thorn EMI UAT intercept* **13** *Plessey Type 996(1) air/surface search radar* **14** *BAe GSA 8B/GPEOD electro-optic director* **15** *Kelvin Hughes Type 1007 navigation radar* **16** *VHF rod antenna* **17** *GEC-Marconi Sea Gnat decoy launchers (four)* **18** *McDonnell Douglas Harpoon Block 1C SSM launchers (eight)* **19** *BAe Seawolf GWS 26 Mk1 VLS launcher (32 canisters)* **20** *VSEL 114 mm Mk 8 gun* **21** *Ferranti-Thomson Sintra Type 2050 bow sonar* **22** *Forward magazine* **23** *Forward auxiliary machine room* **24** *Gas-turbine room* **25** *Electrical machinery room* **26** *Cray Marine 324 mm torpedo tubes (two per side)* **27** *After magazine* **28** *Dowty Type 2031Z linear towed array (amidships)* **29** *Perkins emergency diesel generator (starboard)* **30** *Type 182 towed torpedo decoy (port)*

GENERAL SPECIFICATIONS

Operator: United Kingdom
Type: 23

Class: DUKE

Built: 13
Active: 12
Building: 4

Displacement:
standard: 3,500 t
full load: 4,200 t

Dimensions
Length: 133 m (436.2 ft)
Beam: 16.1 m (52.8 ft)
Draught: 5.5 m (18 ft) (screws); 7.3 m (24 ft) (sonar)

Speed: 28 kts; 15 kts (diesel-electric)
Range: 7,800 n miles at 15 kts

Complement: 174 (12 officers) (accommodation for 185 (16 officers))

SHIPS

NORFOLK (F 230)

Builder	Yarrow Shipbuilders, Glasgow, UK
Laid down	14 Dec 1985
Launched	10 Jul 1987
Commissioned	1 Jun 1990

ARGYLL (F 231)

Builder	Yarrow Shipbuilders, Glasgow, UK
Laid down	20 Mar 1987
Launched	8 Apr 1989
Commissioned	31 May 1991

LANCASTER (F 229)

Builder	Yarrow Shipbuilders, Glasgow, UK
Laid down	18 Dec 1987
Launched	24 May 1990
Commissioned	1 May 1992

MARLBOROUGH (F 233)

Builder	Swan Hunter Shipbuilders, Wallsend-on-Tyne, UK
Laid down	22 Oct 1987
Launched	21 Jan 1989
Commissioned	14 Jun 1991

IRON DUKE (F 234)

Builder	Yarrow Shipbuilders, Glasgow, UK
Laid down	12 Dec 1988
Launched	2 Mar 1991
Commissioned	20 May 1993

MONMOUTH (F 235)

Builder	Yarrow Shipbuilders, Glasgow, UK
Laid down	1 Jun 1989
Launched	23 Nov 1991
Commissioned	24 Sep 1993

MONTROSE (F 236)

Builder	Yarrow Shipbuilders, Glasgow, UK
Laid down	1 Nov 1989
Launched	31 Jul 1992
Commissioned	2 Jun 1994

WESTMINSTER (F 237)

Builder	Swan Hunter Shipbuilders, Wallsend-on-Tyne, UK
Laid down	18 Jan 1991
Launched	4 Feb 1992
Commissioned	13 May 1994

NORTHUMBERLAND (F 238)

Builder	Swan Hunter Shipbuilders, Wallsend-on-Tyne, UK
Laid down	4 Apr 1991
Launched	4 Apr 1992
Commissioned	29 Nov 1994

RICHMOND (F 239)

Builder	Swan Hunter Shipbuilders, Wallsend-on-Tyne, UK
Laid down	16 Feb 1992
Launched	6 Apr 1993
Commissioned	Jun 1995

SOMERSET (F 82)

Builder	Yarrow Shipbuilders, Glasgow, UK
Laid down	12 Oct 1992
Launched	25 Jun 1994
Commissioned	May 1996

GRAFTON (F 80)

Builder	Yarrow Shipbuilders, Glasgow, UK
Laid down	13 May 1993
Launched	5 Nov 1994
Commissioned	Sep 1996

SUTHERLAND (F 81)

Builder	Yarrow Shipbuilders, Glasgow, UK
Laid down	14 Oct 1993
Launched	Feb 1996
Commissioned	Mar 1997

KENT ()

Builder	Yarrow Shipbuilders, Glasgow, UK
Laid down	Oct 1996
Launched	Jun 1998
Commissioned	May 2000

ST ALBANS ()

Builder	Yarrow Shipbuilders, Glasgow, UK
Laid down	May 1997
Launched	Nov 1998
Commissioned	Oct 2000

PORTLAND ()

Builder	Yarrow Shipbuilders, Glasgow, UK
Laid down	Oct 1997
Launched	Mar 1999
Commissioned	Mar 2001

Lancaster (F 229) on builder's trials. It was originally planned that there would be 23 of these ships, but it now appears probable that a total of 16 will be built (Yarrow)

Iron Duke *(F 234) conducting a shoot with the 114 mm (4.5 in) Mk 8 gun* (Jane's/H M Steele)

WEAPONS SYSTEMS

ANTI-SHIP MISSILES (ASM)

McDonnell Douglas RGM-84C Harpoon

Eight Harpoon anti-ship missile canisters are mounted immediately before the bridge screen, with two groups of four launchers each, with one group pointing to either beam. (Although the capacity is eight missiles, in peacetime only four missiles are usually carried).

The missiles are Block 1C versions, with certain additional options over earlier blocks, including the ability to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications

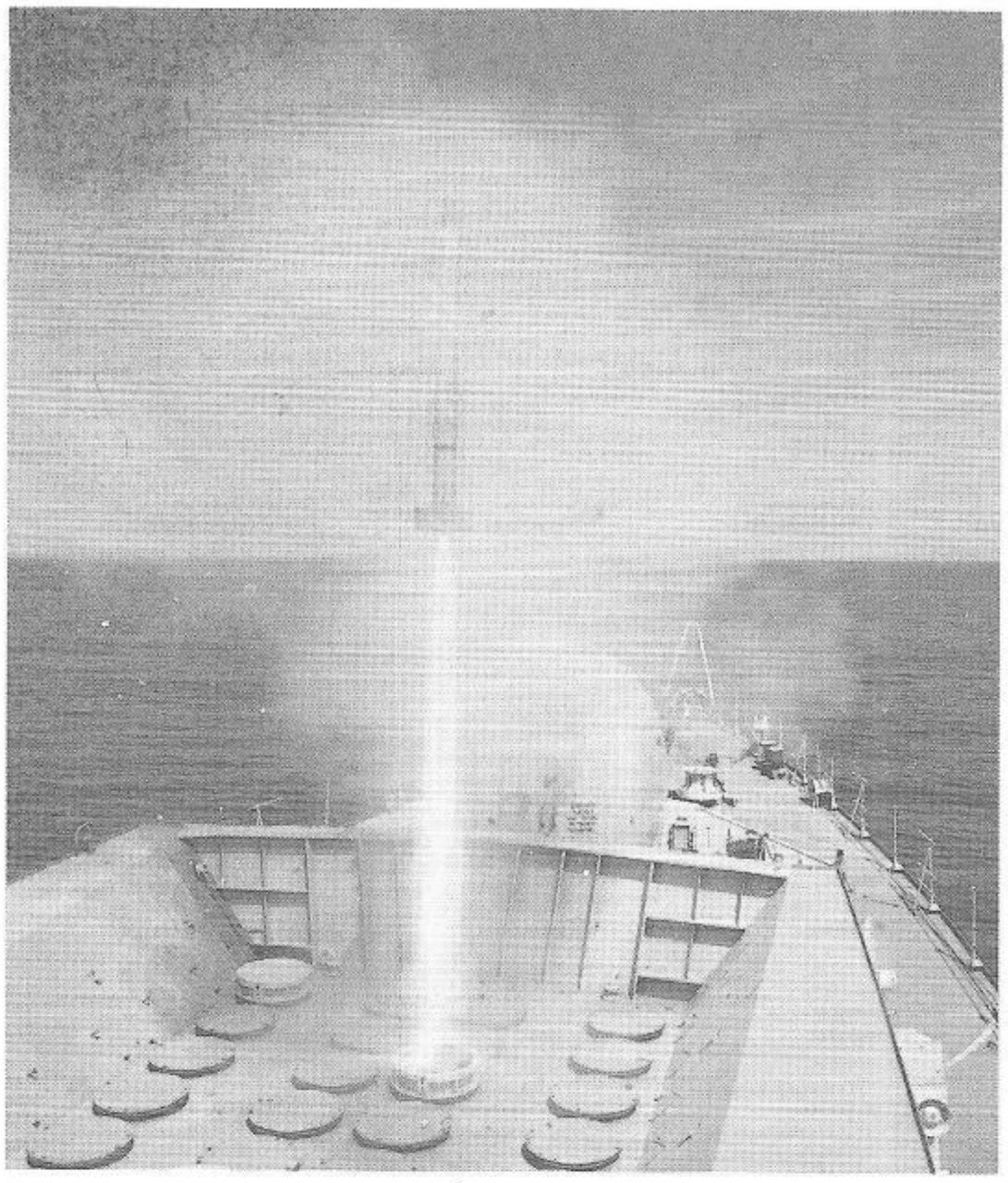
Block 1C

Length:

with booster: 4.63 m (15.19 ft)

without booster: 3.84 m (12.59 ft)

Diameter: 34 cm (1:12 ft)



Firing of vertical launch Seawolfs from HMS Norfolk (British Aerospace)

Weapons on the foredeck are 114 mm (4.5 in) Mk 8 gun. 16 vertical launched Seawolf in the zareba behind the gun and eight Harpoon anti-ship missiles. The radomes either side of the bridge are SCOT 1D Satcom antennas and on the bridge roof is the Type 911 fire controller. The circular device on the platform below the yard-arm is the electro-optical GPEOD. At the masthead is the Plessey Type 996(I) 3D radar and below it, encircling the mast the UAF-1 Cutlass intercept array (Jane's/H M Steele)

Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 kg)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

Seawolf (GWS.26) close area defence and anti-missile system

Type 23s are fitted with the Seawolf GWS.26 Mod 1, with 32 vertically launched missiles in a so-called 'zareba' on the foredeck. The GWS.26 system consists of a Type 996 air search radar, two Type 911 Mod 2 trackers, a missile and a command subsystem, using a Ferranti FM1600E processor.

GWS.26 features the most radical change with the introduction of vertical launch, a new launcher and the Type 911 Mod 2 tracker. The Seawolf VL missile is identical internally to earlier models but differs externally in having no taper at the rear. The missile is in a 3.3 m (10.8 ft) long, 60 cm (23.6 in) diameter, sealed launcher-container, which weighs 70 kg (154 lb) and is delivered to the ship in a transport frame. The canister, which has its own efflux management system, is then loaded into a missile silo. The canisters are grouped into eight-cell modules with a missile firing unit and efflux ducting system. The Type 911 fire controller is a dual-frequency radar with two antennas: one for I-band transmission and the other for L/M-band transmission. The I-band element is used for long-range tracking and high-angle engagements, its signal processing including fast-Fourier transform techniques to ensure effective operation in severe clutter. The L/M-band element is derived from the DN 181 Rapier Blindfire radar and provides accurate tracking at close range and at low levels. This facility is assisted by separate illumination of the upper and lower parts of the antenna.

Specifications

Seawolf VL
Length: 3 m (9.8 ft)
Diameter: 18 cm (7.0 in)
Wing span: 70 cm (27.5 in)
Weight: 140 kg (308.7 lb) (Seawolf VL)
Speed: Mach 2.5
Range: 3.2 n miles (6 km) (Seawolf VL)
Guidance: CLOS
Warhead: Royal Ordnance 14 kg (30.87 lb) fragmentation high explosive
Fuze: Impact proximity

Manufacturer/Contractor

British Aerospace Defence Ltd, Dynamics Division.

TORPEDOES

Cray Marine 324 mm anti-submarine torpedo launching system

There are four fixed Cray Marine 324 mm MTLS torpedo tubes (MTLS = Magazine Torpedo Launch System) with two on each side of the forward end of the hangar, firing across the weather deck. MTLS was developed specifically for the Type 23 frigates and, compared to STWS, it has an air flask mechanism which swings down on two metal arms and there is only one electrical interface. Two of these tubes are fitted, on shockproof mountings, to a steel frame with their mouths pointing out of the magazine through a bulkhead closure. An electropneumatic door protects the mouth of each tube. Between the port and starboard tubes is a roof-mounted mechanical handling system, produced by GEC Mechanical Handling, for ease of reloading. This can be moved to the torpedo racks and can extract a weapon which is then presented to the tubes and loaded manually. All four tubes can be reloaded in 9 minutes.

The system is integrated with the ship's sonar, command and control systems through an electrical equipment cabinet in the sonar instrumentation space, with data being exchanged along the CSH (Combat System Highway). Controls in the ASW Director's console consist of a fire-control panel, a torpedo selection panel and a jettison unit. The control panel selects the data acquisition mode, defines the target and selects the tube. It automatically opens the muzzle door, sets the weapon parameters then launches the weapon. In the event of major system failure there are two manually operated local launcher control panels in the aircraft hangar for weapon discharge.

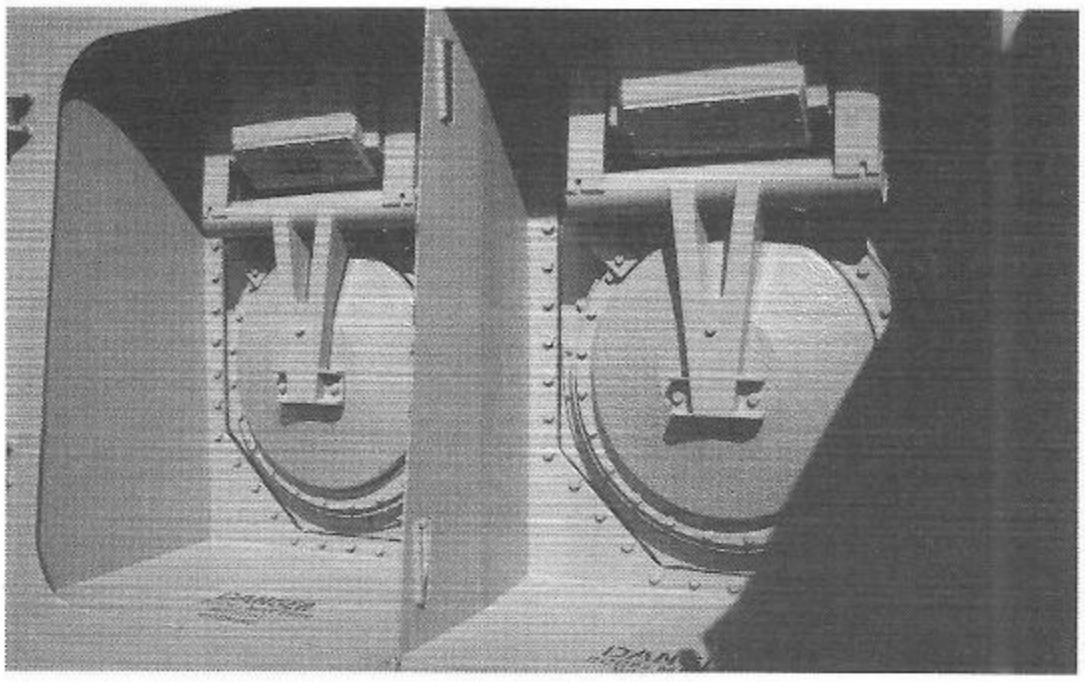
Manufacturer/Contractor

Cray Marine Ltd, Barnstaple, Devon, UK.

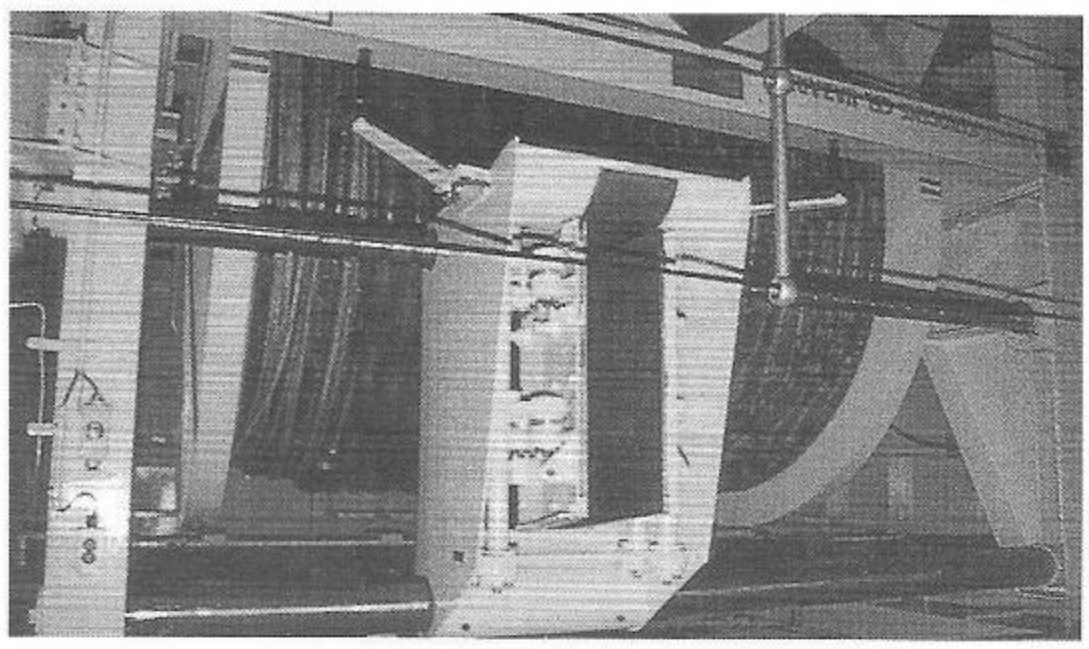
Sting Ray lightweight anti-submarine weapon

The Sting Ray lightweight ASW torpedo is intended for use in either deep or shallow waters, using a multiband, multibeam sonar, with a narrowband capability to give good Doppler discrimination against slow or quiet targets, while the broadband capability provides target discrimination, range and bearing resolution. The acoustic beam sweeps the whole volume of the water from the surface to the maximum operating depth.

The computer can be reprogrammed 'through the skin' whenever updated software, or programs tailored to a particular customer's operational requirements, are required. These programs then adapt themselves to the particular tactical and environmental conditions in which the torpedo operates. The computer also controls the signals, beam form, speed and trajectory of the weapon. Power is provided by a Chloride seawater-activated magnesium/silver chloride battery driving a Lucas DC electric motor which, in turn, drives two contrarotating ducted propulsors. The control surfaces are



Cray Marine 324 mm torpedo tubes are fixed, with the magazine in the forward end of the hangar (Jane's/H M Steele)



The Type 2031Z towed array occupies its own citadel and is streamed centrally to avoid asymmetric stresses on the stern. It can be towed at speeds up to 28 knots (Jane's/H M Steele)

actuated by an electrohydraulically driven proportional control system developed by BAe Dynamics Group.

When the torpedo enters the water it starts a preprogrammed search pattern designed to maximise the chances of target detection. On acquiring the target, the computer and active/sonar sensors make it almost impossible for the target to evade attack. The advanced software of the guidance/homing system allows it to filter out background noise and decoys and to make interception rather than perform a conventional tail-chase attack. Maximum speed of about 45 knots with an estimated endurance of some eight minutes at that speed.

Specifications

Length: 2.59 m (8.5 ft)
Diameter: 0.32 m (1.05 ft)
Weight: 267 kg (588.7 lb) (in air)
Warhead: 35 kg (77 lb), Torpex, directed energy
Speed: 45 kts
Range: 6 n miles (11 km)
Max depth: 750 m (2,640 ft)

Manufacturer/Contractor

GEC-Marconi Underwater Weapons Systems Ltd.

GUNS

Vickers 114 mm (4.5 in)/55 Mk 8 multipurpose gun

The Type 23 mounts a single 114 mm (4.5 in)/55 calibre Mk 8 gun in 'A' position. This weapon provides quick-reaction short-range air defence, engages surface targets including fast attack craft, and provides gunfire support to ground forces. The weapon system consists of the gun mounting, the ammunition feed system, the remote power control system, and the captain-of-turret panel.

The barrel is 6.22 m (20.4 ft) long, is fitted with a muzzle brake and fume extractor, and has a life of 3,300 rounds EFC. The mounting is completely enclosed in a glass fibre shield which protects it against the environment, blast and shrapnel. The loading system is hydraulically operated, with an autoloader which is manually fed by two loaders and has a capacity of six rounds. The hoist transfers them in two stages to the turret from where they are raised by a pivoting loading arm to the breech where they are inserted by a power rammer. After the shell is fired, the case is extracted automatically and ejected through a chute in the front of the mounting.

Specifications

Calibre: 114 mm
Length of barrel: 55 calibres
Traverse: 340° at 40°/s
Elevation: −10 to +55° at 40°/s
Muzzle velocity: 868.7 m/s (2,850 ft/s)
Weight of projectile: 21 kg (46 lb)
Rate of fire: 25 rds/min
Range:
anti-surface: 11.9 n miles (22 km)
anti-air: 6,000 m (20,000 ft)
Crew: 4 (gun captain (CIC), loading supervisor, 2 loaders)

Manufacturer/Contractor

Vickers Shipbuilding and Engineering Ltd, Barrow-in-Furness, Cumbria, UK.

MSI DS 30B 30 mm gun mounting

There are two 30 mm gun mountings either side of the deckhouse immediately before the stack. The weapon itself is an Oerlikon KCB 30 mm cannon, which is positively locked and gas-operated, with a belt-feed mechanism fixed to the cradle. The left-hand feed KCB-B02 is used in the DS 30B mounting. The ribbed barrel has constant rifling with 18 grooves and a 6° clockwise constant turn. The weapon includes a muzzle brake, axial recoil buffer and mechanical ignition system. The KCB normally fires in automatic mode only but in the DS 30B a single shot capability has been included.

The mounting is a locally controlled, power-driven and line of sight stabilised unit designed to allow a variety of sensor and weapon packages to be fitted. The pedestal contains the stabilisation and training machinery and the open gunner's position is on the right of the mounting with the 160-round magazine on the left. The mounting incorporates alloys to reduce magnetic signature and has clean lines to meet NBC washdown requirements. An integral battery pack provides up to 10 minutes of operation in the event of ship power failure.

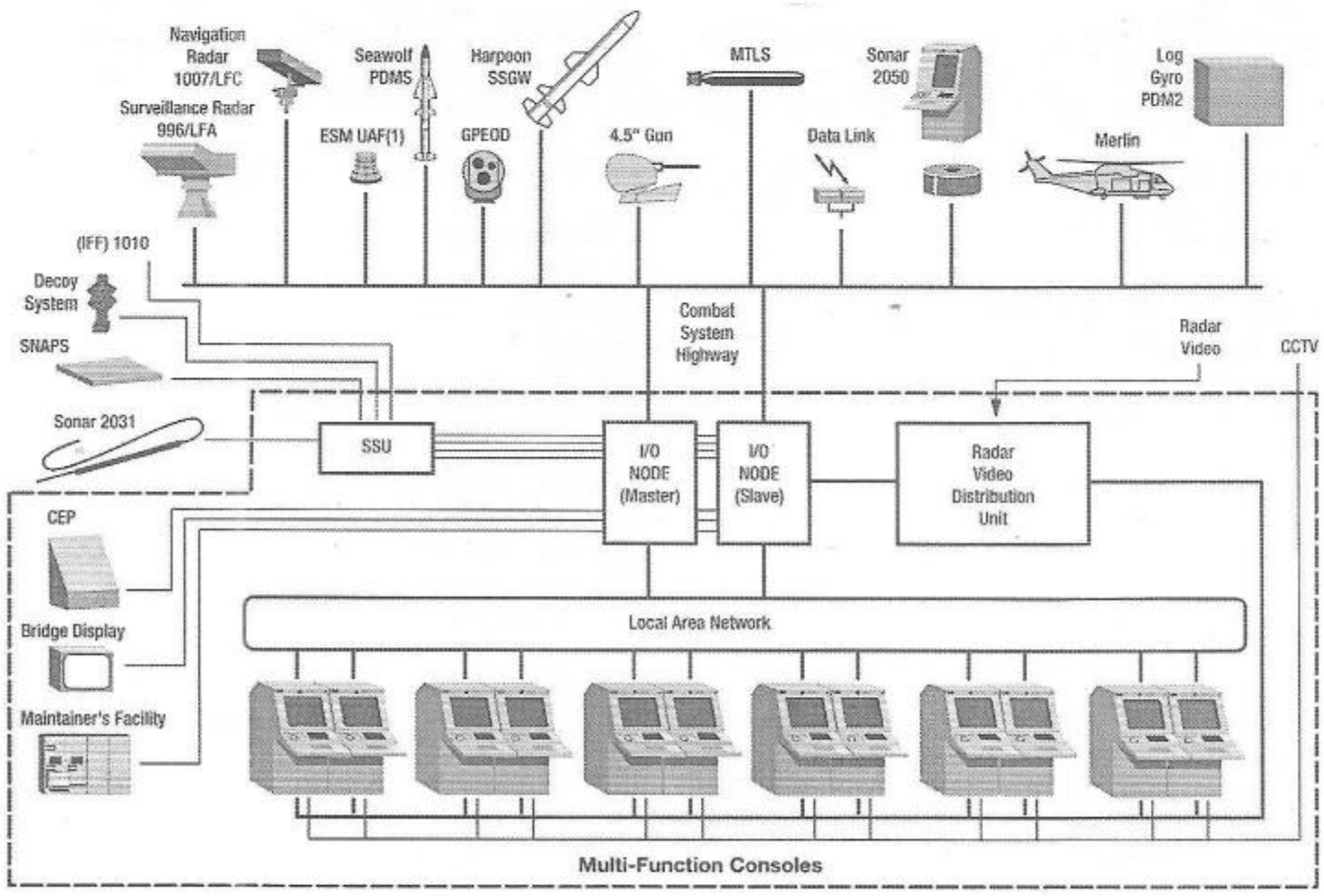
Specifications

Mounting (DS 30B)
Traverse: 230° (operational)
Elevation: −25 to +70°
Traverse speed: 55°/s
Elevation speed: 55°/s
Crew: 1

Gun (KCB)
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 650 rds/min
Ammunition weight: 870 g

Manufacturer/Contractor

MSI Defence Systems Ltd.



BAeSema Surface Ship Command System (SSCS) as installed in British Type 23 frigates (BAeSema)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Outfit UAF(1) ESM system

Outfit UAF(1) is an advanced automated ESM system which measures the parameters of received radar signals and compares them with a programmed library of parameters. Signal identity, bearing and threat category are then displayed in tabular format on colour displays, the first such to be used in an RN ESM system. Raw data on bearing and frequency are given on a display which can be overlaid with symbols and data derived from the signal analysis processor. Specific intercepts can be analysed in greater depth using a manual pulse analyser. The antenna is an eight-port array just below the head of the foremast.

Manufacturer/Contractor
Racal.

Outfit UAT ESM system

Outfit UAT has been installed in F 237 onwards during construction and will be retrofitted in F 230 to F 236 when funds are available. Originally known as Outfit UAF(X), UAT is heavily based on the Thorn EMI Sceptre XL equipment and is intended to measure all radar parameters with a 'significantly increased sensitivity' over current systems. Sceptre XL covers the band 2 to 18 GHz and it is assumed that UAT does the same, providing threat lethality classification and possessing a high signal sorting capability. UAT consists of three major components; an eight-element antenna array, a receiver/processor and an operator's console, and can be integrated with the ship's command system. The receiver is a channelised type developed originally by the Philips Research Laboratory. Processing is undertaken by a system based on transputers which are configured in a neural network type of architecture. An integrated receiver system is employed and software control is used heavily across the entire system. The display is based on that of the Sceptre XL with two screens, one a situation display and the other an alphanumeric tabular display with emitter data information.

Manufacturer/Contractor
Thorn EMI Electronics Ltd, Sensors Group, Crawley.

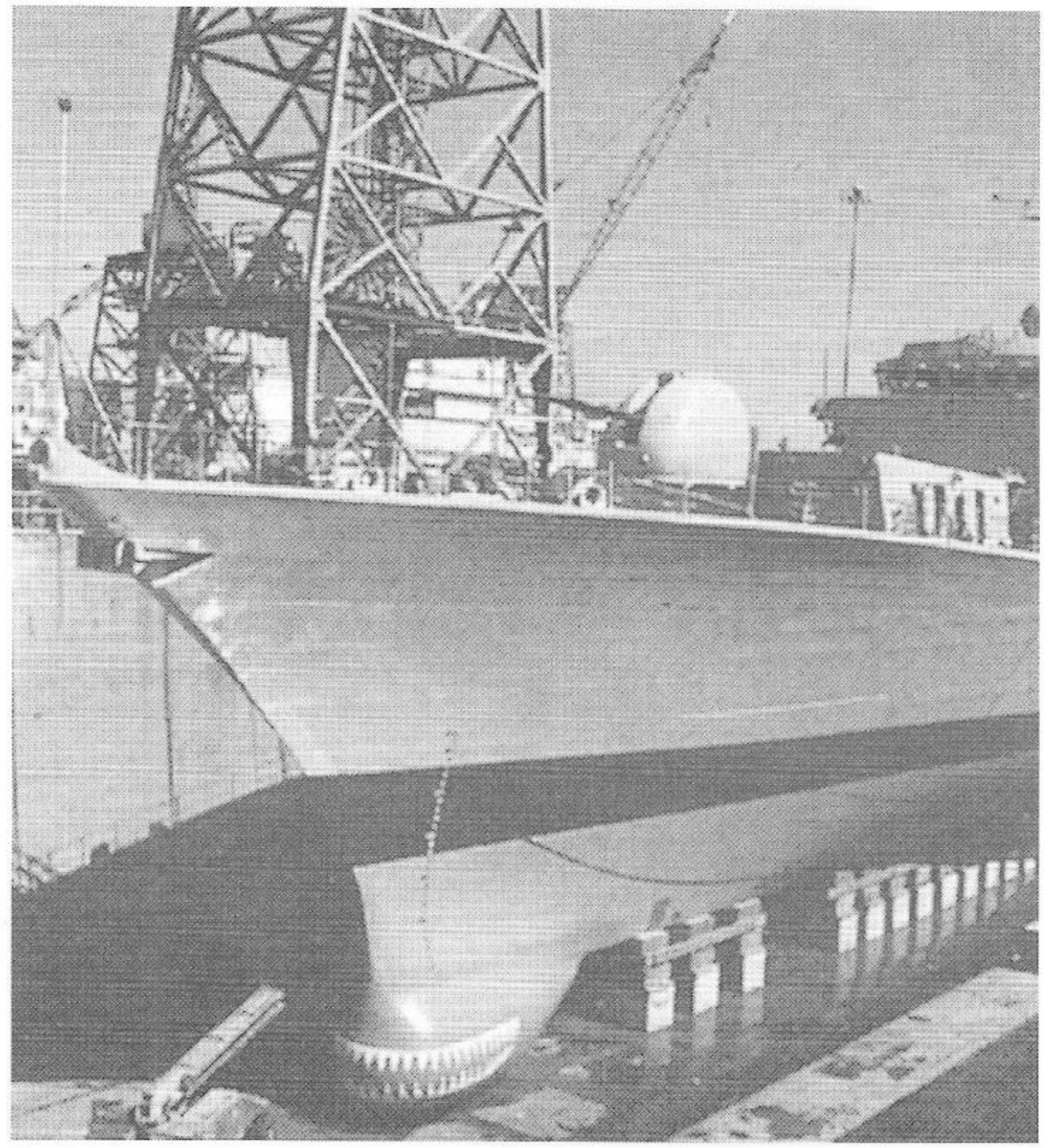
Type 675(2) radar detection and jamming system

Type 675(2) is installed in all Type 23s. It is an active/passive EW system designed to counter a wide range of operational threats, particularly those of radar-guided missiles. The system counters and confuses surveillance and missile homing radars by the use of selective jamming techniques for both area and point defence. Azimuth coverage is 360° with an elevation cover of 50° and a detection range of up to 500 km. Two antenna mounts, both with mechanical steering to give full azimuth and elevation coverage, ensure uninterrupted all-round view. Each mount carries a direction-finding receiving antenna together with transmit antennas. Received signals are analysed to identify those which may pose a threat and the selected signals are processed to allow generation of the jamming signal.

High-power transmitter subsystems, matched to the antenna, provide jamming capability against several types of target simultaneously. A comprehensive ECM library stores the appropriate countermeasures to a range of potential threats, and on receipt of a warning from the ESM system the ECM processor selects the appropriate jamming mode to give fast response.

Manufacturer/Contractor
Thorn EMI Electronics Ltd, Sensors Group, Crawley.

Stern view of Montrose *(F 236). Note the central hawse for the Type 2031Z variable depth sonar (VDS) to remove asymmetric stresses on the after part of the ship* (Jane's/H M Steele)



Type 2050 bow-mounted sonar on Monmouth *(F 235)* (Navy News)

DECOYS

Outfit DLB

Outfit DLB consists of four Hunting Engineering 130 mm 'Sea Gnat' six-barrel launchers which are grouped in pairs on either side of the bridge structure. The control unit, by Thorn EMI, provides for the launching of the most effective combination of rounds for distraction and centroid/seduction giving the type, speed and direction of the threat, the ship's speed and heading as well as wind direction and speed. The munitions involved are the Mk 214 RF seduction, Mk 216 RF distraction rounds, and Mk 218 IR seduction rounds.

Manufacturers/Contractors
Thorn EMI/AB Precision Ltd (control unit).
Hunting Engineering (launchers).
Chemring Ltd (munitions).

Graseby Type 182 towed torpedo decoy

The Type 182 towed torpedo decoy is designed to decoy both active and passive homing torpedoes, using signals electronically generated within the ship and fed, via the towing cable, to electroacoustic transducers within the towed body. The Type 182 produces two independently controllable output signals which

are radiated simultaneously from the towed decoy. An amplitude modulated noise signal simulates the ship's propeller noise and causes passive homing torpedoes to be seduced away from the ship towards the towed decoy. The second signal is a swept CW signal, which simulates sonar echoes, in order to confuse or jam the guidance system of active homing torpedoes, thus causing them to miss the ship. The frequency bands covered by both types of output are switchable to meet tactical scenarios and to enable concurrent operation of other sonar and communication equipments. The winch is located on the port side of the quarterdeck.

Specifications

Towed decoy
diameter: 533 mm (21 in)
length: 2,005 mm (79 in)
weight: 74 kg (163 lb)

Towing cable:
length: 411 m (1,348 ft)
diameter: 14.48 mm
weight: 269 kg (593 lb)

Manufacturer/Contractor

Graseby Marine (Graseby Dynamics Ltd), Watford, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

BAeSEMA SSCS action data automation

See under Further Information.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11, Link 14; Link 16 (in due course)
Satcom: Matra Marconi SCOT 1D Satcoms
IFF: Type 1010/1011

WEAPONS CONTROL

BAe GSA8B electro-optical fire-control system

Type 23 frigates have one General Purpose Electro-Optic Director (GPEOD, but referred to in speech as 'Gee-pod'), which is located on a small platform on the foremast. The system detects and tracks air and surface targets, and engages them with the 114 mm gun, using a single console. The system operates in four modes: surveillance; air defence; surface engagement; and shore bombardment. There are four units in the system: the GPEOD, a console, a director electronic unit (DEU), a predictor unit and a director power unit.

The lightweight director provides smooth and accurate tracking with low-vibration and noise levels, using direct drive motors, inductosyns for accurate position feedback and the latest digital servo technology. High acceleration rates (90°/s² in elevation and traverse) together with software-based slew control ensures fast reactions.

The sensor package includes a thermal imager, a television camera and a laser rangefinder. The thermal imager features the SPRITE detector, TICM (Thermal Imaging Common Modules) and a closed-cycle cooling engine. The TI operates in the 8-12 µm range with CCIR 625-line output and has a 3-17° field of view. There is a large object lens and a zoom facility. The TV camera is the Radamec Naval Mk 3 based upon the HK 202, and is a daylight, monochrome unit with fields of view of 3-18°. It is a CCD camera with Peltier cooler and a resolution of 450,000 pixels. The DEU contains the precision digital servos and Passive Angle Tracking System (PATS).

Manufacturer/Contractor

British Aerospace Systems and Equipment Ltd, UK.

RADARS

Type	Type 996(1)	Type 1007	Type 911
Company	GEC-Marconi	Kelvin Hughes	GEC-Marconi
Role	Surface search	Navigation	Fire control
Band	E/F	I	I
Beam	1.4 × 1.5°	1.0 × 18°/ 0.75 × 18°	
Peak power	125 kW	25 kW	
Gain	41 dB	31 dB/33 dB	
Pulsewidth	low angle — 65 µs; high angle — 31.5 µs	0.08/0.3/0.8 µs	
PRF	550-3,000 µs	1,600/800/400 pps	
Scan rate	12.5-20 rpm	26 rpm	

SONARS

Type 2050 sonar

The bow-mounted Type 2050 sonar uses digital signal processing and distributed data processing with Ferranti Digital Signal Processing (DSP) cards and multiple Ferranti Argus M700 processors. The provision of extensive data processing facilities and improved man/machine interfaces allows one operator to control the complete system. The equipment will interface to the combat system data highway feeding data to the BAeSema SSCS action-information system. Type 2050 operates at 4.5 to 7.5 kHz, using 64 5.5° beams.

Manufacturer/Contractor

Ferranti-Thomson Sonar Systems UK Ltd, Stockport, UK (prime system).

Type 2031Z towed array sonar system

Ships up to and including *Northumberland* (F 238) are fitted with Type 2031Z towed array sonar. Using the innovative 'Curtis' architecture developed by Professor Curtis at the UK Admiralty Research Establishment in Portland, Dorset, the 2031Z electronic signal processing suite has, because of its compactness, a considerably lower installed cost than other systems, and yet provides a multi-octave broad and narrowband analysis

CIC in Type 23 frigate (BAeSema)

SSCS operator's position at a Multi-Function Console (BAeSema)

facility capable of tracking the most elusive threats. The array itself is towed behind the ship and has a very low self-noise characteristic and is considerably longer than that used by any other self-contained sonar. It provides good bearing accuracy, even down to the very low-frequency end of the acoustic spectrum. The combination of an advanced signal processing architecture and a high-performance towed array ensures that the system is a dual-capability sensor, able to fulfil both the tactical and surveillance role. A 2031Z-equipped frigate can, therefore, act as an ASW picket or close escort.

Manufacturers/Contractors

Ultra Electronics Ocean Systems, Weymouth, UK (inboard electronics suite).

Basys Marine, Barnstaple, Devon, UK (towed array).

Clarke Chapman, Gateshead, UK (winching equipment).

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 27 × 16 m (88 × 52 ft)

HELICOPTERS

One Westland Lynx HMA 8

(EH.101 Merlin HAS 1 in due course).

Specifications

(Westland Lynx HMA.8)

Dimensions:

main rotor diameter: 12.80 m (42.00 ft)

tail rotor diameter: 2.21 m (7.25 ft)

length overall (rotors turning): 15.165 m (49.75 ft)

Weights

empty: 2,740 kg (6,040 lb)

empty, equipped (ASW): 3,343 kg (7,370 lb)

Performance:

cruising speed: 125 kts (232 km/h; 144 mph)

speed for max endurance: 70 kts (130 km/h)

max rate of climb: 661 m (2,170 ft)/min

time on station (ASW) 50 n miles (93 km) radius: 2 h

max range: 320 n miles (593 km)

max endurance: 2 h 50 min

Power plant: 2 Rolls-Royce Gem 41-1 with max contingency rating of 835 kW (1,120 shp)

Crew: 2 (pilot and co-pilot/observer

Radar: GEC-Marconi ARI5979 Seaspray Mk 1 lightweight search and tracking radar

Mission: Racal MIR-2 Orange Crop passive radar detection system; CAE Electronics AN/ASQ-504(V) internal MAD, optional GEC Sandpiper FLIR

General: ASW armament includes two homing torpedoes, 2 Mk 11 depth charges, or 4 Sea Skua semi-active homing missiles

EH 101 Merlin in the hangar of Westminister *(F 237) with plenty of room to spare, even for this comparatively large helicopter* (Westland)

Hel 2 Future helicopter is the EHI.101 Merlin (Westland)

Hel 1 Current helicopter is the Westland HMA Mk 8 (Westland)

PROPULSION

Specifications

System: Combined diesel-electric and gas turbine (CODLAG)

Main machinery: 2 Rolls-Royce Spey SM1A (F 229-F 236) or SM1C (F 237 onwards) gas turbines; 23.2 MW (31,100 hp) sustained; 4 Paxman 12CM diesels; 6 MW (8,100 hp); 2 GEC electric motors; 3 MW (4,000 hp)

Shafts: 2

Propellers: Skew-bladed, fixed-pitch propellers

FURTHER INFORMATION

PROGRAMME

The design that would eventually become the Type 23 had its origins in the late 1970s, when the early concept and feasibility designs were carried out for a new ASW frigate to succeed the very successful 'Leander' class. At that time the major issue in British warship design was the controversy over the relative merits of a 'short fat' hull and a 'long thin'. Such considerations were, however, overtaken by the Falklands (Malvinas) War of 1982 which brought with it many lessons about warship design, ship construction, materials to be used or

avoided, and combat systems. Not surprisingly, the entire operational requirement and ship design was completely reconsidered.

The first of class was eventually ordered on 29 October 1984, with the keel-laying in December 1985 and launch in June 1987. This was followed by a somewhat uneven pattern of orders, with three being ordered in September 1986 and an invitation to tender for another four being issued in October 1987, although only three orders were placed in July 1988. A second invitation to tender was issued in late 1988 and yet again resulted in only three orders on 19 December 1989. Long lead items for another six were ordered in 1990 but contracts were not placed until 23 January 1992 (three) and February 1996 (the final three).

NAMES

The class is named after British dukes, including *Iron Duke,* which is named after the first Duke of Wellington and is the only ship in the RN to carry a person's nickname rather than the formal surname or title. There is no F 232 pennant number as this is the number of the RN form used to report collisions and groundings' and is considered unlucky; the ship was, therefore renumbered F 229.

DESIGN

The hull is beamier than previous British frigate designs with the length matching the distance between peaks in a typical North Atlantic swell; thus, the Type 23s ride well and it is rare for waves to break over the forecastle, making bulwarks unnecessary.

Care has been taken to ensure that Type 23s have the lowest possible radar signature; all vertical surfaces are sloped at 7°, there are no 90° corners on the superstructure and the number of radar 'wave traps' has been minimised, with the attention to detail being emphasised by the bollards, which are not at the customary 90° to the deck. Flat horizontal surfaces are broken up by long, wedge-shaped strips of radar absorbent material (RAM), with a single strip on the bridge roof and three above the hangar, their apparently random, asymmetric siting being the outcome of computer assessments.

Numerous measures are incorporated to reduce the acoustic signature. All major equipment is raft-mounted, most machinery installed in acoustic cabinets, and the drive shafts are short, while the skew-bladed propellers have fixed pitch to avoid the noise made by controlled-pitch propellers. Underwater fittings are streamlined and the hull vibration monitoring display is on the helmsman's console, where it is under constant observation. There is a bubble device to reduce hull noise.

POWER SYSTEMS

The propulsion system is combined diesel-electric and gas turbine (CODLAG) which was selected to achieve extremely quiet running during ASW operations. Two Rolls-Royce Spey SM1A (F 229 to F 236) or SM1C (F 237 onwards) are sited in the gas turbine room. The diesels are, however, split: one pair of Paxman 12CM Valenta diesels is located in the upper auxiliary machine room on rubber mounts, but, since they are some 5 m (16.41 ft) above the waterline, there is no need for acoustic cabinets. Such cabinets are required for the other two Paxman diesels, which are in the forward auxiliary machine room, since they are well below the waterline. The two GEC electric motors are located in the motor generator room.

ASW SENSORS

The Type 2050 bow-mounted sonar has a very large dome, resulting in the Type 23's 6 m (19.7 ft) overall draft and leading to the requirement that the ship must go astern while anchoring so that the anchor does not foul the dome. The second ASW sensor is the Type 2031Z towed array, sited in its own citadel on the quarterdeck, which is streamed centrally to minimise asymmetric stresses on the stern. Towing speeds of up to 28 knots have been reported. A Type 182 torpedo decoy can also be deployed from its winch on the port side of the quarterdeck, although it is not normally carried at the moment.

FUTURE DEVELOPMENTS

The current towed array, Dowty Type 2031Z, may be replaced by Type 2087 in due course; this is an active low-frequency towed body with a VLF passive array.

The Type 23s will operate the new EH.101 Merlin HAS.1 in due course and all proving trials have already been completed, showing that the helicopter, despite its size can operate from this platform.

TRIALS

F 233 carried out a trial of a Dowty track management system (TMS) which uses a form of artificial intelligence.

DEPLOYMENT

F 233, F 229, F 234, F 237, F 239 and F 80 are based at Portsmouth and form the 4th Frigate Squadron. The remainder are at Devonport and form the 6th Frigate Squadron.

SSCS

The automated command system for the Type 23 frigates is the BAeSema Surface Ship Command System (SSCS), whose development is known to be some years behind that of the ship platform. This is, however, by no means a unique problem and it is now extremely rare for a software-centred system to be ready at the same time as the ship, and the system aboard the Dutch 'M' class frigates, for example, was only classified for use in the Adriatic in mid-1996, although the first of class had entered service in 1991. As the combat data system is now on the critical path for new ship development, the history of the SSCS project is of particular relevance.

THE REQUIREMENT

More than most projects, the Type 23's command system has suffered from change in the requirement. It was originally envisaged that the Type 23 would be an ASW frigate, with weapon and sensor systems that were similar in number and type to those in the Type 22 Batches 2 and 3 frigates, albeit with some advances in performance. It followed that the command system should also have been a development of the CACS 1, the command system installed in Type 22 Batches 1 and 2, even though this meant that the new system would be based on an old architectural concept and use dated technology, such as the FM1600 processor. Nevertheless, development of the new system, designated CACS 4, began.

Two unexpected problems then arose. First, the Falklands (Malvinas) War made it obvious that even CACS 4 would not be capable of performing the tasks now required. In addition to this, the planned role of the Type 23 changed from a specialised ASW frigate to a general purpose escort, which, in addition to its Type 2031 towed array and Stingray-based MTLS, would also have vertically launched Seawolf, Harpoon anti-ship missiles and a Vickers 114 mm gun.

In these new circumstances it became clear that the efforts to develop CACS 4 were misplaced and would almost certainly lead to failure. As a result, the MoD decided in late 1986 to cancel CACS 4 and to start again with a completely new system. An invitation to tender for a successor was subsequently issued, leading to a three-way competition between (the then) Ferranti, Plessey and Dowty-SEMA, with the last-named (now BAeSema) being declared the winner and receiving a development contract in August 1989 for what was then known as the New Command System (NCS).

These problems with the command system did not,

TABLE 1: TYPE 23 — ORDERS AND DELIVERIES

Serial	Invitation to tender		Contract placed				Ships
	Date	Hulls	Date	Hulls	Pennant No	Launched	In service
1			29 Oct 1984	1	F 230	Jul 87	Jun 90
2			Sept 1986	3	F 231	Apr 89	May 91
3					F 229	May 90	Nov 91
4					F 233	Jan 89	Jun 91
5	Oct 1987	4	11 Jul 88	3	234	Mar 91	20 May 93
6					235	Nov 91	24 Sep 93
7					236	Jul 92	May 94
8	Oct 1988	4	19 Dec 89	3	237	Apr 92	May 94
9					238	Apr 92	May 94
10					239	Apr 93	Nov 94
11		3	23 Jan 92	3	82	Jun 94	May 96
12					80	Nov 94	Oct 96
13					81	Mar 96	May 97
14	29 Feb 94	3	Feb 96	3	-	Jun 98	May 00
15					-	Nov 98	Oct 00
16					-	Mar 99	May 01

The original plan was for a total of 23 ships, but it now appears that the class will not exceed the 16 now in service or on order.

however, stop the ship construction programme which by this time was well down the line and the first three ships of the class had actually been launched. Indeed, the first six ships of the class entered service with the RN without an integrated combat system.

STAFF REQUIREMENT

The staff requirement for the new SSCS system, incorporated the lessons learnt from the Falklands (Malvinas) War and included:

Multifunction consoles with an easy-to-use MMI
Extensive command planning and management functions
Integrated organic ('own ship') sensor data, combined with datalink and intelligence inputs from external sources
Co-ordinated weapon assignment and control
A range of navigation functions and facilities
Very high system reliability and data resilience
Very high performance (response times) and high data (track management) capacity
On-board training, data recording and general system support (for example, system diagnostics).

This resulted in an extremely demanding specification, with a large-scale system using approximately two million lines of code in Ada and OCCAM languages, and running on about 200 processors.

FUNCTIONS

Stemming from the staff requirement, SSCS is required to:

Prepare and co-ordinate a tactical database from all available sensor data and collate it into an accurately defined tactical situation
Present the information comprising the agreed tactical picture in the appropriate manner to suit the current requirement of each member of the command team
Perform track management and link data co-ordination functions
Carry out and present threat evaluation
Provide the means to execute and to monitor weapons and sensor management policies in accordance with mission plans, rules of engagement, tactical doctrine and current tactical situation
Prepare and present weapon and situation status reports, including the identification of any conflicts in weapon/sensor assignment or the engagement process
Provide automatic assistance with combat system or data management tasks, including special-to-task functions
provide the facilities for planning, data recording, post-action analysis and training.

SOFTWARE DEVELOPMENT

The contract called for four operational releases of software, designated Phases 2 to 5 (Phase 1 was a 'trials only' release):

Phase 2 — ship safety and manual picture compilation. This comprised radar data processing, navigation, data recording, system management, tactical picture compilation (TPC), and manual data entry
Phase 3 — above water warfare. This comprised IFF; ESM; weapon control for Seawolf PDMS, 114 mm gun and Harpoon SSM and decoys; together with extensions of the TPC function to include automatic picture compilation
Phase 4 — subsurface and datalink capability. This involved passive and active sonar data processing, magazine torpedo launching system (MTLS), aviation (including Vectacs), datalink (including force picture compilation), anti-air and anti-submarine warfare command planning functions, and yet further extensions of TPC
Phase 5 — command planning, datalink extensions, training and support. This final phase includes command planning, extensions to existing functionality (datalink, aviation) training and recording

It was intended that the underlying 'machine', which consisted of the operating system (scheduler), communications and data management software, and the graphics 'engine' would be embodied in Phase 2. This meant that Phases 3, 4 and 5 would be achieved by the addition of more Applications code. This has been largely achieved, although some of the special purpose graphics engine software has had to be developed in support of particular phase requirements.

Software Status At 1 January 1997 the status was as follows:

Phase 2 software
seven ships were in service with Phase 2 software
Phase 3 software
One ship had completed trials
the software package was ready for installation in the seven ships with Phase 2 software as soon as they could spend sufficient time alongside
the shore-based training establishment had Phase 3 software in full use

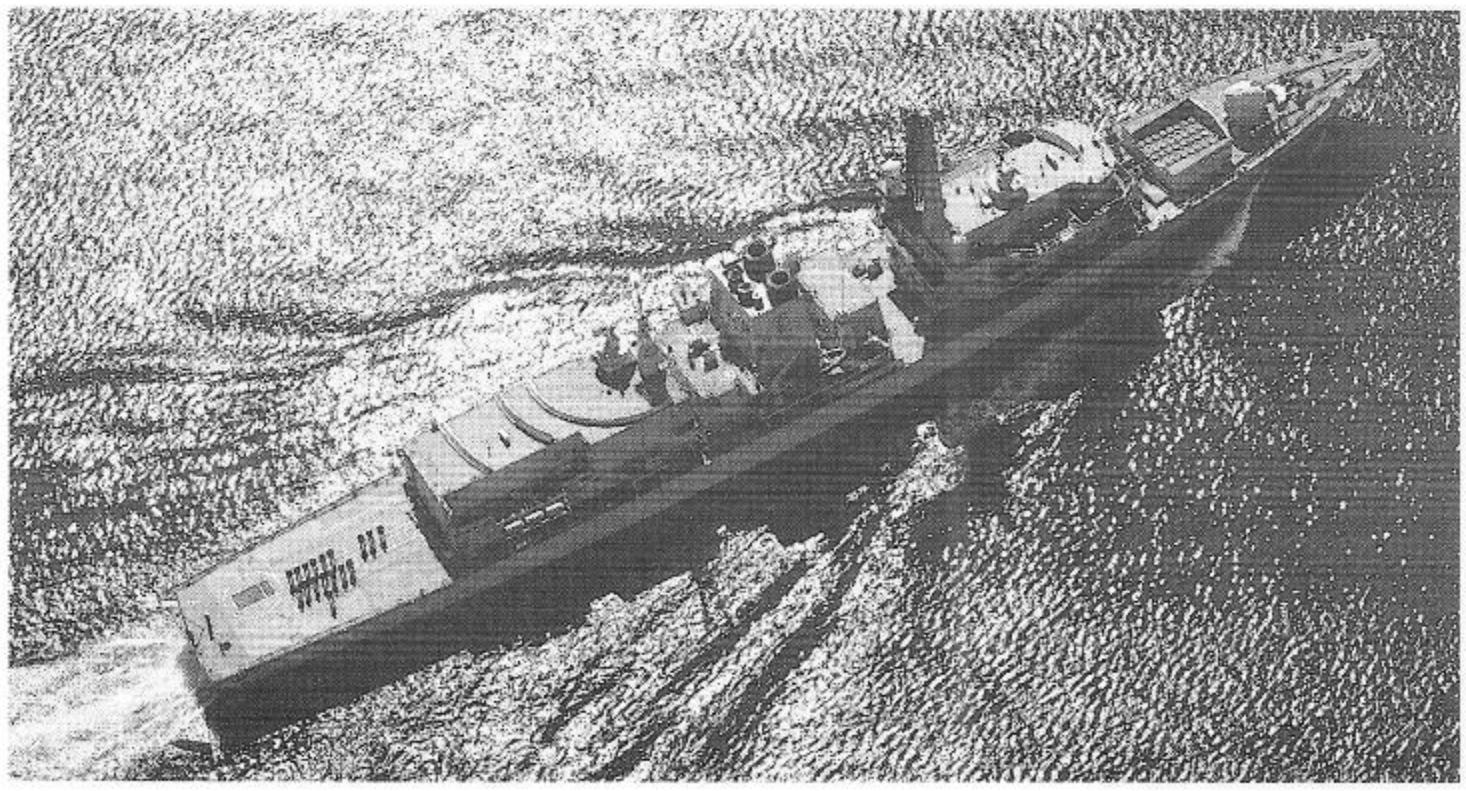
Phase 4 software
development was completed in late 1996
combat system integration trials were under way at the land-based test site.

Hardware status
two early-build ships were awaiting installation of SSCS hardware
three recently-completed ships had SSCS hardware but were still undergoing RN acceptance trials
all five ships would enter/return to service with SSCS Phase 3.

The SSCS system
SSCS is designed to provide:
The presentation of choices to operators and recommendations for action
the means by which the operator can execute the actions associated with his current task
a distributed-processing architecture with large memory and disc capacity, coupled with a high-bandwidth, dual-redundant, self-healing local area network, linking the principal elements of the command system.
high performance through the use of a specially developed software infrastructure, which enables large Ada applications to be run on a real-time, distributed-processing architecture.
replication and distribution of all processed data to all operator positions, with guaranteed data consistency without any degradation in system performance.

DAMAGE CONTROL AND SURVIVABILITY

Fire mains are triplicated and, while previous Type 23s are fitted with a dry main running along the keel to act as a last resort for fire hoses, *Northumberland* is the first to have a wet main, permanently filled with fresh water to prime the system for the smooth introduction of salt water, when required. There is a 150 per cent provision of ELSAs (Emergency Life Saving Equipment) positioned throughout the ship and all emergency gear, such as communications connectors and spanners, is luminous, while wiring is separated from bulkheads to reduce damage potential. There are hundreds of access boxes for the secondary communications system and all damage control personnel wear a communications box in a pouch. A particular concern from the Falklands (Malvinas) experience (and also from that of the US frigate *Samuel B Roberts*) is the disposal of water pumped into damaged compartments; as a result Type 23s have 11 overboard discharge pipes and 20 manually operated drain-down plugs, which are operated on orders from the CIC.



Argyll *(F 231) showing the strips of radar-absorbing material (RAM) positioned on the roofs of the bridge and hangar to disrupt the radar reflections given by the flat surfaces. Note also the layout of the Seawolf SAMs in the zareba on the foredeck* (UK MoD/PO Parker)

A Perkins emergency diesel generator powers emergency systems (five fire pumps, emergency lighting, and so on) and is located on the starboard side abreast the towed array citadel and thus well away from likely missile impact areas and other machinery. The cooling fan extracts onto the quarterdeck but, if all other extraction systems have failed, the generator room forward door is left open so that this fan will draw smoke from inside the ship.

The basic firefighting principle is to fight fires from the outside for as long as practicable. Thus, on detecting a fire there will be two separate halon shots, followed by water or foam, and only as a last resort will a five-sailor firefighting team be sent in.

PF 103

OVERVIEW

The PF 103 design has its origins in the Italian 'Albatros' class which was designed in the early 1950s under the aegis of the US-funded Mutual Defence Aid Pact (MDAP). The Italians designed a light anti-submarine frigate, with a full load displacement of 950 tonnes and eight were built during the 1950s. They went to three NATO navies: Denmark — four ('Triton' class); Italy — three ('Albatros' class); and Netherlands — one ('Lynx' class). They were powered by two diesels. All have now been stricken, the last to go being the Italian ships, which were stricken in 1986-91.

The Indonesian Navy was also expanding in the 1950s and ordered two ships to a slightly larger design which were launched in 1956-57 and designated the 'Puttimura' class. They displaced 1,200 tonnes and, as built, were armed with two 76 mm guns, two Hedgehog projectors and depth charges, although they were subsequently rearmed with Soviet weapons. Both have been stricken, one in 1979, the other in the 1980s. They had two shafts and were powered by three diesels.

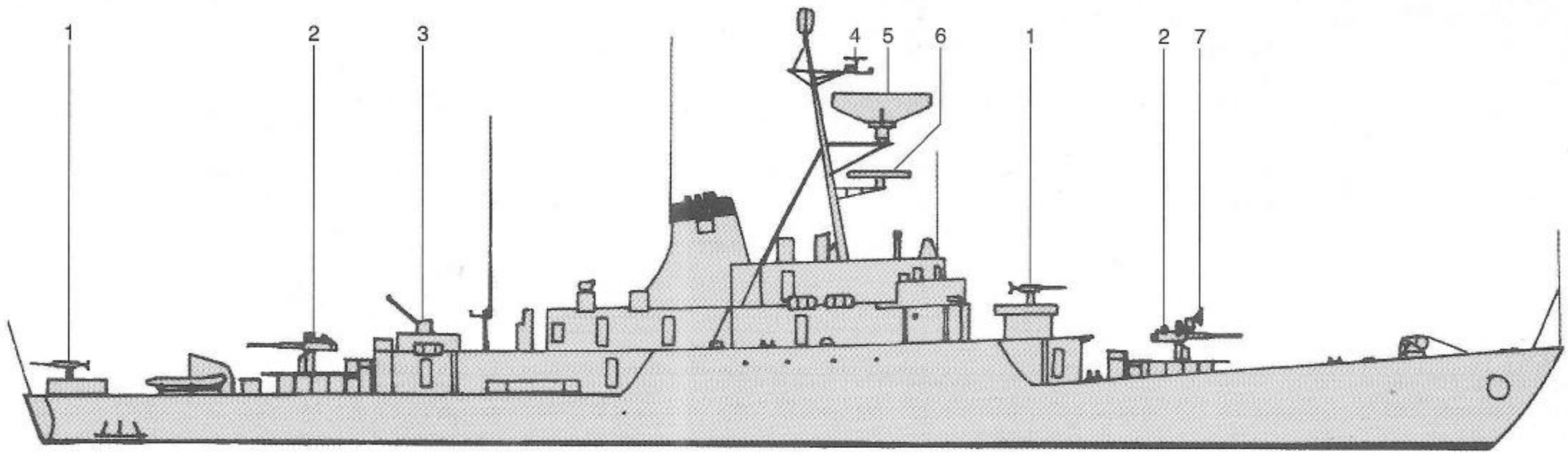
In the early 1960s the Iranian Navy was expanding under the Shah and was seeking a light patrol ship for duties in the Gulf. The programme came under the Mutual Aid Pact (MAP) and as the US was funding the project, they selected the design, which was that of the PF 103, but built in a US rather than an Italian yard. This became the 'Bayandor' class, with one pair being launched in 1963 and the second pair some years later in 1968. The design was very similar to the Indonesian 'Puttimura' class. Two were sunk in 1982 and two remain in service.

Finally, came the Thai 'Tapi' class. Two were ordered from the USA and were launched in 1970 and 1973. As built, they were virtually identical to the Iranian 'Bayandor' class, but differences have arisen as a result of subsequent refits. All remain in service.

Thus, of the sixteen built, six remain.

PF103 of Thai Navy (H & L van Ginderen Collection)

BAYANDOR (PF 103)



Bayandor (Ian Sturton)
1 *Oerlikon GAM-BO1 20 mm/70 cannon* **2** *US Navy 76 mm (3 in)/50 Mk 34 gun (open mount)* **3** *Bofors twin 40 mm/60* **4** *Raytheon 1650 navigation radar* **5** *Westinghouse SPS-6C air/surface search radar* **6** *Racal-Decca Type 1226 navigation radar* **7** *Western Electric Mk 36 fire-control radar*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: IRAN
Type: PF 103

Class: BAYANDOR

Acquired: 4
Active: 2

Displacement:
standard: 900 t
full load: 1,135 t

Dimensions
Length: 84.0 m (275.6 ft)
Beam: 10.1 m (33.1 ft)
Draught: 3.1 m (10.2 ft)

Speed: 20 kts
Range: 2,400 n miles at 18 kts; 4,800 n miles at 12 kts

Complement: 140

SHIPS

BAYANDOR (81)

Builder	Levingstone Shipbuilding, Orange, Texas, USA
Laid down	20 Aug 1962
Launched	7 Jul 1963
Commissioned	18 May 1964

NAGHDI (82)

Builder	Levingstone Shipbuilding, Orange, Texas, USA
Laid down	12 Sep 1962
Launched	10 Oct 1963
Commissioned	22 Jul 1964

WEAPONS SYSTEMS

GUNS

US Navy 76 mm (3 in) L/50 Mk 33 Mod 4 gun mounting

There are two single 76 mm (3 in) open mounts in 'A' and 'Y' positions. These are virtually the last mounts of this type left in service and use Mk 22 guns. Only the forward gun has a Mk 36 fire-control radar.

Specifications
Mk 22 gun
Calibre: 76.2 mm
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,700 ft/s) (new gun, nominal); 808 m/s (2,651 ft/s) (mid-life)
Range: 7 n miles (13 km)
Altitude: 8,951 m (29,368 ft)
Ammunition: 10.9 kg (24 lb)

Mk 33 mount
Traverse: 360°
Elevation: −14/15° to +85°
Traverse rate: 30°/s
Elevation rate: 24°/s
Rate of fire: 20 rds/min

Bofors 40 mm L/60 twin mounting

There is one twin Bofors 40 mm/60 in an open mounting on the after end of the superstructure.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,000 m/s (3,280 ft/s)

Bayandor *(81) — in 1994. Note that the forward gun has a Mk 36 fire-control radar; the after gun does not*

Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

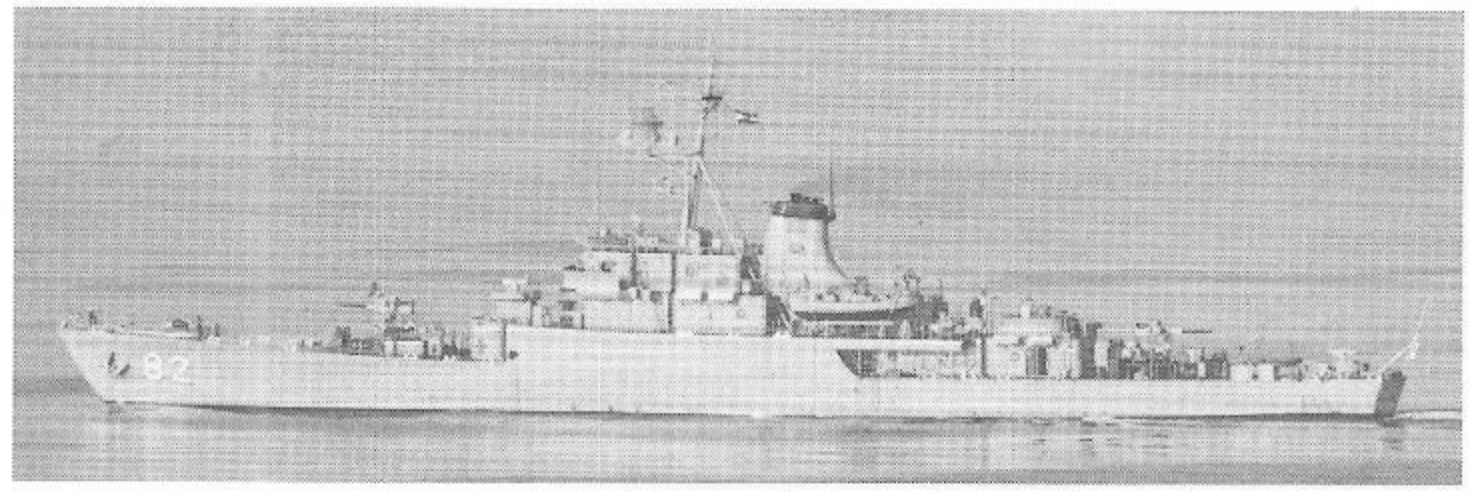
Oerlikon GAM-BO1 20 mm cannon

Two single, manually operated Oerlikon GAM-BO1 20 mm cannon mounts were installed in 1990; one on a small platform immediately before the bridge, the other on the stern.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +90°

M2HB 12.7 mm (0.50 in) machine guns
Two M2HB 12.7 mm machine guns are carried and can be mounted on flexible mounts.

Specifications
Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rds/min
Muzzle velocity: 883 m/s (2,900 ft/s)



Iranian frigate Naghdi *(82) on patrol in Gulf waters in July 1995. The two 76 mm guns are in open mounts, as are the 40 mm Bofors. Note one GAM-BO1 20 mm mount on the stern and the second in 'B' position just forward of the bridge*

Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-air: 1,380 m (4,500 ft)

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Mk 51 Mod 2 GFCS
There are two Mk 51 Mod 2 Gun Fire Control Systems (GFCS), one for each Bofors 40 mm mounting. The system is a lead-computing gunsight.

Mk 63 GFCS
The Mk 63 GFCS is associated with the 76 mm gun and is a combination of the Mk 51 sight and an SPG-34 radar (see table).

IFF
UPX-23.

SONAR

EDO AN/SQS-17
The AN/SQS-17 is a 1950s-vintage sonar, which was designed by EDO and built under licence in France. It is a hull-mounted, active search set, working at 12, 13 and 14 kHz, using a 24 stave 50 cm (19.6 in) diameter array. In view of the fact that all ASW weapons have been removed from these ships, the sonar may well also have been removed.

RADARS

Type	AN/SPS-6C	1226	1650	AN/SPG-34
Company	Westinghouse	Racal-Decca	Raytheon	Western Electric
Role	Air/surface search	Surface search	Navigation	Fire control
Band	D	I	I/J	I/J
Beam	3.5 × 30°	1.2°		2.5°
Peak power	500 kW	25 kW		50 kW
Gain	27 dB	30 dB		36 dB
Pulsewidth	4/1 µs	0.05/0.25/1 µs		0.3 µs
PRF	150/600 pps			1,800 pps
Scan rate	2.5-15 rpm	28 rpm		—

PROPULSION

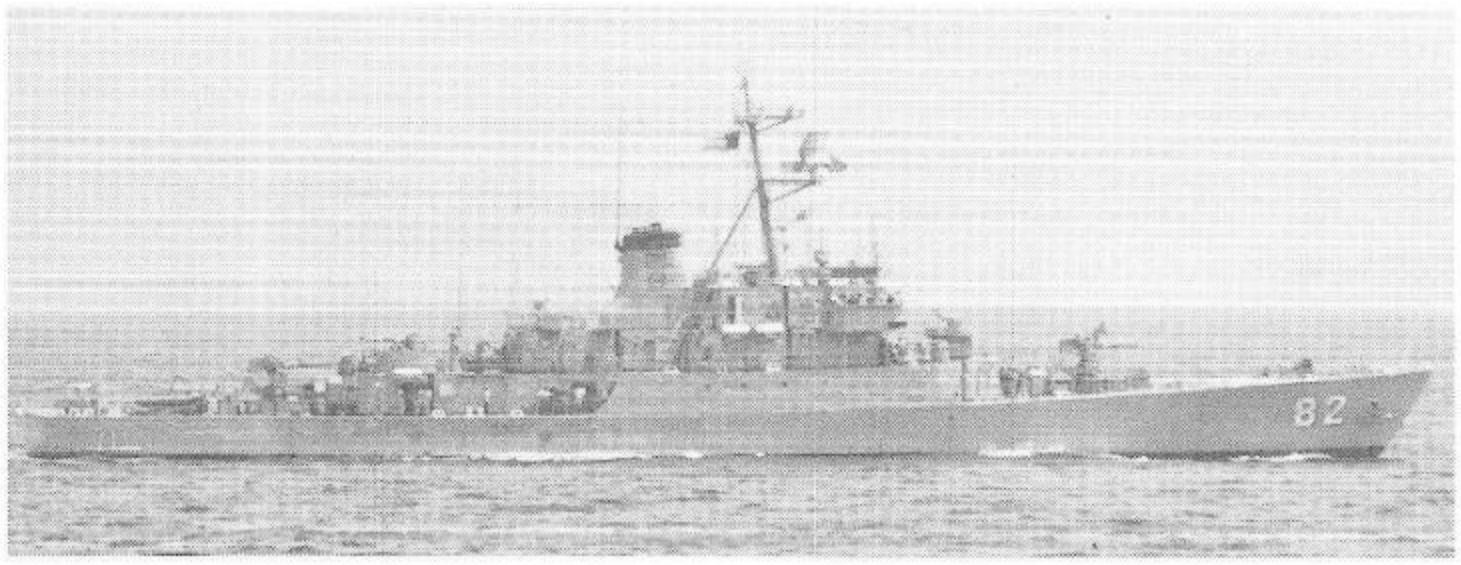
Specifications
System: Diesel
Main machinery: 2 Fairbanks-Morse 38TD8-1/8-9 diesels; 3.9 MW (5,250 hp) sustained

Shafts: 2
Note: *Naghdi* may now have different engines: see 'Modernisation (below).

FURTHER INFORMATION

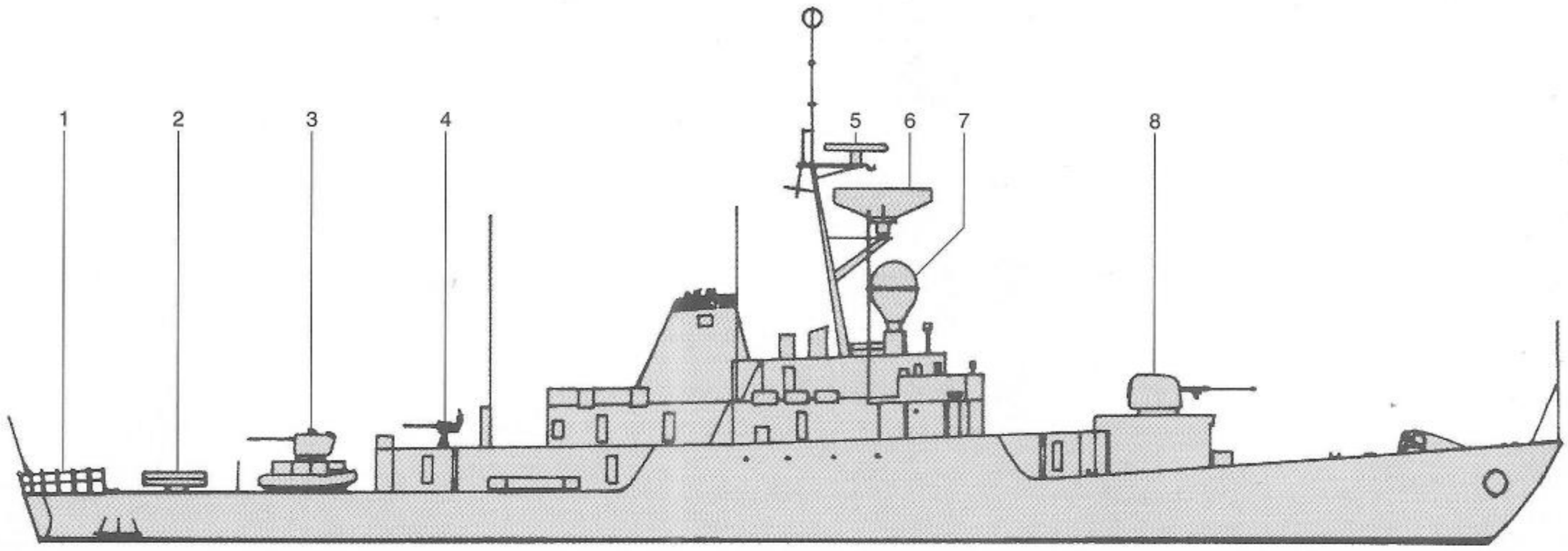
PROGRAMME
Four ships were supplied to Iran in the 1960s under the Mutual Aid Pact. Of these, two were sunk in the 1982 war with Iraq and two remain in service.

MODERNISATION
These ships have been modified several times during their service. *Naghdi* (82) completed a major refit in 1988 during which the engines were changed, probably to a new type. Russian-pattern 23 mm twin AA guns were removed and replaced by British-made GAM-BO1, 20 mm cannon. All ASW weapons have been removed and, although visual confirmation is impossible, it would appear likely that the sonar was removed at the same time. These ships are, therefore, suitable only for surface surveillance duties and have little combat capability except against light surface vessels. They are, however, very active and carry out frequent patrols in Gulf waters.



Naghdi *(82)*

TAPI (PF 103)



Tapi (Ian Sturton)
1 *Depth-charge rack* **2** *USN triple Mk 32 324 mm torpedo tubes* **3** *Bofors single 40 mm/70 cannon (open mount)* **4** *Oerlikon 20 mm/70 cannon (open mount)* **5** *Raytheon SPS-53E surface search radar* **6** *Signaal LW-04 air/surface search radar* **7** *Signaal WM-22/61 fire control* **8** *OTOBREDA 76 mm (3 in)/62 compact gun*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Thailand
Type: PF 103

Class: TAPI

Acquired: 2
Active: 2

Displacement:
standard: 885 t
full load: 1,172 t

Dimensions
Length: 83.8 m (275 ft)
Beam: 10 m (33 ft)
Draught: 3 m (10 ft) (hull); 4.3 m (14.1 ft) (sonar)

Speed: 20 kts
Range: 2,400 n miles at 18 kts

Complement: 135 (15 officers)

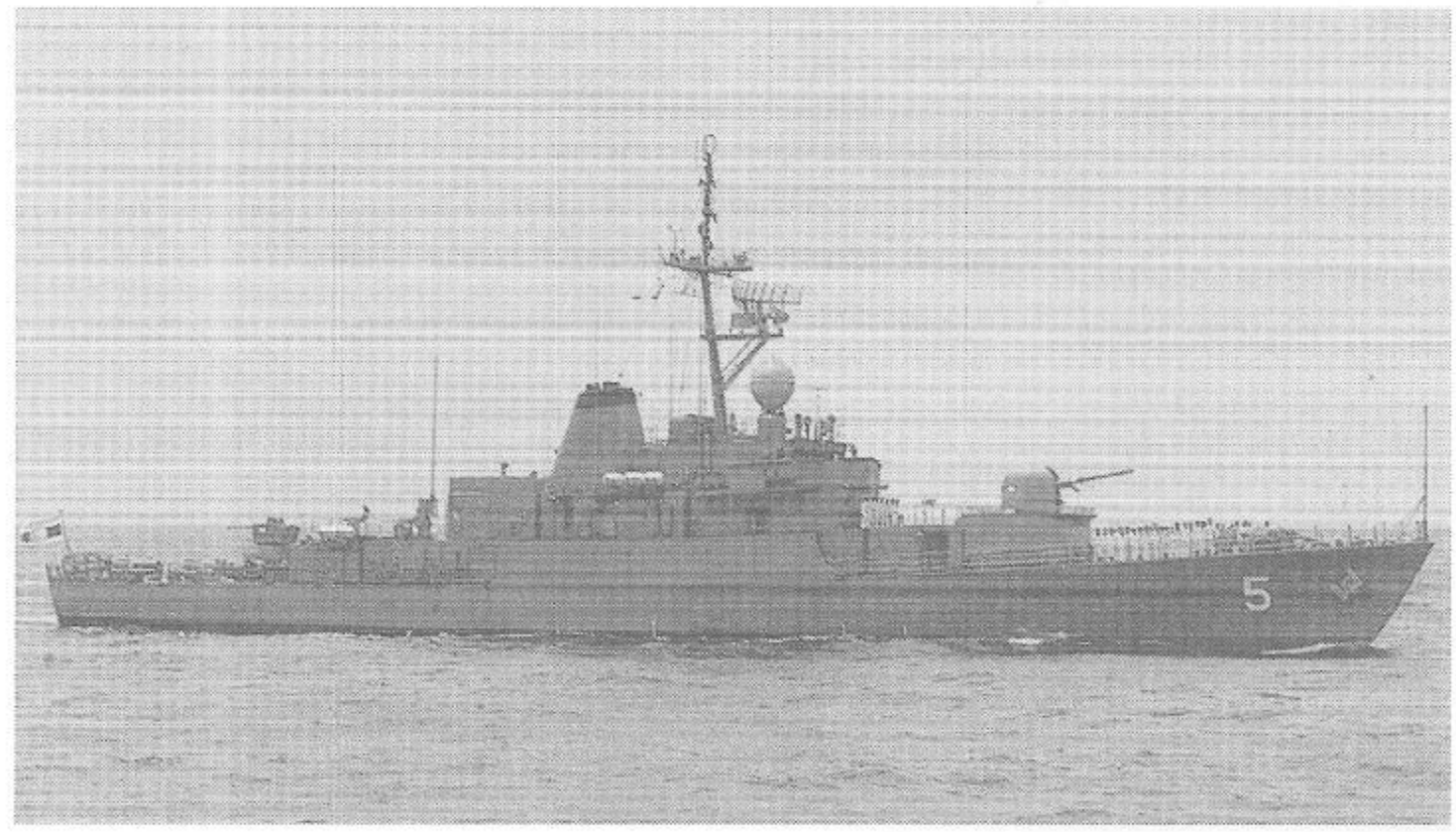
SHIPS

TAPI (431) (ex-5)

Builder	American Shipbuilding, Toledo, Ohio, USA
Laid down	1 Jul 1970
Launched	17 Oct 1970
Commissioned	19 Nov 1971

KHIRIRAT (432) (ex-6)

Builder	Norfolk Shipbuilding & Drydock, Norfolk, Virginia, USA
Laid down	18 Feb 1972
Launched	2 Jun 1973
Commissioned	10 Aug 1974



Tapi *(5) after the mid-1980s modernisation, with an OTOBREDA 76 mm forward and a Bofors 40 mm aft* (Royal Thai Navy)

WEAPONS SYSTEMS

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited on the quarterdeck.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

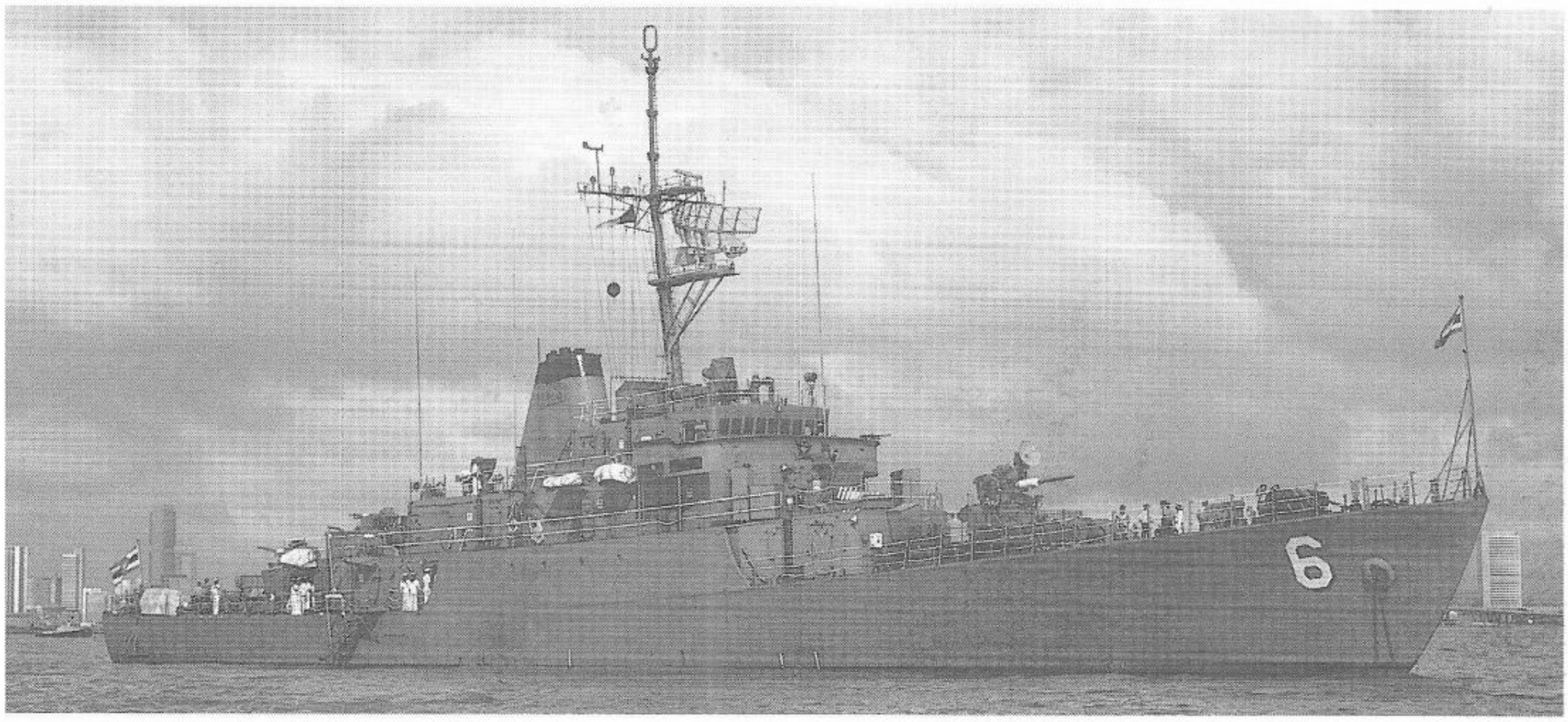
Alliant Techsystems Mk 46 Mod 5, 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Compact
One OTOBREDA 76 mm (3 in)/62 Compact is mounted in 'A' position. These ships were originally armed with two US Navy 76 mm (3 in) guns but these were removed in the mid-1980s' refits and replaced by one OTOBREDA 76 mm and one Bofors 40 mm.

Specifications
Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s



Khirirat *(6) in the ship's original form. Note the US Navy open 76 mm mounts in 'A' and 'Y' position, and the Mk 10 Hedgehog launcher below the bridge. Since this picture,* Khirirat *has been given a new pennant number, 432* (Jane's/HM Steele)

Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Bofors 40 mm L/70 twin mounting
There is one single Bofors 40 mm/70 in 'Y' position in a 'tub' mounting.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

Oerlikon 20 mm cannon
Two single, manually operated Oerlikon 20 mm cannon are mounted on the after superstructure.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +90°

M2HB 12.7 mm (0.50 in) machine guns
Two M2HB 12.7 mm machine guns are carried and can be mounted on flexible mounts.

Specifications
Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rds/min
Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-air: 1,380 m (4,500 ft)

DEPTH CHARGES

There is one depth-charge rack.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Signaal SEWACO-TH
These ships are fitted with a Signaal DAISY (Digital Action Information SYstem) C^2 system which is integrated with the various radars and fire-control systems to form the SEWACO-TH (SEnsor Weapon Control And COmmand — Thailand) system. The DAISY system is designed to present raw and/or processed sensor data from search and fire-control radars together with IFF, sonar, electronic warfare and electro-optic systems to create a picture of the tactical situation. The data may also be used to designate targets to weapon systems and to assist in operations with auxiliary functions such as ASW helicopter direction and tactical navigation. As far as is known there is no link to enable the system to supplement 'own ship' data with data from offboard sensors.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

Type	LW-04	AN/SPS-53E	WM 22-61
Maker	Signaal	Raytheon	Signaal
Role	Air/surface search	Surface search	Fire control
Band	E/F	I	I/J
Beam	2.2 × 10°	1.6 × 20°	Search: 1.5 × 7° Track: 2.4°
Peak power	1,100 kW	40 kW	200 kW
Gain	30 dB	30 dB	33.5 dB
Pulsewidth	1.3/2.6 µs	0.5/1.0 µs	0.22/0.45 µs
PRF	1,000/500 pps	750/1,500 pps	3,600/1,800 pps
Scan rate	7.5/15 rpm	15 rpm	60 rpm

IFF
UPX-23.

SONAR

DSQS-21 hull-mounted sonar systems
DSQS-21 is an active search and attack radar using computer-aided detection techniques for classification and tracking, and the information is presented on colour CRT displays to permit Doppler coding and the discrimination of data on the integrated displays. The transducer array is 1 m (3.28 ft) in diameter and consists of 32 staves.

Manufacturer/Contractor
STN Atlas Elektronik GmbH, Bremen, Germany.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Fairbanks-Morse 38TD8-1/8-9 diesels; 3.9 MW (5,250 hp) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

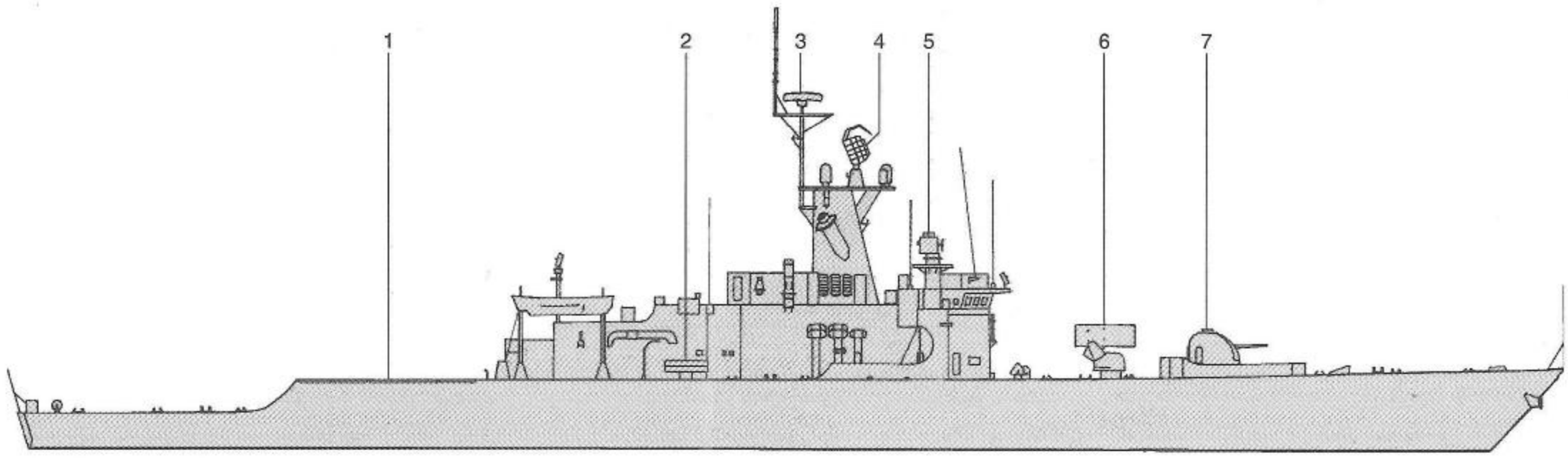
Tapi was ordered in 1969 and *Khirirat* in June 1971, and commissioned in 1971 and 1974, respectively.

MODERNISATION

Both ships underwent a major refit in the 1980s: *Tapi* completed 1983 and *Khirirat* in 1987. This included new gunnery and radars and a slight heightening of the funnel. Further modernisation took place in 1988-89 mainly to external and internal communications.

Khirirat *with the new pennant number, 432*

GALEANA (BRONSTEIN)



Nicolas Bravo (Ian Sturton)
1 *Flight deck (no hangar, few facilities)* **2** *US Navy Mk 32 324 mm torpedo tubes* **3** *Raytheon AN/SPS-10F surface search radar* **4** *Lockheed AN/SPS-40D air search radar* **5** *General Electric Mk 35 fire control* **6** *Mk 112 eight-cell launcher for ASROC* **7** *US Navy twin 76 mm (3 in)/50 Mk 33 enclosed mount*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Mexico
Type: Bronstein

Class: GALEANA

Built: 2
Purchased: 2

Active: 2

Displacement:
standard: 2,360 t
full load: 2,650 t

Dimensions
Length: 113.2 m (371.5 ft)
Beam: 12.3 m (40.5 ft)
Draught: 4.1 m (13.5 ft) (hull); 7 m (23 ft) (sonar)

Speed: 25 kts

Complement: 207 (17 officers)

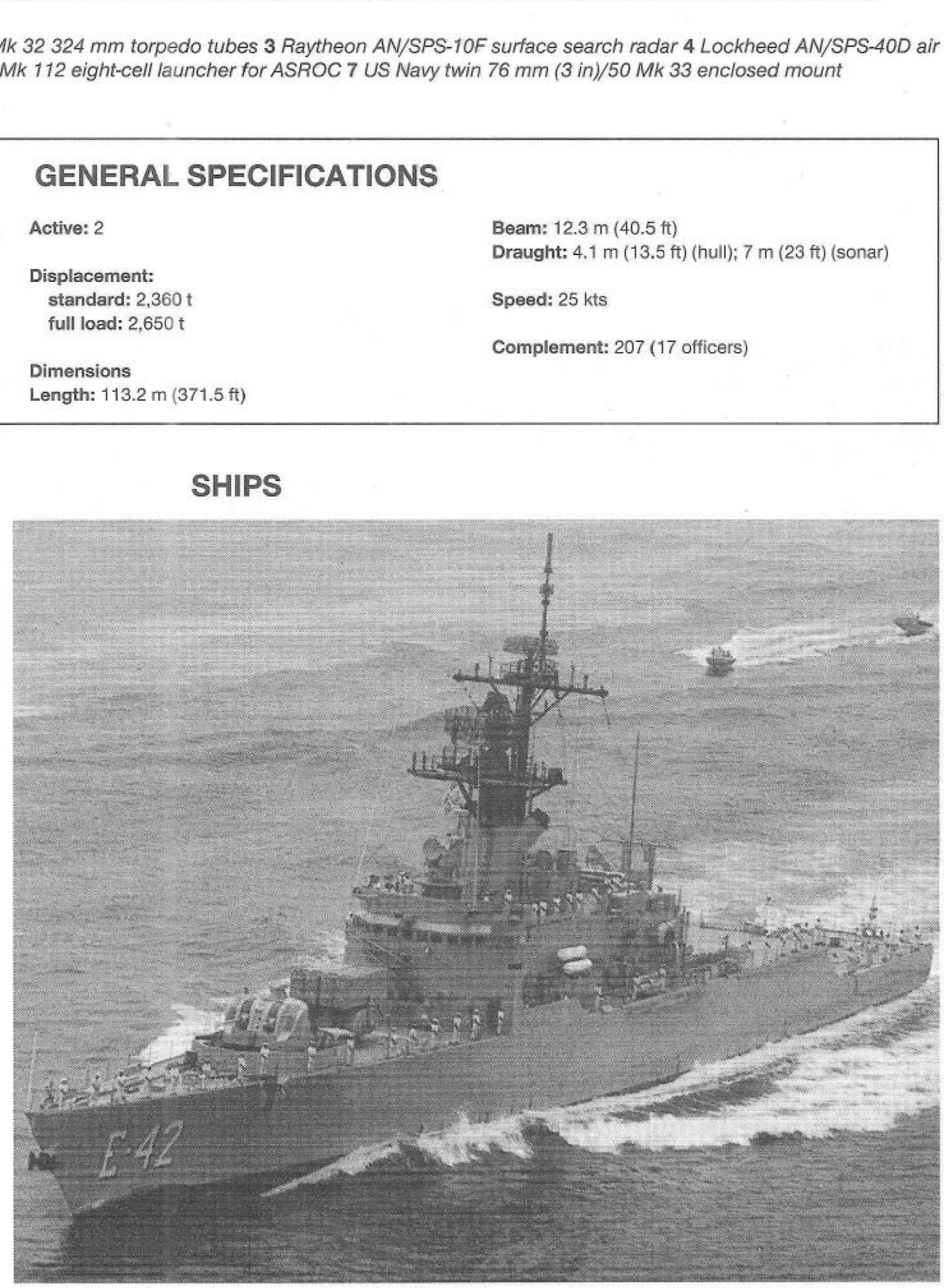
SHIPS

HERMENEGILDO GALEANA (E 42)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	16 May 1961
Launched	31 Mar 1962
Commissioned (US Navy)	16 Jun 1963 (*Bronstein* (FF 1037))
Stricken from US list	13 Dec 1990
Transferred by sale (Mexico)	12 Nov 1993

NICOLAS BRAVO (E 40)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	15 Sep 1961
Launched	9 Jun 1962
Commissioned (US Navy)	21 Oct 1963 (*McCloy* (FF 1038))
Stricken from US list	17 Dec 1990
Transferred by sale (Mexico)	12 Nov 1993



Hermenegildo Galeana *(E 42)*

WEAPONS SYSTEMS

ANTI-SUBMARINE MISSILES

Mk 16 launcher group

There is a single Mk 16 launcher group located on the foredeck, with a Mk 112 launcher, consisting of four pairs of launch tubes, each pair elevating independently. Maximum launch rate is three missiles per minute. These two ships have the early ASROC loading system, which is characterised by a vertical bridge screen.

Honeywell RUR-5A ASROC

ASROC consists of a Mk 46 torpedo with strap-on aerodynamic surfaces and a rocket motor to enable it to fly to within range of its submarine target. Attached to the rear end of the torpedo is a short airframe assembly of clam-like construction, held together by a steel band, with a Naval Propulsion Plant solid propellant booster and four trapezoidal aerodynamic surfaces to provide stability in flight. The torpedo has a dome-shaped frangible plastic nose cap to protect the transducer as it enters the water. Payload is an Alliant Mk 46 Mod 5 torpedo, which has a seeker designed specifically to detect most types of target including submarines with anechoically coated hulls and has an estimated acquisition range of 460 m (1,509 ft).

When a submarine target is detected, it is tracked and the attack console's fire-control computer predicts the target's position. The launcher is turned in the appropriate direction and elevated to an angle appropriate to the range. The fire-control computer then

orders the launch and the booster burns for a programmed time of between 1 and 4 seconds, by which time the missile will have reached a height of between 60 and 305 m (197 and 1,001 ft), although the aerodynamically stable airframe enables it to coast up to 600 m (1,969 ft). On reaching the programmed position, an explosive bolt cuts the steel band holding the airframe assembly sections together and, as they separate, the parachute deploys to retard the torpedo's fall, water, entry taking place some 14 to 50 seconds after launch. As the torpedo enters the water, the frangible nose cap breaks off and the torpedo begins its search for the target using a predetermined pattern.

Specifications

ASROC missile
Length: 4.6 m (15.1 ft)
Diameter: 32.5 cm (12.8 in)
Span: 84.5 cm (33.3 in)
Weight: 435 kg (959 lb)
Range: 0.86-5.39 n miles (1.6-10 km)
Speed: Mach 0.9

Mk 46 Mod 5 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Manufacturer/Contractor

Honeywell, USA.

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited in the waist. It is reported that the torpedoes used are Mk 46.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications

Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

US Navy 76 mm (3 in) L/50 Mk 33 Mod 4 gun mounting

There is one twin 76 mm (3 in) mount on the foredeck. This is a twin gun, power-driven, base-ring mount, with local or remote control, with a gun house (Mod 4). It uses two Mk 22 guns.

Specifications

Mk 22 gun
Calibre: 76.2 mm
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,700 ft/s) (new gun, nominal); 808 m/s (2,651 ft/s) (mid-life)
Range: 7 n miles (13 km)
Altitude: 8,951 m (29,368 ft)
Ammunition: 10.9 kg (24.0 lb)

Mk 33 mount
Traverse: 360°
Elevation: −14/15° to +85°
Traverse rate: 30°/s
Elevation rate: 24°/s
Rate of fire: 100 rds/min

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

AN/WLR-1

AN/WLR-1 is a US-manufactured, manually operated, radar warning system covering frequencies from 50 MHz to 10.75 GHz, employing a number of separate antennas.

AN/WLR-3

AN/WLR-3 is a 1950s-vintage radar warning receiver.

ELECTRONIC COUNTERMEASURES (ECM)

AN/ULQ-6

AN/ULQ-6 is a deception jammer which was originally developed to deal with the threat posed by Soviet missiles such as SS-N-2.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers

There are two Mk 33 systems. Mk 33 is the designation for a system consisting of four launchers, each with six fixed tubes arranged in two rows at elevation angles of 55, 65 and 75°. RBOC uses a Mk 164 Mod 0 bridge launcher control as a back-up control but the Mk 158 Mod 0 is the master launch control.

Each launcher has a ready-use locker with up to 40 cartridges depending upon type.

Specifications

Munitions	Dimensions (L × D)	Weight
Chaffstar I	412.1 × 112.3 mm	4.15 kg
Chaffstar II	1,067 × 112 mm	18.2 kg
Gemini	434 × 112 mm	5.2 kg
Hiram I	416.8 × 112.3 mm	4.1 kg
Hiram II	889 × 203 mm	13.3 kg
Loroc	1,200 × 112 mm	14.74 kg

Manufacturer/Contractor

Loral Hycor, USA.

T-Mk 6 Fanfare

The T-Mk 6 torpedo decoy consists of two winches each with a cable and a 'fish' containing a mechanical acoustic device.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Mk 56 Gun Fire Control System (GFCS)

The Mk 56 GFCS consists of a radar/optical director and a below-decks computer fit and requires a crew of five. The system can issue simultaneous gun and fuze-setting orders to the gun mounts and can produce a very fast fire-control solution, typically within 2 seconds of beginning to track.

The target is designated through the SPS-40B (air search) and SPS-10C (surface search) radars and the director is turned in the appropriate direction. In theory the director is capable of turning 360° in azimuth, although this is restricted in practice, while the elevation is −15 to +85°. Using elevation and traverse error signals, when the target moves out of the radar's line of sight, the radar antenna keeps on the target through the servo system. The error signal inputs are received by the tracking control circuits which are inserted in the servo loop. These inputs are processed to provide tracking signals for the antenna power drive as well as elevation and traverse rates for the fire-control computer. The tracking signals are passed to an on-mount gyro unit which modifies them so that the demands of the antenna power drives (also on-mount) allow for ship movement. From these two elements, two sets of data inputs are provided to the computer, one defines the target's line of sight relative to the ship while the other defines it relative to the gyro platform. The two computers were the Mk 42, for primary and secondary ballistics, and the Mk 30, for primary gun orders. These also receive inputs on ship speed and course from the log and gyrocompass as well as target range from the radar. Values are inserted for gun dead time, for initial velocity, true windspeed and wind direction. On the basis of all this data the computers generate training and elevation instructions together with fuze orders for the guns.

Manufacturer/Contractor

General Electric Company, Ordnance Systems Division.

Mk 114 ASW FCS

The main element in the Loral Mk 114 ASW fire-control system is the Mk 53 Attack Console, an electro-mechanical analogue system with two major units, the attack plotter and the ballistic computer. The latter conducts weapon presets for both ASROC and ASW torpedoes. The Mk 114 system also includes the Mk 33 underwater fire-control switchboard which accepts data from two Mk 19 gyrocompasses and other sensors, as well as from the Mk 134 sonar stabilisation computer. The consoles have an AN/UYK-44 reconfigurable processor with some 70,000 lines of CMS-2 language code. The system interfaces with the sonar: in this case the EDO SQS-26 AXR (D 29, D 30) or the EDO SQS-26B (D27, D 28).

Manufacturer/Contractor

Loral Librascope.

RADARS

Set	AN/SPS-40D	AN/SPS-10F	LN 66	AN/SPG-35
Company	Lockheed	Raytheon/Sylvania	Canadian Marconi	Western Electric
Role	Air search	Surface search	Navigation	Fire control (Mk 56 GFCS)
Band	E/F	G	I	I/J
Range	175 n miles (320 km)	—	—	27,000 m (30,000 yd)
Beam	1.5 × 16°	1.5 × 16°	2.5 × 22[2]	2.0°
Peak power	500 kW	500 kW	75 kW	50 kW
Gain	30 dB	30 dB	—	37.5 dB
Pulsewidth	0.25/1.3 µs	0.25/1.3 µs	1.0/0.1 µs	0.1-0.15 µs
PRF	650 pps	650 pps	500/2,000 pps	3,000 pps
Scan rate	15 rpm	15 rpm	22 rpm	—

SONAR

AN/SQS-26AXR

Both ships are fitted with bow-mounted AN/SQS-26 active search and attack, medium-frequency sonar. AN/SQS-26 works in surface duct, bottom bounce and convergence zone modes, using surface duct for shorter ranges, bottom bounce for medium ranges and convergence zone for longer ranges. The last two modes require electronic beam-steering in elevation. SQS-26 is an active system transmitting at about 3.5 kHz with an output power of about 192 kW and receiving in seven channels between 1.5 and 4 kHz. The transducer is reported to be about 4.87 m (16.0 ft) in diameter and 1.68 m (5.5 ft) high, with 72 staves, each with eight elements. Ranges are reported to be approximately 10 n miles (18.5 km) in surface duct mode, and 34.5 n miles (64 km) in convergence zone mode. AN/SQS-26AXR was a variant with a modified power supply.

Manufacturer/Contractor

EDO, Government Systems Division, College Point, New York, USA.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 14.5 × 12.3 m (47 × 40 ft)
Remarks: There is a helicopter flight deck but no hangar

PROPULSION

Specifications

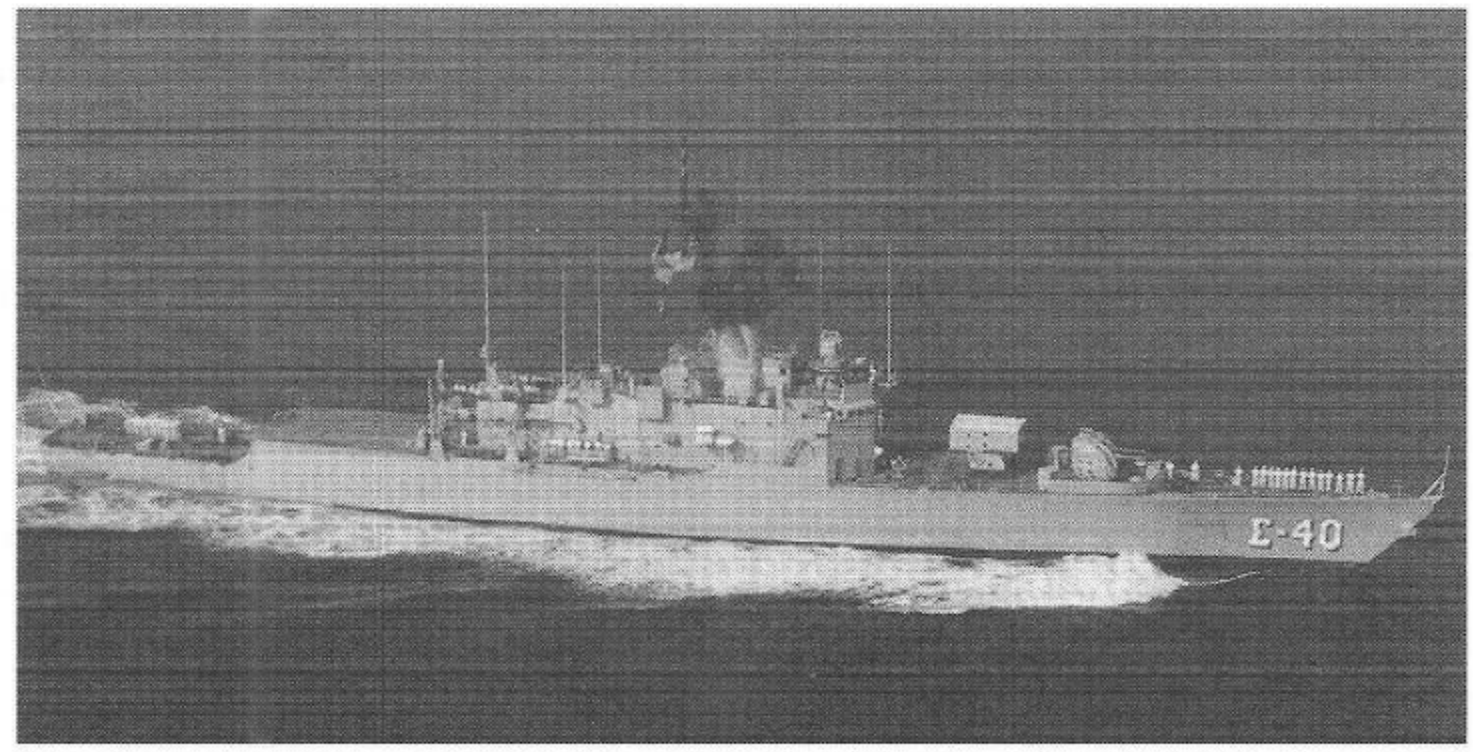
System: Steam turbines
Main machinery: 2 Foster-Wheeler boilers; 1 De Laval geared turbine; 14.92 MW (20,000 hp)
Shafts: 1

FURTHER INFORMATION

PROGRAMME

There was considerable dissatisfaction in the US Navy with the 'Claud Jones' (DE 1033) class, four of which were commissioned between 1958 and 1960. They were considered to be too slow and ill-equipped for their ASW mission. As a result, a new design — the 'Bronstein' class — was prepared which was faster, but at 26 knots was still not capable of keeping up with the 30 knot task group it was supposed to be protecting, and only two were built.

These two Bronsteins served in the US Navy from 1963 to 1990, when they were stricken from the Navy List. They were, however, not scrapped and were eventually bought by the Mexican Navy on 12 November 1993, providing a much-needed boost to that service's capabilities.



Nicolas Bravo *(E-40) one of two former US Navy 'Bronstein' class frigates which were sold to Mexico in 1993*

DESIGN

These Bronsteins were the first of the second generation of open-ocean ASW escorts for the US Navy, with a new design of hull and a high freeboard. They were also the first to have the new AN/SQS-26 bow-mounted sonar with its very large dome, which necessitated an overhanging stem and a stem anchor, with the portside anchor moved well back to just forward of the gun mount.

They also had a better ASW capability and were the first ships at sea with the (then) new ASROC system. They also had two triple torpedo tubes and a DASH helicopter drone, although this proved unsuccessful. Surface armament comprised three 76 mm (3 in) guns, two in a twin, closed mount in 'A' position and a single gun in an open mount in 'Y' position. Air defence weapons were non-existent.

The basic hull form and design were used as the basis for the subsequent 'Garcia' and 'Brooke' classes, which were larger and had more powerful engines.

MODERNISATION

While in US service the after 76 mm (3 in) gun mount was removed in order to accommodate a Towed Array Surveillance System (TASS). The DASH facilities were deactivated, but unlike other, larger ships there was insufficient space or weight allowance to enable the hangar and flight deck to be fitted to accommodate the LAMPS-I system.

Before delivery to Mexico the TASS facilities were removed. The Mexican Navy currently plans to install Bofors 57 mm SAK mounts, as has already been done in the *Ilhuicamina* (see 'Gearing' class). This might be achieved by installing the new gun on the quarterdeck in the position previously occupied by the single, open mounted 76 mm gun, or by replacing the ASROC launcher, for which the Mexican Navy would not seem to have a requirement.

GARCIA

OVERVIEW

The US Navy's 'Garcia' class had its origins in the late 1950s when there was a requirement for new escorts to replace the ageing Second World War destroyers. There was also interest at the time in pressure-fired propulsion systems, which promised faster ships, and it was decided to build a new class with these new systems, even though a prototype had not yet run. The result was a class of 17 ships with a common hull, of which ten were optimised for ASW ('Garcia' class), six for air defence ('Brooke' class), and one (Glover (AGDE 1)) had an experimental pump-jet system. Construction ended in 1967 as the ships were considered to have limited capabilities and to be very expensive, although their maximum speed of 30 knots was considered impressive.

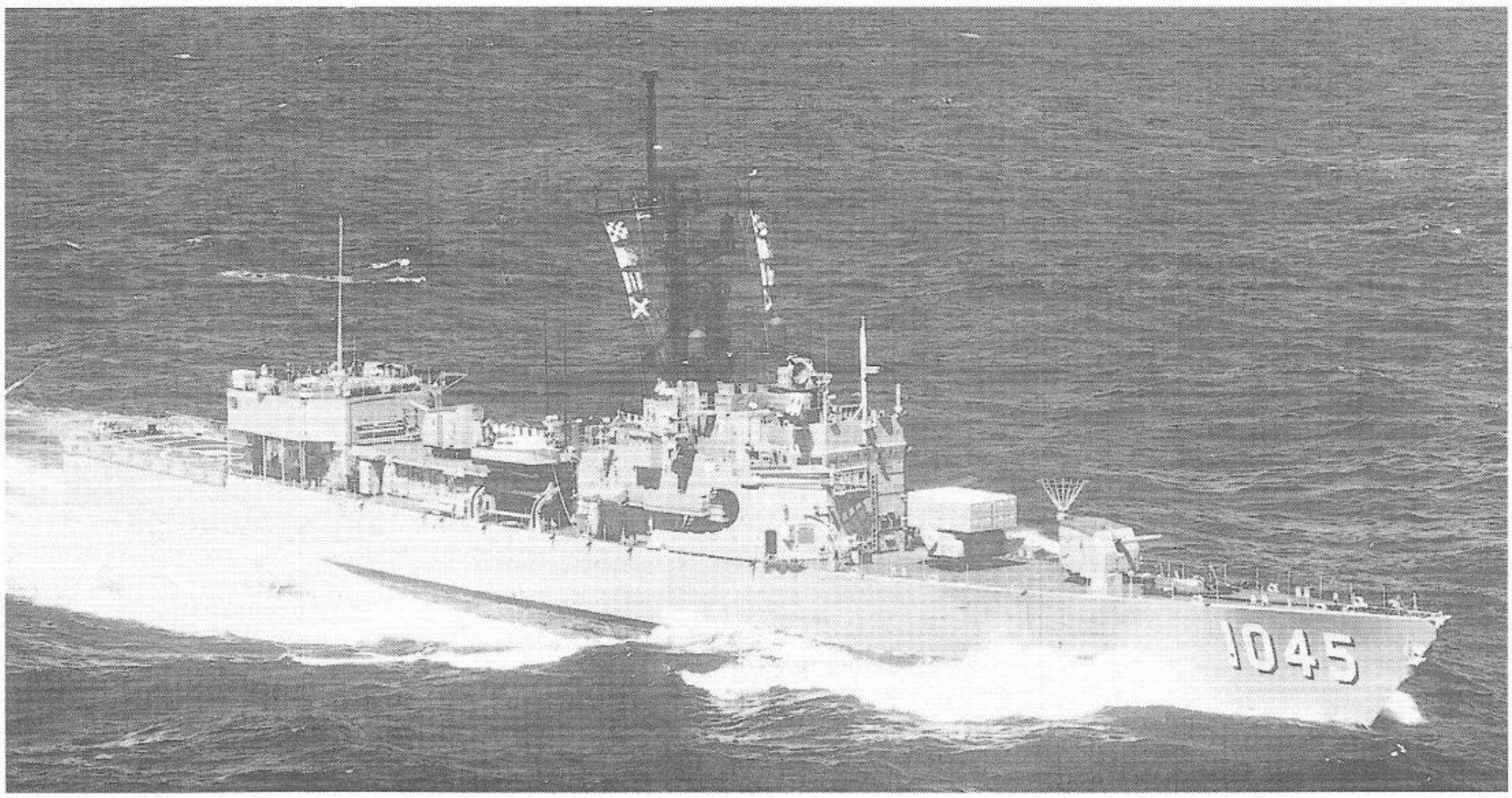
The 'Garcia' class entered service between 1964 and 1968 and its ASW armament included two 533 mm (21 in) tubes in the transom and a hangar and flight deck for the short-lived DASH helicopter drone. During their service the flight deck and hangar were adapted and enlarged to take LAMPS I helicopters in all except *Sample* (FFG 1048) and *Albert David* (FFG 1050) which were modified instead to take the AN/SQR-15 towed array system.

The ships were decommissioned between 1988 and 1990, and offered for lease. Four were leased on five-year leases to Pakistan in 1988/89, which also took four of the very similar 'Brooke' class FFGs. All eight ships had to be returned in 1993-94 when the USA declined to renew the lease, due to Congressional disapproval of Pakistan's nuclear programme. These ships were all subsequently scrapped in Singapore.

The only other country to take up the leasing offer was Brazil, which took four 'Garcia' class ships, all being transferred in 1988. The lease on these ships was renewed for a further five years in 1993.

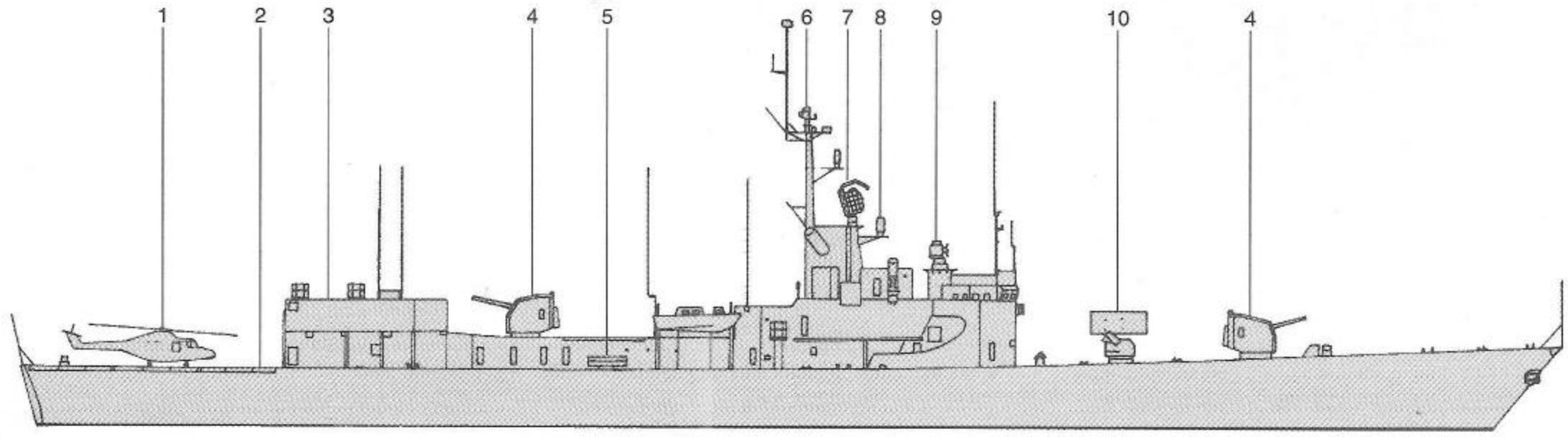
The other two 'Garcia' class ships were broken up in the USA in 1992.

US Navy 'Garcia' class frigate Davidson *(FF 1045) in 1978. Main armament was two 127 mm guns and Mk 112 launcher for ASROC. The ASROC launcher has one two-cell segment raised in the launching position* (US Navy)



Starboard side view of Davidson *(FF 1045) in 1986, at a time when it was conducting a midshipmen's cruise.* Davidson *is now the Brazilian Navy's* Paraiba *(D 28)* (US Navy)

PARA (GARCIA)



Paraiba (Ian Sturton)
1 *Westland SAM-11 Lynx* **2** *Flight deck* **3** *Hangar* **4** *US Navy 127 mm (5 in)/38 Mk 30 gun (enclosed mount)* **5** *US Navy Mk 32 triple 324 mm torpedo tubes* **6** *Raytheon AN/SPS-10C surface search radar* **7** *Lockheed AN/SPS-40B air/surface search radar* **8** *AN/WLR-1/6 radar warning* **9** *General Electric Mk 35 fire control* **10** *Mk 112 eight-cell launcher for ASROC*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Brazil
Type: Garcia

Class: PARA

Leased: 4
Active: 4

Displacement:
standard: 2,620 t
full load: 3,403 t

Dimensions
Length: 126.3 m (414.5 ft)
Beam: 13.5 m (44.2 ft)
Draught: 7.3 m (24 ft) (sonar); 4.4 m (14.5 ft) (keel)

Speed: 27.5 kts
Range: 4,000 n miles at 20 kts

Complement: 286 (18 officers) + 25 spare

SHIPS

PARA (D 27)

Builder	Lockheed Shipbuilding, Seattle, Washington, USA
Laid down	29 Apr 1964
Launched	19 Dec 1964
Commissioned (US Navy)	19 Oct 1968 *(Albert David* (FF 1050))
Recommissioned	18 Sep 1989

PARAIBA (D 28)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	20 Sep 1963
Launched	2 Oct 1964
Commissioned (US Navy)	7 Dec 1965 (*Davidson* (FF 1045))
Recommissioned	25 Jul 1989

PARANA (D 29)

Builder	Lockheed Shipbuilding, Seattle, Washington, USA
Laid down	19 Jul 1963
Launched	28 Apr 1964
Commissioned	23 Mar 1968 (*Sample* (FF 1048))
Recommissioned	24 Aug 1989

PERNAMBUCO (D 30)

Builder	Bethlehem Steel, San Francisco, California, USA
Laid down	17 Jan 1963
Launched	26 Mar 1964
Commissioned	15 May 1965 (*Bradley)* (FF 1041))
Recommissioned	25 Sep 1989

Para *(D 27). The four former US Navy 'Garcia' class frigates were leased to Brazil for five years in 1989 and this was renewed for a further five years in 1994* (Adam Goodrich)

WEAPONS SYSTEMS

ANTI-SUBMARINE MISSILES

Mk 16 launcher group

The 'Garcia' class is fitted with a Mk 16 Launcher Group located on the foredeck, with a single Mk 112 launcher, which consists of four pairs of launch tubes, each pair elevating independently. Maximum launch rate is 3 missiles per minute.

The first five ships to be built (FFG 1040 to FFG 1045) had an earlier ASROC loading system characterised by a vertical bridge screen and this is retained by the Brazilian ships *Pernambuco* (ex-FFG 1041) and *Paraiba* (ex-FFG 1045). The subsequent five 'Garcia' class ships were, however, built with a new automated ASROC reload system which had been developed for the 'Knox' class, which has a sloping front to the bridge screen, as in the other two Brazilian ships: *Parana* (ex-FFG 1048) and *Para* (ex-FFG 1050).

Honeywell RUR-5A ASROC

ASROC consists of a Mk 46 torpedo with strap-on aerodynamic surfaces and a rocket motor to enable it to fly to within range of its submarine target. Attached to the rear end of the torpedo is a short airframe assembly of clam-like construction, held together by a steel band, with a Naval Propulsion Plant solid propellant booster and four trapezoidal aerodynamic surfaces to provide stability in flight. The torpedo has a dome-shaped

frangible plastic nose cap to protect the transducer as it enters the water. Payload is an Alliant Mk 46 Mod 5 torpedo, which has a seeker designed specifically to detect most types of target including submarines with anechoically coated hulls and has an estimated acquisition range of 460 m (1,509 ft).

When a submarine target is detected it is tracked and the attack console's fire-control computer predicts the target's position. The launcher is turned in the appropriate direction and elevated to an angle appropriate to the range. The fire-control computer then orders the launch and the booster burns for a programmed time of between 1 and 4 seconds, by which time the missile will have reached a height of between 60 and 305 m (197 and 1,000 ft), although the aerodynamically stable airframe enables it to coast up to 600 m (1,969 ft). On reaching the programmed position, an explosive bolt cuts the steel band holding the airframe assembly sections together and, as they separate, the parachute deploys to retard the torpedo's fall, water entry taking place some 14 to 50 seconds after launch. As the torpedo enters the water the frangible nose cap breaks off and the torpedo begins its search for the target using a predetermined pattern.

Specifications
ASROC missile
Length: 4.6 m (15.1 ft)
Diameter: 32.5 cm (12.8 in)
Span: 84.5 cm (33.3 in)
Weight: 435 kg (959 lb)
Range: 0.86-5.39 n miles (1.6-10 km)
Speed: Mach 0.9

Mk 46 Mod 5 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Manufacturer/Contractor
Loral Defense Systems, Akron, Ohio, USA.

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited in the waist. 14 torpedoes are carried.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)

Close-up of Para *(D 27). The sloped bridge screen houses the ASROC magazine and reloading gear* (Giorgio Arra)

Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

Mk 30 127 mm (5 in) L/38 gun mounting
There are two Mk 30 127 mm (5 in) L/38 single mounts. One is on the foredeck, the other on the superstructure forward of the hangar. This weapon is based on the 127 mm (5 in) 38 calibre Mk 12 gun which is 5.68 m (18.6 ft) long and weighs 3.25 tonnes. The barrel is secured to the rest of the weapon by a bayonet joint, the weapon featuring a semi-automatic vertical sliding wedge breech block. On top of the weapon is a 5 or 7 hp rammer motor. Shells are loaded manually into a hydraulically powered ramming tray. The approximate life of the weapon is 4,600 EFC.

The Mk 30 is a single gun, base ring, mount with manual drive or power operation in local or remote control. The mount uses a 24.95 kg (55 lb) semi-fixed round with 6.89 kg (15.2 lb) of propellant and 0.93 kg (2.0 lb) of explosive.

Specifications
Mk 30
Calibre: 127 mm (5 in)
Length of barrel: 38 calibres
Muzzle velocity: 792 m/s (2,598 ft/s) (new gun), 762 m/s (2,500 ft/s) (mid-life)
Range: 13.5 n miles (25.26 km)
Altitude: 12,836 m (28,303 ft)
Ammunition: 24.95 kg (55 lb)
Traverse: ±115 to ±165°
Elevation: −15 to +85°
Traverse rate: 30°/s
Elevation rate: 15°/s
Rate of fire: 20 rds/min

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

AN/WLR-1
WLR-1 is a US-manufactured, manually operated, radar warning system covering frequencies from 50 MHz to 10.75 GHz, employing a number of separate antennas.

AN/WLR-6
WLR-6 is a communications ESM system.

AN/ULQ-6
AN/ULQ-6 is a US-supplied deception jammer, whose main function is to produce a false target to mislead incoming sea-skimming missiles.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers
There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

T-Mk 6 Fanfare
The T-Mk 6 torpedo decoy consists of two winches each with a cable and a 'fish' containing a mechanical acoustic device. It was introduced into the US Navy in the 1950s and was replaced in most ships by AN/SLQ-25 Nixie.

Masker/Prairie Masker noise suppression systems
The ships are fitted with both Masker and Prairie radiated noise suppression systems. In Prairie, high-pressure air is bled off from either the ship's gas turbine or dedicated compressors and ejected from a pipe placed laterally across the ship's hull just forward of the machinery spaces. The forward motion of the ship causes the air to form a layer separating the hull from the water and thus masking the machinery noises which would otherwise be radiated directly into the water. Such a system is less effective at slow speeds where the air bubbles tend to rise to the surface rather than remain attached to the hull.

In Masker air is passed down the propeller shaft and ejected from a groove in the leading edge of the blade, thus delaying the onset of cavitation.

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

Satcom. All ships are fitted with Satcom.

Tacan: AN/SRN-15

IFF: UPX XII

WEAPONS CONTROL

Mk 56 Gun Fire Control System (GFCS)

The Mk 56 GFCS consists of a radar/optical director and a below-decks computer fit and requires a crew of five. The system can issue simultaneous gun and fuze-setting orders to the gun mounts and can produce a very fast fire-control solution, typically within 2 seconds of beginning to track.

The target is designated through the SPS-40B (air search) and SPS-10C (surface search) radars and the director is turned in the appropriate direction. In theory the director is capable of turning 360° in azimuth, although this is restricted in practice, while the elevation is −15 to +85°. Using elevation and traverse error signals when the target moves out of the radar's line of sight the radar antenna keeps on the target through the servo system. The error signal inputs are received by the tracking control circuits which are inserted in the servo loop. These inputs are processed to provide tracking signals for the antenna power drive as well as elevation and traverse rates for the fire-control computer. The tracking signals are passed to an on-mount gyro unit which modifies them so that the demands of the antenna power drives (also on-mount) allow for ship movement. From these two elements two sets of data inputs are provided to the computer, one defines the target's line of sight relative to the ship while the other defines it relative to the gyro platform. The two computers were the Mk 42, for primary and secondary ballistics, and the Mk 30, for primary gun orders. These also receive inputs on ship speed and course from the log and gyrocompass as well as target range from the radar. Values are inserted for gun dead time, for initial velocity, true windspeed and wind direction. On the basis of all this data the computers generate training and elevation instructions together with fuze orders for the guns.

Manufacturer/Contractor

General Electric Company, Ordnance Systems Division.

Mk 114 ASW FCS

The main element in the Singer Mk 114 ASW fire-control system is the Mk 53 Attack Console, an electro-mechanical analogue system with two major units, the attack plotter and the ballistic computer. The latter conducts weapon presets for both ASROC and ASW torpedoes. The Mk 114 system also includes the Mk 33 underwater fire-control switchboard which accepts data from two Mk 19 gyrocompasses and other sensors, as well as from the Mk 134 sonar stabilisation computer. The consoles have an AN/UYK-44 reconfigurable processor with some 70,000 lines of CMS-2 language code. The system interfaces with the sonar: in this case the EDO SQS-26 AXR (D 29, D 30) or the EDO SQS-26B (D27, D 28).

Manufacturer/Contractor

Loral Librascope.

RADARS

Set	AN/SPS-40B	AN/SPS-10C	LN 66	Mk 35
Company	Lockheed	Raytheon	Canadian Marconi	General Electric
Role	Surface search	Surface search	Navigation	Mk 56 GFCS
Band	E/F	G	I	I/J
Beam	11 × 19°	1.5 × 16°	2.5 × 22°	Acquisition: 6° spiral Tracking: 0.5° conical
Peak power	200 kW	500 kW	75 kW	50 kW
Gain	21 dB	30 dB	30 dB	
Pulsewidth	60 µs	0.25/1.3 µs	1.0/0.1 µs	0.1 µs
PRF	300 pps	625-650 pps	500/2,000 pps	3,000 pps
Scan rate	7.5/15 rpm	15 rpm	22 rpm	—
Range	175 n miles (320 km)			Aircraft: 15 n miles (27.5 km); height 3,050 m (10,007 ft) Destroyer at ranges of 15 n miles (27.5 km)

SONAR

AN/SQS-26AXR or AN/SQS-26BX

All four ships have the AN/SQS-26 bow-mounted, active search and attack, medium-frequency sonar, but of two different versions. *Parana* (D 29) and *Pernambuco* (D 30) have AN/SQS-26AXR, while *Para* (D 27) and *Paraiba* (D 28) have AN/SQS-26BX. AN/SQS-26 works in surface duct, bottom bounce and convergence zone modes, using surface duct for shorter ranges, bottom bounce for medium ranges and convergence zone for longer ranges. The last two modes require electronic beam-steering in elevation. SQS-26 is an active system transmitting at about 3.5 kHz with an output power of about 192 kW and receiving in seven channels between 1.5 and 4 kHz. The transducer is reported to be about 4.87 m (16.0 ft) in diameter and 1.68 m (5.5 ft) high, with 72 staves, each with eight elements. Ranges are reported to be approximately 10 n miles (18.5 km) in surface duct mode, and 34.5 n miles (64 km) in convergence zone mode.

SQS-26AXR was a variant with a modified power supply, while SQS-26BX was a DIMUS (digital multibeam steering) version.

Manufacturer/Contractor

EDO, Government Systems Division, College Point, New York, USA.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 21.8 × 13.5 m (72 × 44 ft)

HELICOPTERS

Westland Lynx SAH-11 (Super Lynx)

Specifications

Dimensions:
- **main rotor diameter:** 12.80 m (42.00 ft)
- **tail rotor diameter:** 2.21 m (7.25 ft)
- **length overall (rotors turning):** 15.165 m (49.75 ft)

Weights:
- **empty:** 2,740 kg (6,040 lb)
- **empty, equipped (ASW):** 3,343 kg (7,370 lb)

Performance:
- **cruising speed:** 125 kts (232 km/h; 144 mph)
- **speed for max endurance:** 70 kts (130 km/h)
- **max rate of climb:** 661 m (2,170 ft)/min
- **time on station (ASW) 50 n miles (93 km) radius:** 2 h
- **max range:** 320 n miles (593 km)
- **max endurance:** 2 h 50 min

Power plant: 2 Rolls-Royce Gem 41-1 with max contingency rating of 835 kW (1,120 shp)

Crew: 2 (pilot and co-pilot/observer)
Radar: GEC-Marconi ARI5979 Seaspray Mk 3 light-weight search and tracking radar
Mission: CAE Electronics AN/ASQ-504(V) internal MAD
EW: Racal Kestrel EW suite; Racal MIR 2 ESM
ASW role: 2 Mk 44 or Mk 46 torpedoes, or depth bombs
Anti-ship: 4 BAe Sea Skua missiles

PROPULSION

Specifications
System: Steam turbines
Main machinery: 2 Foster-Wheeler boilers; 83.4 kg/cm² (1,200 psi); 510°C (950°F); 1 Westinghouse or General Electric turbine; 26 MW (35,000 hp)
Shafts: 1

FURTHER INFORMATION

PROGRAMME

The first three ships were transferred from the US Navy under the terms of a five-year lease on 15 April 1989, followed by the fourth ship on 1 October 1989. All arrived in Brazil on 13 December 1989. The lease was renewed in 1994.

DESIGNATION

When built, the 'Garcia' class was designated Destroyer Escorts by the US Navy and carried DE pennant numbers. This was changed to frigate (FF) on 30 June 1975, although the actual numbers remained unchanged. In the Brazilian Navy these four ships are designated Destroyers and carry D pennant numbers.

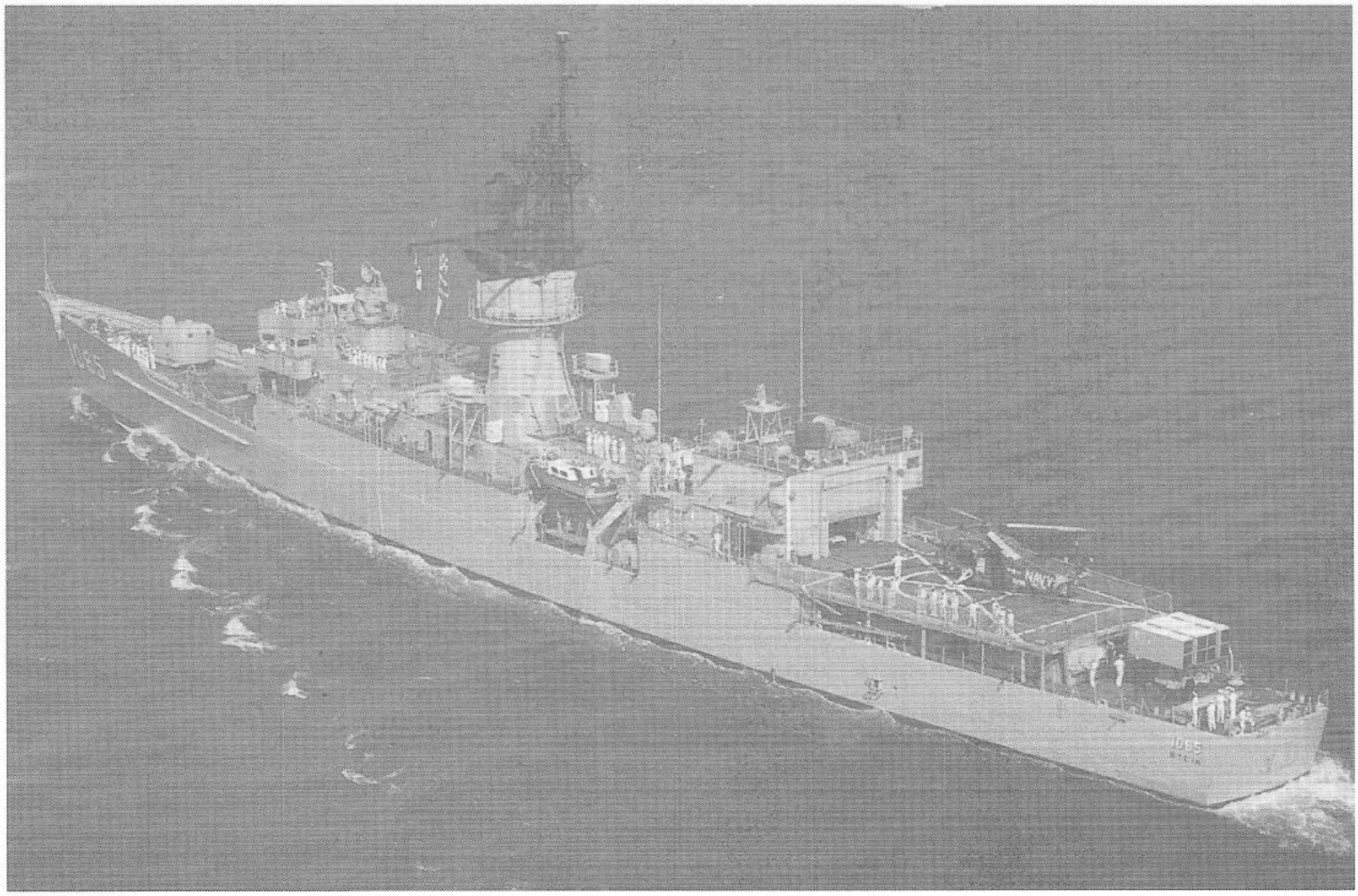
DESIGN

All four ships have an enlarged hangar capable of taking a Sea King-size helicopter although they normally operate a Lynx.

In US Navy service *Para* (D 27) and *Parana* (D 29) had the flight deck area converted to take the AN/SQR-15 towed array, but this was removed before transfer to Brazil.

'KNOX' CLASS

OVERVIEW



Stein *(F 1065) while in US Navy service. Forty-six of these useful ASW frigates were built, originally with the DASH helicopter drone and later, as here, with the Kaman SH-2G Seasprite LAMPS I helicopter* (Jane's/H M Steele)

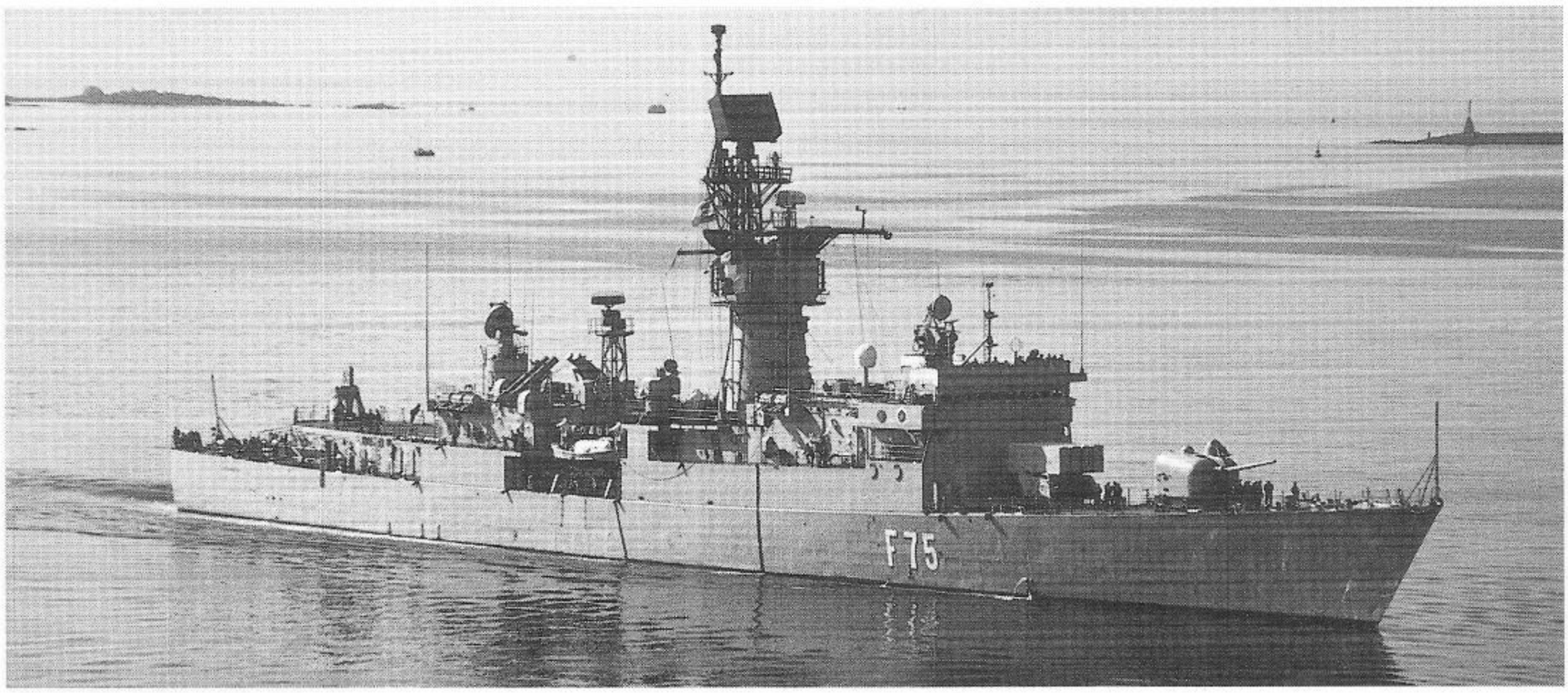
The 'Knox' class was designed in the mid-1960s, at the height of the Cold War, when large numbers of escorts were required for open-ocean patrol duties and to escort convoys. The design evolved from that of the 'Brooke' (DEG 1) class but was somewhat longer (126.5 m (414.9 ft) compared to 118.9 m (390.0 ft) to accommodate machinery that gave an increase in range from 4,000 to 4,500 n miles (7,408 to 8,334 km).

Forty-six were built, entering service between 1969 and 1974, the builders being: Avondale — 27; Lockheed, Seattle — five; Todd, San Pedro — six; and Todd, Seattle - eight. A further ten hulls (DE 1098 to DE 1107) were authorised in FY68, one of which was planned to be a gas-turbine trials ship, but all were cancelled. The ships were originally classified as 'destroyer escorts' (DE) but were redesignated 'frigates' (FF) in 1975.

The ship is dominated by the tall, tower-like 'mack' which was planned to provide the mounting for a series of billboard type antennas, although in practice only normal radar arrays were ever used. As built, the ships were armed with a 127 mm (5 in)/54 gun, four 324 mm Mk 32 ASW torpedo tubes, a DASH helicopter drone, and an eight-cell Mk 16 ASROC launcher, the latter having an improved ASROC-torpedo reloading capability, a visible sign of which is the slanting face of bridge structure immediately behind the launcher. The four Mk 32 torpedo tubes were fixed in the midships superstructure, two on each side, angled out at 45° which provides improved loading capability and a reduced maintenance requirement compared to the exposed triple Mk 32 torpedo tubes mountings.

An unusual feature of the design is the anchor arrangement. In this, there is a 1,800 kg (4,000 lb) lightweight anchor fitted on the port side and no stem or starboard anchors. Instead, there is a 3,600 kg (8,000 lb) anchor, which is housed in the after section of the sonar dome.

Non-retractable fin stabilisers were installed in all ships during construction. All are also fitted with the Prairie-Masker noise suppression system which emits bubbles through holes in the hull and propeller blades.



Extremadura *(F 75), the last of five modified 'Knox' class frigates built in Spain for the Spanish Navy* (H M Steele)

The propulsion plant features high-pressure steam boilers working at 84.37 kg/cm² (1,200 lb/sq in) and high temperature 510° C (1,081°F), which are designed to improve efficiency and take up less volume. This does, however, require a large, well-trained crew and takes at least 4 hours to become operational from a cold start. This is one reason why a number of navies have declined to accept these ships on lease.

MODERNISATION

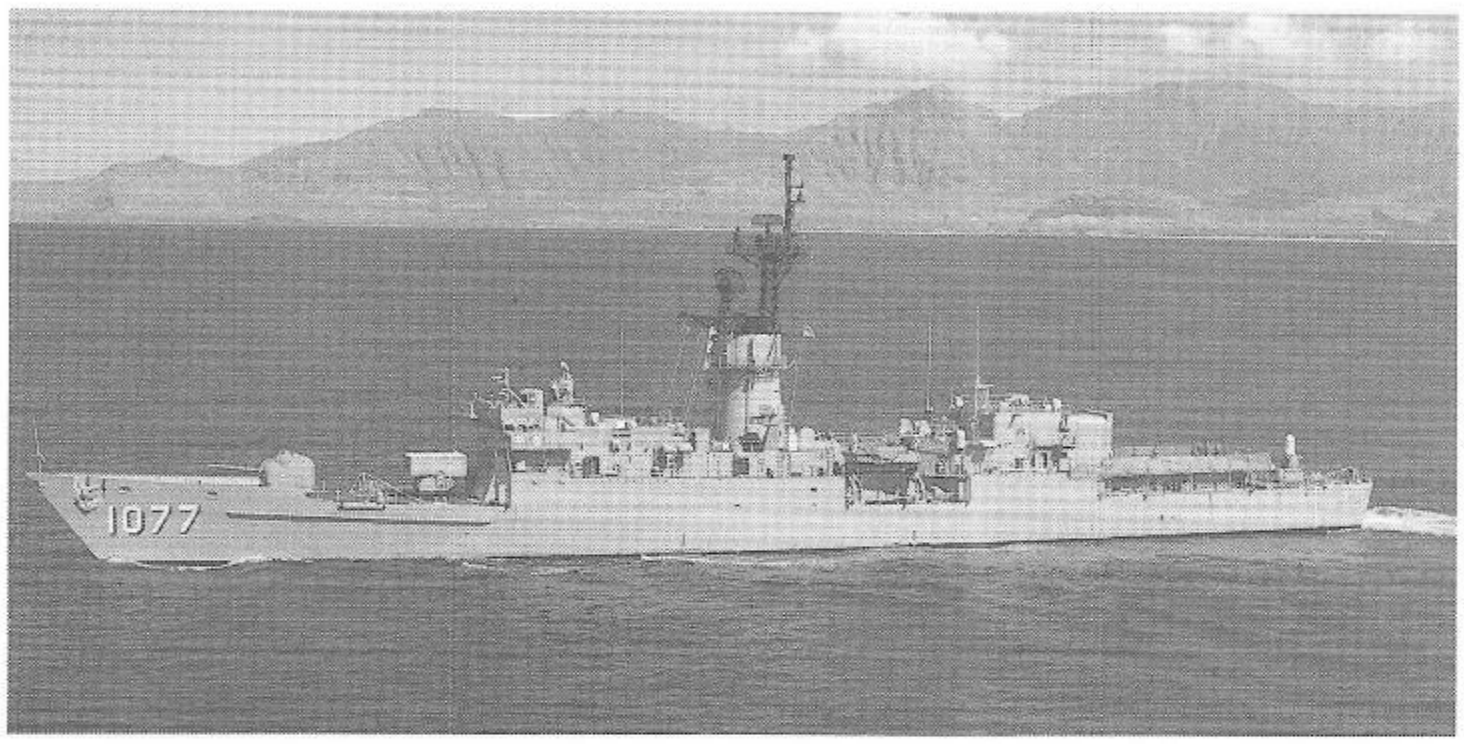
During their service the DASH was replaced by a Kaman SH-2 Seasprite helicopter and 31 of the ships were fitted with Sea Sparrow, although a mid-1970s plan to fit Sea Chapparal in the remainder came to naught.

Most of the 'Knox' class were fitted with EDO AN/SQS-35 VDS, but as submarines became quieter this had insufficient performance and 35 of the ships were further modified to take the EDO AN/SQR-18A TACTAS towed array, with modules attached to the 'fish'. The combination of LAMPS-I and the VDS resulted in such an increase in the data flow that the Commercial-Off-The-Shelf (COTS)-based Fast Frigate Integrated Shipboard Tactical System (FFISTS) was developed. FFISTS-1 was based on Hewlett-Packard workstations and was installed in six ships. This was followed by FFISTS-2 using SUN-4/110 SPARC workstations but the programme had not been completed by the time the ships started to be sold off. It appears that only the ships intended for Taiwan, Thailand and Turkey have the system.

In the early 1980s the Sea Sparrow short-range air defence system was replaced by a single Mk 15 20 mm Phalanx CIWS mounted on the quarterdeck. Also in the early 1980s the McDonnell Douglas Navy Mast-Mounted Sight (NMMS) was installed in ships undertaking Gulf deployments to assist in detecting floating mines, low-flying aircraft and small surface craft, especially in haze conditions. These were normally removed from ships as they returned from the Gulf, but it appears that the ships sold to Egypt, Thailand and Turkey have NMMS fitted.

An original plan to fit two 533 mm (21 in) torpedo tubes was never implemented. The ships were, however, given an anti-ship capability from 1972 onwards when the two port cells of the ASROC launcher were modified to accept RGM-84 Harpoon with two Harpoons displacing two ASROCs in the magazine, for a total of four missiles.

The 'Knox' class ships were criticised from the start for having only one propeller, while during their service they were considered too wet forward. The former could not be rectified, but all ships received bulwarks and spray strakes in the early 1980s, which increased their length slightly and added 9.1 tonnes to the displacement.



Onellet *(F 1077). This ship was transferred to the Royal Thai Navy in August 1996* (US Navy)

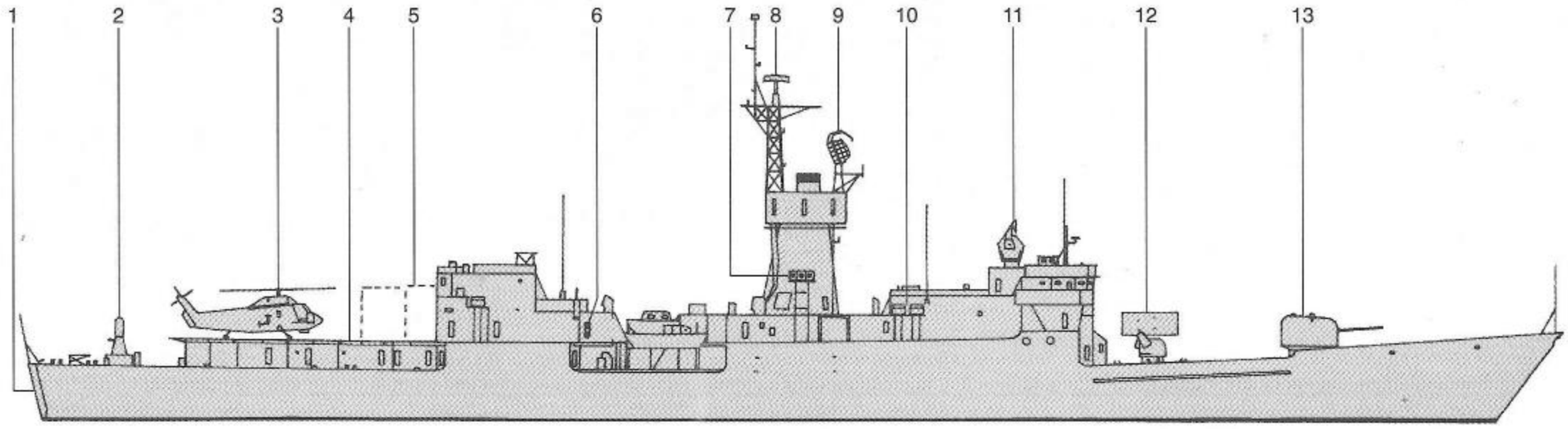
EXPORTS

The only early export order was for five, which were built in Spain as the 'Baleares' class, joining the Spanish fleet between 1973 and 1976 (see 'Baleares' class entry). With the end of the Cold War, however, the 'Knox' class ships were rapidly taken out of US service and were put into reserve before being offered for sale. They were offered to selected friendly navies on five-year leases, although not all the offers were taken up.

TABLE: EX-US NAVY 'KNOX' CLASS SHIPS ON FIVE-YEAR LEASES

Country	Quantity	Delivered	Comment
Egypt	2	1994	
Greece	3	1992-93	
Taiwan	3 3 3	1993 1995 1996	
Thailand	2	1994	May request two more later
Turkey	4 4	1993 1994	There is also one hulk used for spares
Total	**24**		

DAMYAT (KNOX)



Damyat (Ian Sturton)
1 *EDO SQR-18A(V)1* **2** *Hughes Mk 15 Vulcan 20 mm CIWS* **3** *Kaman SH-2G Seasprite* **4** *Flight deck* **5** *Telescopic hangar* **6** *Two Mk 32 324 mm fixed torpedo tubes* **7** *SLQ-32(V)2 ESM system* **8** *Raytheon SPS-10 or Norden SPS-67* **9** *Lockheed SPS-40B air search radar* **10** *Loral Hycor Mk 36 SRBOC six-tube chaff/IR launcher* **11** *Western Electric SPG-53A fire control* **12** *Mk 16 eight-tube launcher (ASROC and Harpoon)* **13** *United Defense 127 mm (5 in)/54 Mk 42 Mod 5 gun*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Egypt
Type: Knox

Class: DAMYAT

Leased: 2
Active: 2

Displacement:
standard: 3,011 t
full load: 4,260 t load

Dimensions
Length: 134 m (439.6 ft)
Beam: 14.3 m (46.9 ft)
Draught: 4.6 m (15 ft) 7.8 m (25.5 ft (sonar))

Speed: 27 kts
Range: 4,000 n miles at 22 kts on 1 boiler

Complement: 288 (17 officers)

SHIPS

DAMYAT (961)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	8 Apr 1971
Launched	18 Mar 1972
Commissioned (US Navy)	17 Feb 1973 (*Jesse L Brown* (FF 1089))
Recommissioned	1 Oct 1994

RASHEED (966)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	25 Aug 1972
Launched	12 May 1973
Commissioned (US Navy)	2 Nov 1974 (*Moinester* (FF 1097))
Recommissioned	1 Oct 1994

WEAPONS SYSTEMS

MISSILE LAUNCHER

Mk 16 launcher group

The 'Knox' class is fitted with a Mk 16 Launcher Group located on the foredeck, with a single Mk 112 launcher, which consists of four pairs of launch tubes, each pair elevating independently. The version installed in the 'Knox' class is the Mk 16 Mod 8, which has the port pair of tubes adapted to take RGM-84 Harpoon missiles. Maximum launch rate is three missiles per minute.

ANTI-SHIP MISSILES (ASM)

McDonnell Douglas UGM-84B Harpoon

The missile magazine can contain eight missiles, of which a maximum of two can be Harpoon. This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns and for the terminal phase can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 kg)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg (11,905 lb) thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

ANTI-SUBMARINE MISSILES

Honeywell RUR-5A ASROC

The magazine also houses 12 ASROC missiles. ASROC consists of a Mk 46 torpedo with strap-on aerodynamic surfaces and a rocket motor to enable it to fly to within range of its submarine target. Attached to the rear end of the torpedo is a short airframe assembly of clam-like construction which is held together by a steel band, with a Naval Propulsion Plant solid propellant booster and four trapezoidal aerodynamic surfaces to provide stability in flight. The torpedo has a dome-shaped frangible plastic nose cap to protect the transducer as it enters the water. Payload is an Alliant Mk 46 Mod 5 torpedo, which has a seeker designed specifically to detect most types of target including submarines with anechoically coated hulls and has an estimated acquisition range of 460 m (1,508.8 ft).

When a submarine target is detected it is tracked and the attack console's fire-control computer predicts the target's position. The launcher is turned in the appropriate direction and elevated to an angle appropriate to the range. The fire-control computer then orders the launch and the booster burns for a programmed time of between 1 and 4 seconds, by which time the missile will have reached a height of between 60 and 305 m (197 and 1,001 ft), although the aerodynamically stable airframe enables it to coast up to 600 m (1,968 ft). On reaching the programmed position, an explosive bolt cuts the steel band holding the airframe assembly sections together and as they separate the parachute deploys to retard the torpedo's fall, water entry taking place some 14 to 50 seconds after launch. As the torpedo enters the water the frangible nose cap breaks off and the torpedo begins its search for the target using a predetermined pattern.

Specifications
ASROC missile
Length: 4.6 m (15.1 ft)
Diameter: 32.5 cm (12.8 in)
Span: 84.5 cm (33.3 in)

Weight: 435 kg (959 lb)
Range: 0.86-5.39 n miles (1.6-10 km)
Speed: Mach 0.9

Mk 46 Mod 5 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Manufacturer/Contractor
Loral Defense Systems, Akron, Ohio, USA.

TUBES

324 mm Mk 32 Mod 9 torpedo launchers
Two twin Mk 32 Mod 9 324 mm torpedo launchers are mounted at the forward end of the after deckhouse, angled outwards at 45°.

The torpedo magazine contains 22 torpedoes.

TORPEDOES

Mk 46 Mod 5 torpedo
Normal armament is the Honeywell Mk 46 Mod 5 anti-submarine torpedo, although some obsolete Mk 44 torpedoes are known to be still in service.

Specifications
Mk 46 Mod 5
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight:
torpedo: 230 kg (507 lb)
warhead: 44 kg (97 lb)
Speed: 40 kts (max)
Range: 5.9 n miles (11 km)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg; PBXN-103

GUNS

United Defense Mk 42 Mod 9 Single 127 mm (5 in)/54 gun mounting
There is one Mk 42 Mod 9 mounting, housing a single Mk 18 127 mm/54 gun. The Mk 18 gun has replaceable liner and a service life of some 2,000 rounds. A bayonet-type joint attaches the gun to the housing which includes a vertical sliding breech block and the entire gun assembly is supported on rollers in the slide. A separate rammer is mounted on the slide. The Mk 42 mounting was introduced in 1953 and the upper part of the mounting is fully power-driven and is enclosed in an armoured shield. The Mk 42 mounting requires a crew of 12: four men within the shield, and eight in the magazine and ammunition handling system.

Ammunition is loaded by a dual system with projectiles supplied automatically to the slide alternately from the right and left. The loading system consists of two manually loaded drums, one with 20 projectiles and the other with 20 charges which rotate to bring the projectile and cartridge together. Complete rounds are lifted from the lower hoist to the upper hoist and from there to the cradles which move them to the tray from where they are rammed into the breech.

Magazine capacity is 550 rounds and ammunition includes the Mk 41 AAC/HC, Mk 42 common, and Mk 48 illumination rounds, all of which weigh 31.75 kg (70 lb). All rounds have point detonating, proximity or mechanical time fuzes.

Specifications
Gun, 127 mm/54 Mk 18
Calibre: 127 mm
Length of barrel: 54 calibres
Muzzle velocity:
new barrel: 807 m/s (2,647 ft/s)
mid-life: 792 m/s (2,598 ft/s)
Max range: 13 n miles (24 km)
Max altitude: 14,400 m (47,000 ft)
Ammunition: 31.75 kg (70 lb)

Mounting, Mk 42 Mod 9
Traverse: 360° at 40°/s
Elevation: −15 to +85° at 25°/s
Rate of fire: 20-40 rds/min

Manufacturer/Contractor
United Defense Armament Systems Division, Minneapolis, Minnesota, USA.

Hughes Mk 15 CIWS Phalanx
There is one Hughes Mk 15 Phalanx close in weapons system (CIWS) situated on the quarterdeck. The mount consists of a 20 mm M61A1 Vulcan, six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,378 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA (system).

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

AN/SLQ-32(V)2 ESM Suite
These Egyptian ships have the AN/SLQ-32(V)2 EW suite, which gives radar warning on B to J-bands. (Note that AN/SLQ-32(V)2 does not have an active jamming element, which only comes with the AN/SLQ-32(V)3 or AN/SLQ-32(V)5 suites.

Manufacturer/Contractor
Raytheon Company, Electromagnetic Systems Division, Goleta, California, USA.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers
There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

AN/SLQ-25 Nixie noisemaker
One AN/SLQ-25 Nixie solid-state, electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter to generate and amplify the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed over the transom. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. The winch streams and recovers the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed body, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, is 95 cm long (3.10 ft), 15.24 cm (6 in) in diameter and weighs 18 kg (40 lb). It receives amplifier outputs, converts them into acoustic signals and projects them.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.

Masker/Prairie Masker noise suppression systems
The ships are fitted with both Masker and Prairie-Masker radiated noise suppression systems. In Masker, high-pressure air is bled off from either the ship's gas turbine or dedicated compressors and ejected from a pipe placed laterally across the ship's hull just forward of the machinery spaces. The forward motion of the ship causes the air to form a layer separating the hull from the water and thus masking the machinery noises which would otherwise be radiated directly into the water. Such a system is less effective at slow speeds where the air bubbles tend to rise to the surface rather than remain attached to the hull.

In Prairie Masker, air is passed down the propeller shaft and ejected from a groove in the leading edge of the blade, thus delaying the onset of cavitation.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Fast Frigate Integrated Shipboard Tactical System - 1 (FFISTS-1)

The Egyptian ships were among the nine 'Knox' class ships to receive the FFISTS-1 system while in US Service. FFISTS-1 was an 'off-the-shelf' system, with a 'star' network architecture and using four Desktop Tactical-support Computers (DTC-1), essentially commercial Hewlett-Packard HP9020A/C (Model 500) with 32-bit microprocessors and some additional software. These are linked to a large hard drive Shared Resource Monitor (SRM) (and, through this common access, to each other) and to the peripherals. All interconnections are provided by Hewlett-Packard HP-1B links. With the hard disks, the system has a memory of up to 130 Mbytes and a speed of 1.5 Mips.

One DTC-1 conducts ASW data fusion and also receives data from Link 14 and a satellite communications link. The second DTC-1 acts as the Link 11 input/output terminal and also as track supervisor, receiving processed data from the navigation radar console. The third DTC-1 interfaces with the sonar systems while the fourth conducts target motion analysis from the sonars, but especially the towed array sonar. Nine FFISTS-1s were manufactured and all were installed in 'Knox' class frigates.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11
Tacan: SRN 15
IFF: UPX-12

WEAPONS CONTROL

AN/SWG-1A Harpoon Launch Control System (LCS)

SWG-1A is the Harpoon weapons control system, which activates the missile, selects the flight pattern and sets seeker search modes (with small, medium or large acquisition windows), as well as providing target range and bearing data. Alternatively, the missile can simply be launched along the bearing of the target, with the seeker activated early to scan a 90° sector; if, after a set time, no target has been acquired the missile commences a preset search pattern. SWG-1A takes account of other ships in the general target area and generates indirect flight plans for the missile, including waypoints to optimise angles of approach which will achieve the highest possibility of success while minimising the chances of the missile being destroyed by hostile fire. It can also be used to compute flight plans in a multiple attack so that several missiles, from either the same or different ships, arrive on target simultaneously, thus swamping the defences.

Mk 68 Gun Fire Control System (GFCS)

The Mk 68 GFCS provides target data, position orders and firing orders for the 127 mm (5 in) gun Mk 42 mountings for use against both surface and air targets. The system consists of a Mk 68 gun director, an AN/SPG-53 I/J-band radar, a Mk 47 computer, a Mk 16 stable element and the gun mount. The system requires a crew of eight. The Mk 68 gun director has an optical rangefinder, two handwheels for optical tracking, the radar receiver, transmitter and antenna as well as a slip ring assembly. It transmits bearing, elevation and range data both to the computer and the radar operator's console. It can be operated in automatic radar and optical tracking modes.

The SPG-53 radar incorporates both spiral and conical scan for acquisition and tracking respectively. Later versions have monopulse and low-level tracking capabilities together with splash spotting and a missile launch alarm. The radar has both automatic and manual tracking modes. The former involves transmitting radar error signals in both bearing and elevation to the director power-drive amplifiers, where they are converted into control signals which drive the director. Manual tracking is achieved by operating the range, bearing and elevation handwheels at the radar operator's console. The Mk 47 analogue computer receives inputs from the director, the radar, the stable element, gyrocompass and underwater log system and processes this data to produce data on future target location, gun position and fuze orders. When engaging air targets its operation is automatic but for engaging surface and land targets manual rate control may be adopted. The Mk 68 can be given a limited electro-optical capability by the Texas Instruments EOSS (Electro-Optical Surveillance System), which may be installed in the Australian ships.

Manufacturer/Contractor

Norden Systems.

Mk 114 ASW fire-control system

The Mk 114 is the fire-control system for ASW operations. The main element is the Mk 53 Attack Console, an electromechanical analogue system which consists of two major units, the attack plotter and the ballistic computer. The latter conducts weapon presets for both ASROC and ASW torpedoes. The Mk 114 system also includes the Mk 33 underwater fire-control switchboard which accepts data from two Mk 19 gyrocompasses and other sensors, as well as from the Mk 134 sonar stabilisation computer. The consoles have an AN/UYK-44 reconfigurable processor with some 70,000 lines of CMS-2 language code. The system interfaces with the sonar; in this case the bow-mounted EDO SQS-26 CX VDS and the EDO SQS-35 VDS.

RADARS

Set	AN/SPS-40B	AN/SPS-67*	AN/SPS-10*	LN-66	AN/SPG-53A/D/F
Company	Lockheed	Norden	Raytheon	Canadian Marconi	Western Electric
Role	2D surface	Surface search	Surface search	Navigation	Fire control
Band	E/F	H (5.45-5.83 GHz)	G	I/J (9.3-9.4 GHz)	I/J
Beam	11 × 19°	1.5 × 16°	1.5 × 16°	2.5 × 22°	1.6°
Peak power	200 kW	500 kW	285 kW	75 kW	250 kW
Gain	21 dB	30 dB	30 dB	30 dB	39 dB
Pulsewidth	60 µs	0.1, 0.25, 1 µs	0.25-1.3 µs	1.0/0.1 µs	0.25 µs
PRF	300 pps	2,400/1,200, 750 pps	312-325 pps	500/2,000 pps	1,000 pps
Scan rate	7.5/15 rpm	15/30 rpm	15 rpm	22 rpm	—
Range	175 n miles (320 km) 50,000 ft		Can detect a destroyer at 15 n miles		

* Ships are fitted with either AN/SPS-10 or AN/SPS-67.

Manufacturer/Contractor

Loral Librascope, USA.

NMMS electro-optic surveillance system

NMMS (Naval Mast-Mounted Sight) is designed to detect mines, low-flying aircraft and small boats by day or night in all weather conditions. It can also be used to support gunfire missions and to assist in helicopter landing control. NMMS consists of a systems electro-optronic package housed in a composite casing and mounted on a pedestal. The sensor package comprises multiplexer electronics, the boresight assembly and the sensors (a Si-Vidicon television camera and a thermal imager), which float on high-energy, rare-earth magnets which create an energy field designed to produce unblurred images. The thermal imager is based upon the US MCTNS (Manportable Common Thermal Night Sights) modules and has 120 elements with split Stirling cooling system. The sensor package also includes a Litton MMS Laser RangeFinder/ Designator (LRF/D) operating in the 1.06 micron range. Supporting the sensor package is a video tracker which can be used for manual or automatic tracking of targets. There is also a digital scan converter which enhances the thermal imager picture and also provides freeze frame and x2 zoom capabilities. The system is used for both manual and automatic tracking but can also conduct continuous horizon scanning of designated sectors.

It should be noted that the designation 'Mast Mounted Sight' derives from the device's US Army title and it does not necessarily follow that in naval use the device is mounted on the ship's mast. The control console can be collocated with the sight, installed in the bridge or the combat information centre according to the operational requirement.

Specifications

Weight (sensor head): 72.57 kg (160 lb)
Diameter: 64.77 cm (25.5 in)
Stabilisation: less than 20 mrad
Fields of view
thermal imager: 2 × 10°
television: 2 × 8°

Manufacturers/Contractors

McDonnell Douglas Electronic Systems Company (system).
Northrop Electronics Division, Electronics Systems Group (sensor package).

SONARS

EDO AN/SQS-26CX

The hull-mounted AN/SQS-26CX works in surface duct, bottom bounce and convergence zone modes. Surface duct is for shorter range, bottom bounce for medium ranges and convergence zone for longer ranges. The last two modes require electronic beam steering in elevation. SQS-26 is an active system transmitting at about 3.5 kHz with an output power of about 192 kW and receiving in seven channels between 1.5 and 4 kHz. The transduced is reported to be about 4.87 m (16.0 ft) in diameter and 1.68 m (5.5 ft) high, with 72 staves, each with eight elements. Ranges are reported to be approximately 10 n miles (18.5 km) in surface duct mode and 34.5 n miles (64 km) in convergence zone mode. SQS-26CX was developed specially for the 'Knox' class frigates and was the final version of the SQS-26, the next set in the series being the SQS-53A.

Manufacturer/Contractor

EDO, USA.

AN/SQR-18A(V)1 (TACTAS)

AN/SQR-18A(V)1 (also known as TACTAS (Tactical Towed Array Sonar). The low-noise array is 230 m (755 ft) long and is towed behind an SQS-35 VDS 'fish' on a cable some 0.73 km (2,400 ft) long. The system features an adaptive processor which acts to reduce interference from the towing ship's noise (and to a lesser extent from adjacent ships) and a tracked system to provide bearing resolution and target motion analysis. SQR-18 is integrated with the hull-mounted SQS-26 and AN/SQR-17 sonobuoy processor.

Manufacturer/Contractor

EDO, Government Systems Division, College Point, New York, USA.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck:

dimensions: 22.8 × 14 m (75 × 46 ft)

max helicopter take-off weight: 5,000 kg (11,000 lb)

Hangar: The hangar was originally designed to accommodate DASH helicopter drones but was later enlarged to accommodate the LAMPS-I Kaman SH-2 Seasprite. The after end of the hangar is telescopic

HELICOPTERS

Kaman SH-2G/LAMPS I Super Seasprite

Specifications

Main rotor:

diameter: 13.51 m (44.33 ft)

disc area: 143.41 m² (1,543.66 sq ft)

Tail rotor:

diameter: 2.46 m (8.15 ft)

disc area: 4.77 m² (51.32 sq ft)

Length overall (both rotors turning): 16.08 m (52.75 ft)

Fuselage length: 12.19 m (40.00 ft)

Height to rotor head: 4.58 m (15.00 ft)

Weights:

empty: 3,447 kg (7,599 lb)

max take-off: 6,124 kg (13,500 lb)

Max level speed at sea level: 138 kts (256 km/h)

Typical cruising speed: 120 kts (222 km/h)

Service ceiling: 7,285 m (23,894 ft)

Range with max standard fuel: 478 n miles (885 km)

Rasheed *(966). The five-year lease will expire in 1999 when the Egyptian Navy will take permanent ownership of the two frigates* (Diego Quevedo)

Power plant: 2—1,285 kW (1,723 shp) General Electric T700-GE-401 turboshafts

Accommodation: Crew of 3 in ASW role (pilot, co-pilot/tactical co-ordinator, sensor operator)

Sensors: Canadian Marconi LN-66HP surveillance radar; AN/ALR-66(V)1 radar warning/ESM; Teledyne Systems AN/ASN-150 tactical management system; dual Collins AN/ARC-159(V) UHF radios; Texas Instruments AN/ASQ-81(V)2 MAD; Computing Devices AN/USY-503 acoustic processor; Flightline Electronics AN/ARR-84 sonobuoy receiver and AN/ARN-146 on-top position indicator. Tele-Dynamics AN/AKT-22(V)6 sonobuoy datalink; 15 DIFAR and DICASS sonobuoys. AN/ALE-39 chaff/flare dispensers; AN/ASQ-18B torpedo presetter

Weapons: 1 or 2 Mk 46 or Mk 50 torpedoes; 8 Mk 25 marine smoke markers. Provision for pintle-mounted 7.62 mm machine guns in both doorways

PROPULSION

Specifications

System: Steam-turbines

Main machinery: 2 Combustion Engineering/Babcock & Wilcox boilers; 84.4 kg/cm² (1,200 psi); 510°C (950°F); 1 turbine; 26 MW (35,000 hp)

Shafts: 1

FURTHER INFORMATION

PROGRAMME

The five-year lease from the US Navy was agreed in mid-1993 and signed on 27 July 1994, when both ships sailed for Egypt. On completion of the lease the arrangement will be made permanent.

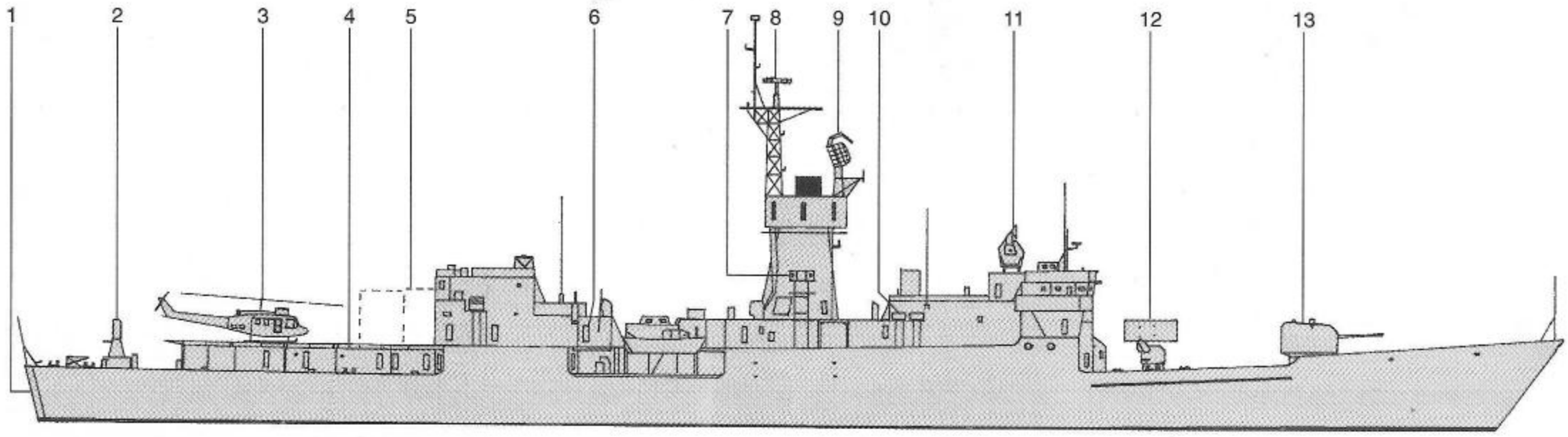
MODERNISATION

It is doubtful whether much modernisation work will be undertaken until the five-year lease is formally converted into an outright sale. Among the measures under consideration by the Egyptian Navy are:

- Replacing AN/SQR-18A(V)1 by AN/SQS 35 VDS sonar
- The removal of the Mk 16 ASROC launcher group
- Installing eight launcher/canisters for RGM-84 Harpoon

Damyat *(961) is one of two ex-US Navy 'Knox' class frigates operated on lease by the Egyptian Navy. Note the prominent platform abreast of the 'mack' for the SLQ-32 (V)2 ESM* (Diego Quevedo)

EPIRUS (KNOX)



Epirus

1 EDO SQS-35 VDS 2 Hughes Mk 15 20 mm Vulcan CIWS 3 AB 212 ASW helicopter 4 Flight deck 5 Telescopic hangar 6 Two fixed 324 mm torpedo tubes 7 AN/SLQ-32(V)5 ECM/ESM system 8 Raytheon SPS-10F surface search radar 9 Lockheed SPS-40D air search radar 10 Loral Hycor Mk 36 SRBOC six-barrel chaff/IR launcher 11 Western Electric SPG-53 fire control 12 Mk 16 eight-cell launcher (ASROC, Harpoon) 13 United Defense 127 mm (5 in)/54 Mk 42 Mod 9 gun

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Greece
Type: Knox

Class: EPIRUS

Leased: 3
Active: 3

Displacement:
standard: 3,011 t
full load: 3,877 t

Dimensions
Length: 134 m (439.6 ft)
Beam: 14.3 m (46.9 ft)
Draught: 4.6 m (15.1 ft) (hull); 7.8 m (25.6 ft)

Speed: 27 kts
Range: 4,000 n miles at 22 kts on 1 boiler

Complement: 288 (17 officers)

SHIPS

EPIRUS (F 456)	
Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	23 Mar 1967
Launched	20 Jul 1968
Commissioned (US Navy)	30 Aug 1969 (ex-*Connole* (FF 1056))
Recommissioned	30 Aug 1992

THRACE (F 457)	
Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	29 Jul 1968
Launched	1 Nov 1969
Commissioned (US Navy)	19 Sep 1970 (*Trippe* (FF 1075))
Recommissioned	30 Jul 1992

MAKEDONIA (F 458)	
Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	20 Mar 1968
Launched	14 Jun 1969
Commissioned (US Navy)	13 Jun 1970 (*Vreeland* (FF 1068))
Recommissioned	25 Jul 1992

WEAPONS SYSTEMS

MISSILE LAUNCHER

Mk 16 launcher group

The 'Knox' class is fitted with a Mk 16 Launcher Group located on the foredeck, with a single Mk 112 launcher, which consists of four pairs of launch tubes, each pair elevating independently. The version installed in the 'Knox' class is the Mk 16 Mod 8, in which one pair of tubes has been adapted to take RGM-84 Harpoon missiles. Maximum launch rate is three missiles per minute.

SURFACE-TO-AIR MISSILES (SAM)

FIM-43 Redeye close in system

The FIM-43 Redeye system is a man-portable close-range SAM, which although originally developed for army use, is also used by a number of navies. Four launchers are deployed in the 'Epirus' class frigates. The system consists of an M46A2 launcher assembly with grip-stock, sighting system, an M41 missile in its launcher-container, and a battery coolant device which is fitted to the M46A2. On acquiring a target the operator activates the battery coolant unit and uses the optical sighting system (x7.5 magnification; 25° field of view) to track the target until the missile seeker 'locks-on', which generates both audio and visual signals, and the missile is launched. The first stage rocket carries the missile out of the tube and the aerodynamic surfaces deploy, and then, after 1.6 seconds, by which time the missile is 6 to 7 m (19 to 23 ft) ahead of the operator, the sustainer motor ignites, the warhead is armed, and the seeker constantly measures the difference between the gyro line of sight and the IR source. Throughout the engagement the seeker is continuously repositioned to remain aimed at the target.

Specifications
FIM-43
Length: 1.28 m (4.2 ft)
Diameter: 70 cm (27.5 in)
Weight: 8.2 kg (18 lb)
Speed: Mach 1.6
Range: 3,300 m (10,824 ft)
Altitude: 3,000 m (9,840 ft)
Guidance: IR passive homing

Manufacturers/Contractors
Hughes Missile Systems (prime).
Raytheon Company, Missile Systems Division (second source).
Dornier GmbH (prime European).

ANTI-SHIP MISSILES (ASM)

McDonnell Douglas UGM-84B Harpoon

The ship carries four Harpoon missiles: two in the launcher and two in the magazine. Harpoon can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns, and for the terminal phase can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 kg)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

ANTI-SUBMARINE MISSILES

Honeywell RUR-5A ASROC

The magazine also houses six ASROC missiles. ASROC consists of a Mk 46 torpedo with strap-on aerodynamic surfaces and a rocket motor to enable it to fly to within range of its submarine target. Attached to the rear end of the torpedo is a short airframe assembly of clam-like construction, held together by a steel band, with a Naval Propulsion Plant solid propellant booster and four trapezoidal aerodynamic surfaces to provide stability in flight. The torpedo has a dome-shaped frangible plastic nose cap to protect the transducer as it enters the water. Payload is an Alliant Mk 46 Mod 5 torpedo, which has a seeker designed specifically to detect most types of target including submarines with anechoically coated hulls and has an estimated acquisition range of 460 m (1,508 ft).

When a submarine target is detected it is tracked and the attack console's fire-control computer predicts the target's position. The launcher is turned in the appropriate direction and elevated to an angle appropriate to the range. The fire-control computer then orders the launch and the booster burns for a programmed time of between 1 and 4 seconds, by which time the missile will have reached a height of between 60 and 305 m (197 and 1,001 ft), although the aerodynamically stable airframe enables it to coast up to 600 m (1,969 ft). On reaching the programmed position, an explosive bolt cuts the steel band holding the airframe assembly sections together and as they separate the parachute deploys to retard the torpedo's fall, water entry taking place some 14 to 50 seconds after launch. As the torpedo enters the water the frangible nose cap breaks off and the torpedo begins its search for the target using a predetermined pattern.

Specifications

ASROC missile
Length: 4.6 m (15.1 ft)
Diameter: 32.5 cm (12.8 in)
Span: 84.5 cm (33.3 in)
Weight: 435 kg (959 lb)
Range: 0.86-5.39 n miles (1.6-10 km)
Speed: Mach 0.9

Mk 46 Mod 5 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Manufacturer/Contractor

Honeywell, USA.

TUBES

324 mm Mk 32 Mod 9 torpedo launchers

Two twin Mk 32 Mod 9 324 mm torpedo launchers are mounted at the forward end of the after deckhouse, angled outwards at 45°.
The torpedo magazine contains 22 torpedoes.

TORPEDOES

Mk 46 Mod 5 torpedo

Normal armament is the Honeywell Mk 46 Mod 5 anti-submarine torpedo.

Specifications

Mk 46 Mod 5
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight:
torpedo: 230 kg (507 lb)
warhead: 44 kg (97 lb)
Speed: 40 kts (max)
Range: 5.9 n miles (11 km)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg; PBXN-103

GUNS

United Defense Mk 42 Mod 9 Single 127 mm (5 in)/54 gun mounting

There is one Mk 42 Mod 9 mounting, housing a single Mk 18 127 mm/54 gun. The Mk 18 gun has replaceable liner and a service life of some 2,000 rounds. A bayonet-type joint attaches the gun to the housing which includes a vertical sliding breech block and the entire gun assembly is supported on rollers in the slide. A separate rammer is mounted on the slide. The Mk 42 mounting was introduced in 1953 and the upper part of the mounting is fully power-driven and is enclosed in an armoured shield. The Mk 42 mounting requires a crew of 12: four men within the shield, and eight in the magazine and ammunition handling system.

Ammunition is loaded by a dual system with projectiles supplied automatically to the slide alternately from the right and left. The loading system consists of two manually loaded drums, one with 20 projectiles and the other with 20 charges, which rotate to bring the projectile and cartridge together. Complete rounds are lifted from the lower hoist to the upper hoist and from there to the cradles which move them to the tray where they are rammed into the breech.

Magazine capacity is 550 rounds and ammunition includes the Mk 41 AAC/HC, Mk 42 common, and Mk 48 illumination rounds, all of which weigh 31.75 kg (70 lb). All rounds have point detonating, proximity or mechanical time fuzes.

Specifications

Gun, 127 mm/54 Mk 18
Calibre: 127 mm
Length of barrel: 54 calibres
Muzzle velocity:
new barrel: 807 m/s (2,647 ft/s)
mid-life: 792 m/s (2,597 ft/s)
Max range: 13 n miles (24 km)
Max altitude: 14,400 m (47,000 ft)
Ammunition: 31.75 kg (70 lb)

Mounting, Mk 42 Mod 9
Traverse: 360° at 40°/s
Elevation: −15 to +85° at 25°/s
Rate of fire: 20-40 rds/min

Manufacturer/Contractor

United Defense Armament Systems Division, Minneapolis, Minnesota, USA

Hughes Mk 15 CIWS Phalanx

There is one Hughes Mk 15 Phalanx close in weapons system (CIWS) situated on the quarterdeck. The mount consists of a 20 mm M61A1 Vulcan, six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,378 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA (system).

ELECTRONIC WARFARE SYSTEMS

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers

There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications

Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

AN/SLQ-25 Nixie noisemaker

One AN/SLQ-25 Nixie solid-state, electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter to generate and amplify the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed over the transom. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. The winch streams and recovers the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed body, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, is 95 cm long (3.10 ft), 15.24 cm (6 in) in diameter and weighs 18 kg (40 lb). It receives amplifier outputs, converts them into acoustic signals and projects them.

Manufacturer/Contractor

Aerojet ElectroSystems, Sacramento, California, USA.

Masker/Prairie Masker noise suppression systems

The ships are fitted with both Masker and Prairie-Masker radiated noise suppression systems. In Masker, high-pressure air is bled off from either the ship's gas turbine or dedicated compressors and ejected from a pipe placed laterally across the ship's hull just forward of the machinery spaces. The forward motion of the ship causes the air to form a layer

separating the hull from the water and thus masking the machinery noises which would otherwise be radiated directly into the water. Such a system is less effective at slow speeds where the air bubbles tend to rise to the surface rather than remain attached to the hull.

In Prairie Masker, air is passed down the propeller shaft and ejected from a groove in the leading edge of the blade, thus delaying the onset of cavitation.

AN/SLQ-32(V)5 Sidekick ESM/ECM Suite

All ships have the AN/SLQ-32(V)2 EW suite, which was upgraded to (V)5 standard by the addition of the Sidekick modification kit while in US service. AN/SLQ-32(V)2 is the ESM system, which gives radar warning across the B to H-bands, while Raytheon's Sidekick adds jamming and deception capabilities.

Manufacturer/Contractor

Raytheon Company, Electromagnetic Systems Division, Goleta, California.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Fast Frigate Integrated Shipboard Tactical System - 2 (FFISTS-2) FFISTS-2 was developed from FFISTS-I and replaces the star-network by a distributed architecture, which uses DTC-2 workstations interconnected by a dual fibre optic or a Thicknet local area network. The DTC-2 work station is a SUN-4/110 SPARC station with either one or two 48 cm (19 in) raster scan screens, 32 Mbytes of RAM, a 200 Mbyte hard drive (eliminating the need for the shared hard drives used in FFISTS-1) and is rated at 7.5 mips. A twin-screen DTC-2 monitors the sonars while a single-screen DTC-2 acts as the Link 11 interface. A third, single-screen, DTC-2 provides data fusion from onboard and offboard sensors including Link 11, Link 14 and satellite communications. FFISTS-2 is reported to be capable of conducting not only ASW operations but also anti-ship operations.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11; Link 14 (receive only)
Tacan: SRN 15
IFF: UPX-12.

WEAPONS CONTROL

AN/SWG-1A Harpoon Launch Control System (LCS)

SWG-1A is the Harpoon weapons control system, which activates the missile, selects the flight pattern and sets seeker search modes (with small, medium or large acquisition windows), as well as providing target range and bearing data. Alternatively, the missile can simply be launched along the bearing of the target, with the seeker activated early to scan a 90° sector; if, after a set time, no target has been acquired the missile commences a preset search pattern. SWG-1A takes account of other ships in the general target area and generates indirect flight plans for the missile, including waypoints to optimise angles of approach which will achieve the highest possibility of success while minimising the chances of the missile being destroyed by hostile fire. It can also be used to compute flight plans in a multiple attack so that several missiles, from either the same or different ships, arrive on target simultaneously, thus swamping the defences.

Mk 68 Gun Fire Control System (GFCS)

The Mk 68 GFCS provides target data, position orders and firing orders for the 127 mm (5 in) gun Mk 42 mountings for use against both surface and air targets. The system consists of a Mk 68 gun director and AN/SPG-53 I/J-band radar, a Mk 47 computer, a Mk 16 stable element and the gun mount. The system requires a crew of eight. The Mk 68 gun director has an optical rangefinder, two handwheels for optical tracking, the radar receiver, transmitter and antenna as well as a slip ring assembly. It transmits bearing, elevation and range data both to the computer and the radar operator's console. It can be operated in automatic radar and optical tracking modes.

The SPG-53 radar incorporates both spiral and conical scan for acquisition and tracking respectively. Later versions have monopulse and low-level tracking capabilities together with splash spotting and a missile launch alarm. The radar has both automatic and manual tracking modes. The former involves transmitting radar error signals in both bearing and elevation to the director power-drive amplifiers, where they are converted into control signals which drive the director. Manual tracking is achieved by operating the range, bearing and elevation handwheels at the radar operator's console. The Mk 47 analogue computer receives inputs from the director, the radar, the stable element, gyrocompass and underwater log system and processes this data to produce data on future target location, gun position and fuze orders. When engaging air targets its operation is automatic but for engaging surface and land targets manual rate control may be adopted.

Manufacturer/Contractor

Norden Systems.

Mk 114 ASW fire-control system

The Mk 114 is the fire-control system for ASW operations. The main element is the Mk 53 Attack Console, an electromechanical analogue system which consists of two major units, the attack plotter and the ballistic computer. The latter conducts weapon presets for both ASROC and ASW torpedoes. The Mk 114 system also includes the Mk 33 underwater fire-control switchboard which accepts data from two Mk 19 gyrocompasses and other sensors, as well as from the Mk 134 sonar stabilisation computer. The consoles have an AN/UYK-44 reconfigurable processor with some 70,000 lines of CMS-2 language code. The system interfaces with the sonar.

Manufacturer/Contractor

Loral Librascope.

NMMS electro-optic surveillance system

The McDonnell Douglas Navy Mast-Mounted Sight (NMMS) was an adaptation of the Mast-Mounted Sight (MMS), which was developed for use in US Army helicopters for target location and designation. NMMS is designed to detect mines, low-flying aircraft and small boats by day or night in all weather conditions. It can also be used to support gunfire missions and to assist in helicopter landing control. NMMS consists of a systems electro-optronic package housed in a composite casing and mounted on a pedestal. The sensor package comprises multiplexer electronics, the boresight assembly and the sensors (a Si-Vidicon television camera and a thermal imager), which float on high energy, rare-earth magnets which create an energy field designed to produce unblurred images. The thermal imager is based upon the US MCTNS (Manportable Common Thermal Night Sights) modules and has 120 elements with split Stirling cooling system. The sensor package also includes a Litton MMS Laser Range-Finder/ Designator (LRF/D) operating in the 1.06 micron range. Supporting the sensor package is a video tracker which can be used for manual or automatic tracking of targets. There is also a digital scan converter which enhances the thermal imager picture and also provides freeze frame and x2 zoom capabilities. The system is used for both manual and automatic tracking but can also conduct continuous horizon scanning of designated sectors.

It should be noted that the designation 'Mast Mounted Sight' derives from the device's US Army title and it does not necessarily follow that in naval use the device is mounted on the ship's mast. The control console can be collocated with the sight, installed in the bridge or the combat information centre according to the operational requirement.

Specifications

Weight (sensor head): 72.57 kg (160 lb)
Diameter: 64.77 cm (25.5 in)
Stabilisation: less than 20 mrad
Fields of view
thermal imager: 2 × 10°
television: 2 × 8°

Manufacturers/Contractors

McDonnell Douglas Electronic Systems Company (system).
Northrop Electronics Division, Electronics Systems Group (sensor package).

RADARS

Set	AN/SPS-40B	AN/SPS 67*	AN/SPS-10*	LN-66	AN/SPG-53A/D/F
Company	Lockheed	Norden	Raytheon	Canadian Marconi	Western Electric
Role	2D surface	Surface search	Surface search	Navigation	Fire control
Band	E/F	H (5.45-5.83 GHz)	G	I/J (9.3-9.4 GHz)	I/J
Beam	11 × 19°	1.5 × 16°	1.5 × 16°	2.5 × 22°	1.6°
Peak power	200 kW	500 kW	285 kW	75 kW	250 kW
Gain	21 dB	30 dB	30 dB	30 dB	39 dB
Pulsewidth	60 µs	0.1, 0.25, 1 µs	0.25-1.3 µs	1.0/0.1 µs	0.25 µs
PRF	300 pps	2,400, 1,200, 750 pps	312-325 pps	500/2,000 pps	1,000 pps
Scan rate	7.5/15 rpm	15/30 rpm	15 rpm	22 rpm	—
Range	175 n miles (320 km) 50,000 ft		Can detect a destroyer at 15 n miles		

* Ships are fitted with either AN/SPS-10 or AN/SPS-67.

SONARS

EDO AN/SQS-26CX

The hull-mounted AN/SQS-26CX works in surface duct, bottom bounce and convergence zone modes. Surface duct is for shorter range, bottom bounce for medium ranges and convergence zone for longer ranges. The last two modes require electronic beam steering in elevation. SQS-26 is an active system transmitting at about 3.5 kHz with an output power of about 192 kW and

receiving in seven channels between 1.5 and 4 kHz. The transduced is reported to be about 4.87 m (16.0 ft) in diameter and 1.68 m (5.5 ft) high, with 72 staves, each with eight elements. Ranges are reported to be approximately 10 n miles (18.5 km) in surface duct mode and 34.5 n miles (64 km) in convergence zone mode. SQS-26CX was developed specially for the 'Knox' class frigates and was the final version of the SQS-26, the next set in the series being the SQS-53A.

EDO SQS-35

The EDO AN/SQS-35 is a variable depth sonar (VDS) designed to detect submarines at medium ranges. It uses an array with 24 staves, operates at 13 kHz and has a peak power of 30 kW. There is a large 'fish' which is lowered over the stern on a large gantry and then streamed on a long cable. SQS-35 is a single console system with miniaturised vacuum-tube electronics.

Manufacturer/Contractor

EDO, Government Systems Division, College Point, New York, USA.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck:

dimensions: 22.8 × 14 m (75 ft × 46 ft)

max helicopter take-off weight: 5,000 kg (11,000 lb)

Hangar: The hangar was originally designed to accommodate DASH helicopter drones, but was later enlarged to accommodate the SH-2 LAMPS-I Kaman SH-2 Seasprite. The after end of the hangar is telescopic

HELICOPTERS

The Hellenic Navy operates one Agusta-Bell AB-212ASW helicopter from these frigates.

Specifications

Main rotor diameter: 14.63 m (48.0 ft)
Length overall (both rotors turning): 22.15 m (72.6 ft)
Fuselage length: 12.92 m (42.39 ft)
Height to rotor head: 3.91 m (12.82 ft)
Rotor disc area: 168.1 m² (1,809 sq ft)
Max take-off weight: 5,070 kg (11,177 lb)
Max speed (never exceed): 130 kts (240 km/h)
Typical cruising speed: 100 kts (185 km/h)
Hovering ceiling (out of ground effect): 396 m (1,300 ft)
Range with max standard fuel: 332 n miles (615 km)
Engine: 1 Pratt & Whitney Canada PT6T-6 Turbo Twin Pac rated at 1,398 kW (1,875 shp)
Role equipment: Torpedoes

PROPULSION

Specifications

System: Steam-turbines
Main machinery: 2 Combustion Engineering/Babcock & Wilcox boilers; 84.4 kg/cm² (1,200 psi); 510°C (950°F); 1 turbine; 26 MW (35,000 hp)
Shafts: 1

FURTHER INFORMATION

PROGRAMME

It was officially announced on 11 February 1992 that three 'Knox' class would be leased from the US to the Hellenic Navy. *Makedonia* arrived at Salamis 25 August 1992, *Thrace* 15 September 1992 and *Epirus* 12 February 1993.

MODERNISATION

The Hellenic Navy plans to improve the air defence capabilities of these ships.

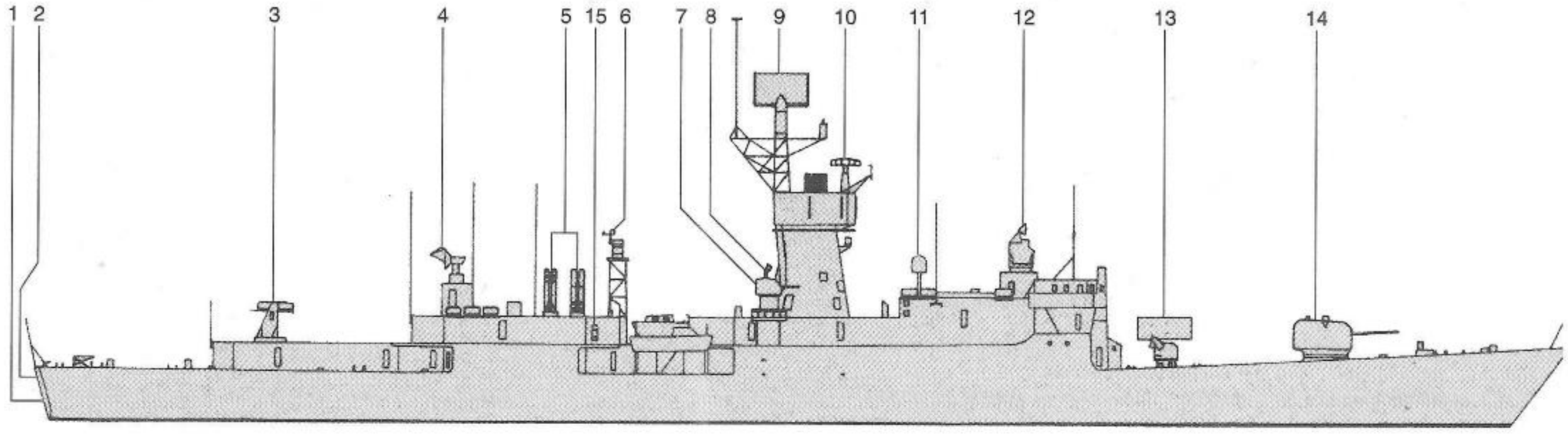
EQUIPMENT

The Greek ships have certain differences from the other ships operating with other navies:

- The AN/SLQ-32 ESM suite has the add-on Sidekick ECM capability.
- Four SAM launchers for Stinger.
- They are equipped with AN/SQS-35 VDS rather than AN/SQR-18(V)1.

Thrace *(F 457). Greece has leased three 'Knox' class frigates from the US Navy and, like the Turkish Navy, they operate an Agusta-Bell AB 212ASW* (Giorgio Ghiglione)

BALEARES (KNOX)



Baleares (Ian Sturton)

***1** EDO SQS-35(V) variable depth sonar **2** Two US Mk 25 torpedo tubes (not used) **3** Mk 22 Mod 0 Launcher for standard SM-1MR SAM **4** Raytheon SPG-51C fire control **5** McDonnell Douglas Harpoon anti-ship missiles (eight) **6** Selenia RAN-12L fire control (for Meroka) **7** Bazan Meroka 12-barrel 20 mm CIWS **8** Sperry VPS2 fire control (for Meroka) **9** Hughes SPS-52B air search radar **10** Raytheon SPS-10 surface search **11** Saturn SATCOM **12** Western Electric SPG-53B fire control (for gun) **13** Mk 112 eight-cell launcher (for ASROC) **14** United Defense single 127 mm (5 in)/54 Mk 42 Mod 9 gun **15** Two US Mk 32 torpedo tubes (internally mounted)*

GENERAL SPECIFICATIONS

Country of origin: Spain/USA
Operator: Spain
Type: Knox

Class: BALEARES

Built: 5
Active: 5

Displacement:
standard: 3,550 t
full load: 4,177 t

Dimensions:
Length: 133.6 m (438 ft)
Beam: 14.3 m (46.9 ft)
Draught: 4.7 m (15.4 ft)(hull); 7.8 m (25.6 ft)(sonar)

Speed: 28 kts
Range: 4,500 n miles at 20 kts

Complement: 256 (15 officers)

SHIPS

BALEARES (F 71)

Builder	Bazan, Ferrol, Spain
Laid down	31 Oct 1968
Launched	20 Aug 1970
Commissioned	24 Sep 1973

ANDALUCIA (F 72)

Builder	Bazan, Ferrol, Spain
Laid down	2 Jul 1969
Launched	30 Mar 1971
Commissioned	23 May 1974

CATALUNA (F 73)

Builder	Bazan, Ferrol, Spain
Laid down	20 Aug 1970
Launched	3 Nov 1971
Commissioned	16 Jan 1975

ASTURIAS (F 74)

Builder	Bazan, Ferrol, Spain
Laid down	30 Mar 1971
Launched	13 May 1972
Commissioned	2 Dec 1975

EXTREMADURA (F 75)

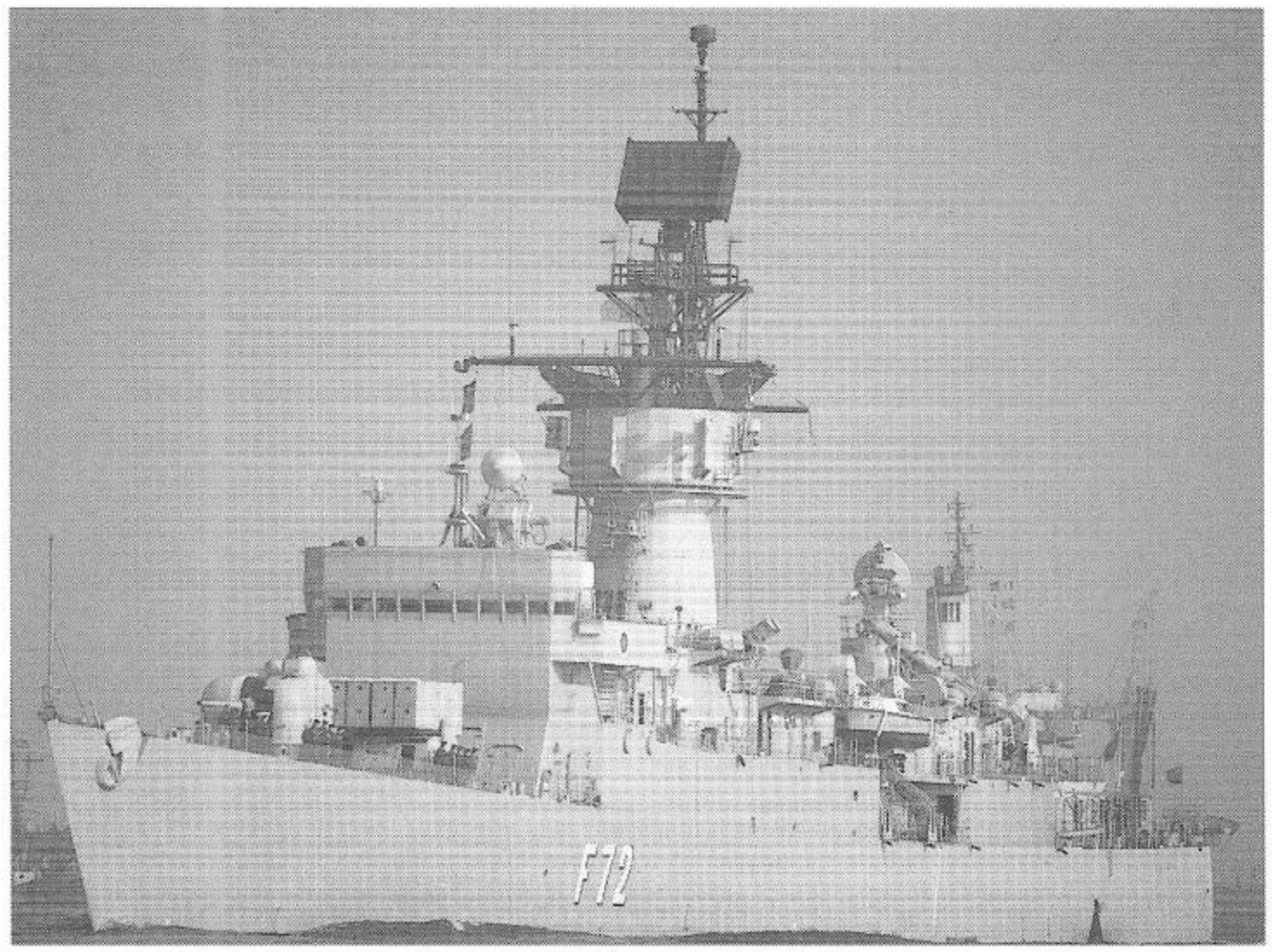
Builder	Bazan, Ferrol, Spain
Laid down	3 Nov 1971
Launched	21 Nov 1972
Commissioned	10 Nov 1976

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84A/C Block 1C Harpoon

Unlike US-built versions of the 'Knox' class, the Spanish 'Baleares' class does not launch Harpoons from the Mk 16 ASROC launcher, but mounts Harpoon launcher-containers atop the after superstructure immediately ahead of the SPG-51 radar, instead. There are mounting brackets for eight missile canisters, although only four are usually carried in peacetime. There are two groups of four launchers, with each group pointing across the ship to the opposite beam. The missiles are the Block 1C version, which has additional options, compared to previous blocks, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C



Andalucia *(F72) one of five modified 'Knox' class frigates built in Spain. The ship is dominated by the huge 'mack' which was intended to be the mounting for a series of billboard type antennas which never materialised* (Jane's/H M Steele)

missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg (11,905lb) thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

Mk 22 Mod 0 launcher
The Mk 22 Mod 0 single-arm launcher is mounted on the after superstructure. There are 16 missiles, which are stored vertically in a circular magazine. Maximum launch rate is seven missiles in 1 minute.

Standard Missile-1 Medium Range (SM-1MR)
Main air defence armament is the Standard SM-1MR. When the target is detected the data is evaluated by the ship's command system and the target is designated for the missile fire-control system, which then tracks and illuminates it. There is one SPG-51C tracker/illuminator radar, which can control one missile. Once the missile is launched, the tracker's main illumination beam holds the target while the rear reference illuminator beam provides guidance data through the missile's rear reference antenna. This guides the missile until the onboard seeker detects the CW reflected energy from the main illuminator beam. The onboard guidance system then brings the missile to an interception course.

Specifications
Length: 4.48 m (14.7 ft)
Diameter: 34.3 cm (13.5 in)
Wing span: 1.06 m (3.4 ft)
Weight: 642.3 kg (1,416 lb)
Speed: Mach 2
Range: 20.5 n miles (38 km)
Altitude: 19,800 m (64,944 ft)

Manufacturers/Contractors
Hughes Missile Systems, Tucson, Arizona, USA.
Raytheon, Missile Systems Division, Bedford, Maryland, USA.

ANTI-SUBMARINE MISSILES

Mk 112 launcher
The 'Baleares' class ships are equipped with the Mk 112 box launcher, which holds eight ASROC rounds, with a further eight rounds in the magazine.

Honeywell RUR-5A ASROC
ASROC consists of a Mk 46 torpedo with strap-on aerodynamic surfaces and a rocket motor to enable it to fly to within range of its submarine target. Attached to the rear end of the torpedo is a short airframe assembly of clam-like construction, held together by a steel band, with a Naval Propulsion Plant solid propellant booster and four trapezoidal aerodynamic surfaces to provide stability in flight. The torpedo has a dome-shaped frangible plastic nose cap to protect the transducer as it enters the water. Payload is an Alliant Mk 46 Mod 5 torpedo, which has a seeker designed specifically to detect most types of target including submarines with anechoically coated hulls and has an estimated acquisition range of 460 m (1,509 ft).

When a submarine target is detected it is tracked and the attack console's fire-control computer predicts the target's position. The launcher is turned in the appropriate direction and elevated to an angle appropriate to the range. The fire-control computer then orders the launch and the booster burns for a programmed time of between 1 and 4 seconds, by which time the missile will have reached a height of between 60 and 305 m (197 and 1,001 ft), although the aerodynamically stable airframe enables it to coast up to 600 m (1,968 ft). On reaching the programmed position, an explosive bolt cuts the steel band holding the airframe assembly sections together and as they separate the parachute deploys to retard the torpedo's fall, water entry taking place some 14 to 50 seconds after launch. As the torpedo enters the water the frangible nose cap breaks off and the torpedo begins its search for the target using a predetermined pattern.

Specifications
ASROC missile
Length: 4.6 m (15.1 ft)
Diameter: 32.5 cm (12.8 in)
Span: 84.5 cm (33.3 in)
Weight: 435 kg (959 lb)
Range: 0.86-5.39 n miles (1.6-10 km)
Speed: Mach 0.9

Mk 46 Mod 5 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Manufacturer/Contractor
Honeywell, USA.

TUBES

324 mm Mk 32 Mod 9 torpedo launchers
Two twin Mk 32 Mod 9 324 mm torpedo launchers are mounted at the forward end of the after deckhouse, angled outwards at 45°. The torpedo magazine contains 22 torpedoes.
(Note that the two stern-mounted 484 mm Mk 25 stern tubes for Westinghouse Mk 37 torpedoes are no longer used.)

TORPEDOES

Mk 46 Mod 5 torpedo

Specifications
Mk 46 Mod 5
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight:
torpedo: 230 kg (507 lb)
warhead: 44 kg (97 lb)
Speed: 40 kts (max)
Range: 5.9 n miles (11 km)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg; PBXN-103

GUNS

United Defense Mk 42 Mod 9 Single 127 mm (5 in)/54 gun mounting
There is one Mk 42 Mod 9 mounting, housing a single Mk 18 127 mm/54 gun. The Mk 18 gun has replaceable liner and a service life of some 2,000 rounds. A bayonet-type joint attaches the gun to the housing which includes a vertical sliding breech block and the entire gun assembly is supported on rollers in the slide. A separate rammer is mounted on the slide. The Mk 42 mounting was introduced in 1953 and the upper part of the mounting is fully power-driven and is enclosed in an armoured shield. The Mk 42 mounting requires a crew of 12: four men within the shield, and eight in the magazine and ammunition handling system.

Ammunition is loaded by a dual system with projectiles supplied automatically to the slide alternately from the right and left. The loading system consists of two manually loaded drums, one with 20 projectiles and the other with 20 charges, which rotate to bring the projectile and cartridge together. Complete rounds are lifted from the lower hoist to the upper hoist and from there to the cradles which move them to the tray where they are rammed into the breech.

Magazine capacity is 550 rounds and ammunition includes the Mk 41 AAC/HC, Mk 42 common, and Mk 48 illumination rounds, all of which weigh 31.75 kg (70 lb). All rounds have point detonating, proximity or mechanical time fuzes.

Specifications
Gun, 127 mm/54 Mk 18
Calibre: 127 mm
Length of barrel: 54 calibres
Muzzle velocity:
new barrel: 807 m/s (2,647 ft/s)
mid-life: 792 m/s (2,598 ft/s)
Max range: 13 n miles (24 km)
Max altitude: 14,400 m (47,000 ft)
Ammunition: 31.75 kg (70 lb)

Mounting, Mk 42 Mod 9
Traverse: 360° at 40°/s
Elevation: −15 to +85° at 25°/s
Rate of fire: 20-40 rds/min

Manufacturer/Contractor
United Defense Armament Systems Division, Minneapolis, Minnesota, USA.

Bazan Meroka
Two Bazan Meroka 12-barrelled 20 mm/120 close in weapons systems (CIWS) are mounted either side of the mack. Meroka is unique in its configuration and operation, consisting of 12 Oerlikon 20 mm KAA barrels arranged in a single unit of two superimposed rows of six with a common breech block. All operations, such as loading, feeding and unlocking, are carried out using compressed air from reservoirs on the mounting, which are recharged from an onboard compressor. Ammunition is brought to the barrels by two belt feeds, supplied by a hydraulically powered, rotating, 72 round magazine.

Specifications
Calibre: 20 mm
Length of barrel: 120 calibres
Muzzle velocity: 1,215 m/s (3,985 ft/s)
Traverse: 360° at 90°/s
Elevation: −20 to +85°
Crew: 0
Range: 0.75 n miles (1.5 km)
Rate of fire: 2,700-3,600 rds/min
Ammunition: 337 g (TP-T, HEI, SAPHEI-T, AP-T); 310 g (APDS-T)

Manufacturer/Contractor
Fabrica de Artilleria de Bazan, Spain.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Ceselsa Deneb

Deneb is a Spanish-developed and manufactured radar intercept system.

Manufacturer/Contractor
Ceselsa, Madrid, Spain.

ELECTRONIC COUNTERMEASURES (ECM)

Ceselsa Canopus

Canopus is a Spanish-developed and manufactured noise and deception jammer.

Manufacturer/Contractor
Ceselsa, Madrid, Spain.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers

There are two Mk 36 SRBOC (Super Rapid Bloom Off-board Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

TRITAN 1 tactical data handling system

TRITAN *(Tratamiento Informatico de Tactica Naval)* is a mainframe system based upon the Unisys CP-642A (USN designation AN/UYK-20A) computer which has a 256 k memory and an operating speed of 125 Kops (thousands of operations per second). The software is written in the CMS-2M language with programs produced at the tactical programming and instruction centre at Rota. Other hardware includes a Selenia (now Alenia) radar central unit, a Quantex Model 2600 (AN/USH-26) signal recorder, a Genicom Model 2120, a CV-2953A signal data converter, a CV-2834 video radar processor and the Sainco-produced horizontal and vertical display systems known as Consolas 'Tritan'. There is a data distribution system, Link 11 datalink hardware (the TE-237P terminal set and the 373E terminal set control) and the Ceselsa Deneb ESM subsystem. The system can track a total of 64 air and surface targets simultaneously, together with four subsurface targets.

The prime air search radar is the Hughes AN/SPS-52B, an E/F-band radar with a flat planar array tilted at an angle of 25° to the vertical. The array is composed of rows of slotted waveguide radiators fed by a sinuous feed system on one side of the array. Beam forming and steering is accomplished by computer-controlled switching of the feed to each row. The radar has its own AN/UYK-20 computer. The surface search radar is the Raytheon AN/SPS-10 G-band system with a 2.4 m (7.8 ft) open lattice construction antenna with horn feed.

In the 'Baleares' class TRITAN operates with the Raytheon DE 1160C (US Navy AN/SQS-56) sonar which is licence-built by Inisel, and the EDO AN/SQS-35V hull-mounted variable depth sonar is a medium frequency, medium range, hull-mounted sonar. The system is a preformed beam, digital sonar which provides panoramic echo ranging and passive surveillance. The Spanish systems are an upgraded version of DE 1160B with greater transmitter ability and, like all versions of this sonar, they transmit at 7.5 kHz.

There are three three-place (including supervisor) horizontal display consoles and two single-operator vertical consoles. The horizontal consoles are used for overall tactical picture compilation, air and anti-submarine operations.

Manufacturer/Contractor
Direccion de Construcciones, Madrid, Spain.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 11
Satcom: Saturn
Tacan: SRN 15A

WEAPONS CONTROL

Mk 68 Gun Fire Control System (GFCS)

The Mk 68 provides target data, position orders and firing orders for the 127 mm (5 in) gun Mk 42 mountings for use against both surface and air targets. The system consists of a Mk 68 gun director and AN/SPG-53B I/J-band radar, a Mk 47 computer, a Mk 16 stable element and the gun mount. The system requires a crew of eight. The Mk 68 gun director has an optical rangefinder, two handwheels for optical tracking, the radar receiver, transmitter and antenna as well as a slip ring assembly. It transmits bearing, elevation and range data both to the computer and the radar operator's console. It can be operated in automatic radar and optical tracking modes.

The SPG-53B radar incorporates both spiral and conical scan for acquisition and tracking respectively. Later versions have monopulse and low-level tracking capabilities together with splash spotting and a missile launch alarm. The radar has both automatic and manual tracking modes. The former involves transmitting radar error signals in both bearing and elevation to the director power-drive amplifiers, where they are converted into control signals which drive the director. Manual tracking is achieved by operating the range, bearing and elevation handwheels at the radar operator's console. The Mk 47 analogue computer receives inputs from the director, the radar, the stable element, gyrocompass and underwater log system and processes this data to produce data on future target location, gun position and fuze orders. When engaging air targets its operation is automatic but for engaging surface and land targets manual rate control may be adopted.

Manufacturer/Contractor
Norden Systems, USA.

Mk 74 missile system

The Mk 74 acquires, tracks and illuminates targets which have been assigned by the weapon direction system. It operates with a missile handling/launching system but is not involved in the launch sequence, which is controlled by the WDS. After missile launching the Mk 74 monitors the weapon and controls it until interception of the target then carries out a post-launch evaluation. The system consists of a computer system, an AN/SPG-51C radar, a Mk 73 director and associated consoles.

The AN/SPG-51C, has two independent channels each with a G/H-band tracking radar and an I/J-band illumination transmitter. This radar has longer detection and acquisition ranges than its predecessor, and automatic target scheduling, which require fewer operator decisions. The console with this system was the dedicated OJ-101. The Mod 14 radar incorporates a universal CW injection modulator in the CW injection transmitter to provide an uplink for the SM-2 missile and a monopulse receiver for more accurate angle tracking.

The Mk 73 director is a rotating electronic structure which includes the transmitter group, the control power supply for CW injection, the power supply for the pulse Doppler system, and a radar data converter. It can traverse up to 360° while elevation limits are −30 to +83°.

Manufacturer/Contractor
Raytheon Company, Equipment Division, USA.

Mk 114 ASW fire-control system

The Mk 114 ASW fire-control system's main element is the Mk 53 Attack Console, an electromechanical, analogue system consisting of two major units: the attack plotter and the ballistic computer. The latter conducts

The TRITAN 1 system was developed specifically for the 'Baleares' class frigates by the Spanish Direccion de Construcciones. The main console is produced by Sainco.

weapon presets for both ASROC and ASW torpedoes. The Mk 114 system also includes the Mk 33 underwater fire-control switchboard which accepts data from two Mk 19 gyrocompasses and other sensors, as well as from the Mk 134 sonar stabilisation computer. The consoles have an AN/UYK-44 reconfigurable processor with some 70,000 lines of CMS-2 language code. The system interfaces with the sonar.

Manufacturer/Contractor
Loral Librascope, USA.

SONARS

Raytheon DE 1160
The 'Baleares' class is fitted with a bow-mounted Raytheon DE 1160LF, medium/low-frequency sonar, the export version of the US Navy's AN/SQS-56. It differs from the SQS-56, however, in having a larger, low-frequency transducer array to give it convergence zone capability.

Specifications
Modes: Active and passive (both fully digital)
Frequencies: 5.6, 7.5, 8.4 kHz
Power output: 36 kW

Manufacturer/Contractor
Raytheon Company, Portsmouth, Rhode island, USA.

EDO SQS-35(V)
The EDO AN/SQS-35(V) is a variable depth sonar (VDS) designed to detect submarines at medium ranges. It uses an array with 24 staves, operates at 13 kHz and has a peak power of 30 kW. There is a large 'fish' which is lowered over the stern on a large gantry and then streamed on a long cable. SQS-35 is a single console system with miniaturised vacuum-tube electronics.

Manufacturer/Contractor
EDO, Government Systems Division, College Point, New York, USA.

RADARS

Set	AN/SPS-52A	AN/SPS-10	Mariners' Pathfinder
Company	Hughes	Raytheon	Raytheon
Role	Air search	Surface search	Navigation
Band	E/F	G	I/J (9,375 ±25 MHz)
Beam	1.1 × 2.25°	1.5 × 16°	2 × 20°
Peak power	1,000 kW	285 kW	10, 25 and 50 kW
Gain	39.5 dB	30 dB	—
Pulsewidth	2.5/4.6/10 µs	0.25-1.3 µs	0.06, 0.5, 1 µs
PRF	1,850/925 pps	312-325 pps	3,600, 1,800, 900 pps
Scan rate	15/6 rpm	15 rpm	20 rpm
Range	240 n miles (440 km)	Can detect a destroyer at 15 n miles	18.3 n miles (118.5 km)

Set	AN/SPG-53B	AN/SPG-51C	RAN-12L	VPS 2 (two)
Company	Western Electric	Raytheon	Selenia	Sperry
Role	Fire control	Fire control (for Mk 73)	Fire control (for Meroka)	Fire control (for Meroka)
Band	I/J	G/I	D/I	I/J (9,200-9,250 MHz)
Beam	1.6°	Track: 1.6° Illum: 0.9°	D: 6.6 × 16° I:1.1 × 6 plus csc²°	4° conical
Peak power	250 kW	Track: 81 kW Illum:5 kW	D:1.1 kW I:135/180 kW	1.4 kW
Gain	39 dB	Track:39.5 dB Illum:45 dB	D: 22 dB I: 35 dB	—
Pulsewidth	0.25 µs	Track: 2.1-3.2 µs	D: 2.9µs I: 1.5/0.15 µs	—
PRF	1,000 pps	Surface: 4.1 kHz Air: 9.5-16.7 kHz	D: 450-550 pps	—
Scan rate	—	—	15/30 rpm	—
Range	—	—	Fighter: low altitude >20 n miles; medium altitude >14 n miles	>5,000 m

Baleares *(F 71). The US versions of the 'Knox' class have a helicopter flight deck aft, but the Spanish Navy replaced this with a Mk 22 Mod 0 launcher and a magazine holding 16 Standard SM-1MR SAMs* (Bazan)

PROPULSION

Specifications
System: Steam-turbines
Main machinery: 2 Combustion Engineering V2M boilers; 84.4 kg/cm² (1,200 psi); 510°C (950°F); 1 Westinghouse turbine; 25.7 MW (35,000 hp(m))
Shafts: 1

FURTHER INFORMATION

PROGRAMME

This class resulted from a very close co-operation between Spain and the USA. The programme was approved on 17 November 1964, with the technical support agreement with the United States being signed on 31 March 1966. The ships and their major equipments were all made in Spain: major hull sections, turbines and gearboxes at El Ferrol; superstructures at Alicante; and boilers, distilling plants and propellers at Cadiz. The US Navy, however, supplied weapons and sensors.

DESIGN

As built, the overall design was essentially the same as that of the US Navy's 'Knox' class. There were, however, a number of exceptions of which the most important was that all helicopter facilities were omitted in order to install a medium-range Standard SM-1MR system, with the associated launcher, magazine and fire-control systems.

MODERNISATION

All five ships have undergone a major mid-life update, which was completed in two stages. The first stage was completed by the end of 1987 and all then passed through the second stage, the complete modernisation being accomplished by: *Asturias* — 1988; *Extremadura* — May 1989, *Cataluna* — early 1990; *Baleares* — July 1990; and *Andalucia* — February 1991.

Apart from general refurbishment, this modernisation programme included:

- mounting eight Harpoon launchers on the superstructure
- fitting two Meroka 20 mm CIWS and associated radars
- adding a Link 11 data terminal
- installing the *Tritan* automated command system
- installing the Deneb passive EW system
- fitting four Mk 36 SRBOC chaff launchers
- replacing SQS 23 with DE 1160 (SQS-56) sonar
- disabling the stern-mounted 533 mm (21 in) torpedo tubes

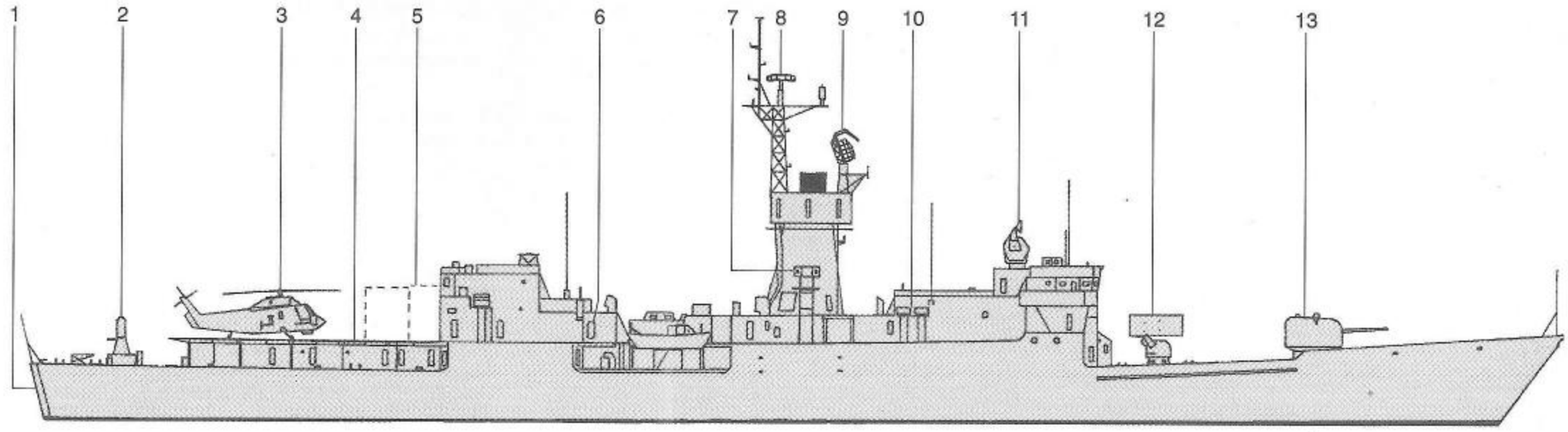
OPERATIONAL

All are based at El Ferrol, where they form the 31st Squadron.

Additional 'Knox' class
When surplus 'Knox' class ships were being offered to allied navies in the early 1990s, the Spanish Navy showed some initial interest in taking two ships. This was, however, cancelled by Spain in 1994.

Baleares *(F71)*

CHIN YANG (KNOX)



Chin Yang (Ian sturton)

1 EDO SQR-18A(Y) passive towed array **2** *Hughes Mk 15 20 mm Phalanx CIWS* **3** *Kaman SH-2G Seasprite LAMPS I (in due course)* **4** *Flight deck* **5** *Telescopic hangar* **6** *Two Mk 32 324 mm torpedo tubes (fixed)* **7** *AN/SLQ-32(V)5 ESM/ECM system* **8** *Raytheon SPS-10 or Norden SPS-67 surface search* **9** *Lockheed SPS-40B air search radar* **10** *Loral Hycor Mk 36 six-barrelled SRBOC chaff/IR launcher* **11** *Western Electric SPG-53 fire control* **12** *Mk 16 eight-tube launcher (Harpoon/ASROC)* **13** *United Defense 127 mm (5 in)/54 Mk 42 Mod 9 gun*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Taiwan
Type: Knox

Class: CHI YANG

Leased: 9
Active: 9
Proposed: 3

Displacement:
standard: 3,011 t
full load: 3,877 t (932, 935); 4,260 t (933, 934)

Dimensions
Length: 134 m (439.6 ft)
Beam: 14.3 m (46.9 ft)
Draught: 4.6 m (15 ft) (hull); 7.8 m (25.5 ft) (sonar)

Speed: 27 kts
Range: 4,000 n miles at 22 kts (on 1 boiler)

Complement: 288 (17 officers) including aircrew

SHIPS

CHIN YANG (932)

Builder	Lockheed Shipbuilding, Seattle, Washington, USA
Laid down	20 Dec 1970
Launched	23 June 1971
Commissioned (US Navy)	23 Sep 1972 (*Robert E Peary* (FF 1073))
Five-year lease (RoC Navy)	2 Jul 1993
Recommissioned (RoC Navy)	6 Oct 1993

FONG YANG (933)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	2 Oct 1970
Launched	24 July 1971
Commissioned (US Navy)	8 July 1972 (*Brewton* (FF 1086))
Five-year lease (RoC Navy)	23 Jul 1993
Recommissioned (RoC Navy)	6 Oct 1993

FENG YANG (934)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	4 Dec 1970
Launched	25 Sep 1971
Commissioned (US Navy)	9 Sep 1972 (*Kirk* (FF 1087))
Five-year lease (RoC Navy)	6 Aug 1993
Recommissioned (RoC Navy)	6 Oct 1993

LAN YANG (935)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	15 May 1969
Launched	7 Mar 1970
Commissioned (US Navy)	22 Apr 1971 (*Joseph Hewes* (FF 1078))
Five-year lease (RoC Navy)	30 Jun 1994
Recommissioned (RoC Navy)	4 Aug 1995

HAE YANG (936)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	20 Mar 1970
Launched	23 Jan 1971
Commissioned (US Navy)	18 Dec 1971 (*Cook* (FF 1083))
Five-year lease (RoC Navy)	3 Mar 1994
Recommissioned (RoC Navy)	4 Aug 1995

HWAI YANG (937)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	5 Feb 1971
Launched	4 Dec 1971
Commissioned (US Navy)	11 Nov 1972 (*Barbey* (FF 1088))
Five-year lease (RoC Navy)	31 May 1994
Recommissioned (RoC Navy)	4 Aug 1995

—

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	15 May 1969
Launched	7 Mar 1970
Commissioned (US Navy)	22 Apr 1971 (*Aylwin* (FF 1081))
Five-year lease (RoC Navy)	1996
Recommissioned (RoC Navy)	—

—

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	20 Mar 1970
Launched	23 Jan 1971
Commissioned (US Navy)	18 Dec 1971 (*Pharris* (FF 1094))
Five-year lease (RoC Navy)	1996
Recommissioned (RoC Navy)	—

—

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	5 Feb 1971
Launched	4 Dec 1971
Commissioned (US Navy)	11 Nov 1972 (*Valdez* (FF 1096))
Five-year lease (RoC Navy)	1996
Recommissioned (RoC Navy)	—

WEAPONS SYSTEMS

MISSILE LAUNCHER

Mk 16 launcher group

The Taiwanese ships are fitted with a Mk 16 Launcher Group located on the foredeck, with a single Mk 112 launcher, which consists of four pairs of launch tubes, each pair elevating independently. The version installed is the Mk 16 Mod 8, in which the port pair of tubes have been adapted to take RGM-84 Harpoon missiles. Maximum launch rate is three missiles per minute.

ANTI-SHIP MISSILES (ASM)

McDonnell Douglas UGM-84B Harpoon

The ship can carry 16 missiles, of which a maximum of four (two loaded, plus two reloads in the magazine) can be Harpoon. This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns, and for the terminal phase can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications

Block 1C
Length:
  with booster: 4.63 m (15.19 ft)
  without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
  with booster: 681.9 kg (1,503 kg)
  without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg (11,905 lb) thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

ANTI-SUBMARINE MISSILES

Honeywell RUR-5A ASROC

The ship carries 12 ASROC missiles. ASROC consists of a Mk 46 torpedo with strap-on aerodynamic surfaces and a rocket motor to enable it to fly to within range of its submarine target. Attached to the rear end of the torpedo is a short airframe assembly of clam-like construction, which is held together by a steel band, with a Naval Propulsion Plant solid propellant booster and four trapezoidal aerodynamic surfaces to provide stability in flight. The torpedo has a dome-shaped frangible plastic nose cap to protect the transducer as it enters the water. Payload is an Alliant Mk 46 Mod 5 torpedo, which has a seeker designed specifically to detect most types of target including submarines with anechoically coated hulls and has an estimated acquisition range of 460 m (1,509 ft).

When a submarine target is detected it is tracked and the attack console's fire-control computer predicts the target's position. The launcher is turned in the appropriate direction and elevated to an angle appropriate to the range. The fire-control computer then orders the launch and the booster burns for a programmed time of between 1 and 4 seconds, by which time the missile will have reached a height of between 60 and 305 m (197 and 1,001 ft), although the aerodynamically stable airframe enables it to coast up to 600 m (1,968 ft). On reaching the programmed position, an explosive bolt cuts the steel band holding the airframe assembly sections together and, as they separate, the parachute deploys to retard the torpedo's fall, water entry taking place some 14 to 50 seconds after launch. As the torpedo enters the water the frangible nose cap breaks off and the torpedo begins its search for the target using a predetermined pattern.

Specifications

ASROC missile
Length: 4.6 m (15.1 ft)
Diameter: 32.5 cm (12.8 in)
Span: 84.5 cm (33.3 in)
Weight: 435 kg (959 lb)
Range: 0.86-5.39 n miles (1.6-10 km)
Speed: Mach 0.9

Mk 46 Mod 5 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Manufacturer/Contractor

Honeywell, USA.

TUBES

324 mm Mk 32 Mod 9 torpedo launchers

Two twin Mk 32 Mod 9 324 mm torpedo launchers are mounted at the forward end of the after deckhouse, angled outwards at 45°. The torpedo magazine contains 22 torpedoes.

TORPEDOES

Mk 46 Mod 5 torpedo

Specifications

Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight:
  torpedo: 230 kg (507 lb)
  warhead: 44 kg (97 lb)
Speed: 40 kts (max)
Range: 5.9 n miles (11 km)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg; PBXN-103

GUNS

United Defense Mk 42 Mod 9 Single 127 mm (5 in)/54 gun mounting

There is one Mk 42 Mod 9 mounting, housing a single Mk 18 127 mm/54 gun. The Mk 18 gun has replaceable liner and a service life of some 2,000 rounds. A bayonet-type joint attaches the gun to the housing which includes a vertical sliding breech block and the entire gun assembly is supported on rollers in the slide. A separate rammer is mounted on the slide. The Mk 42 mounting was introduced in 1953 and the upper part of the mounting is fully power driven and is enclosed in an armoured shield. The Mk 42 mounting requires a crew of 12: four men within the shield, and eight in the magazine and ammunition handling system.

Ammunition is loaded by a dual system with projectiles supplied automatically to the slide alternately from the right and left. The loading system consists of two manually loaded drums, one with 20 projectiles and the other with 20 charges which rotate to bring the projectile and cartridge together. Complete rounds are lifted from the lower hoist to the upper hoist and from there to the cradles which move them to the tray from where they are rammed into the breech.

Magazine capacity is 550 rounds and ammunition includes the Mk 41 AAC/HC, Mk 42 common, and Mk 48 illumination rounds, all of which weigh 31.75 kg (70.0 lb). All rounds have point detonating, proximity or mechanical time fuzes.

Specifications

Gun, 127 mm/54 Mk 18
Calibre: 127 mm
Length of barrel: 54 calibres
Muzzle velocity:
  new barrel: 807 m/s (2,647 ft/s)
  mid-life: 792 m/s (2,598 ft/s)
Max range: 13 n miles (24 km)
Max altitude: 14,400 m (47,000 ft)
Ammunition: 31.75 kg (70.0 lb)

Mounting, Mk 42 Mod 9
Traverse: 360° at 40°/s
Elevation: −15 to +85° at 25°/s
Rate of fire: 20-40 rds/min

Manufacturer/Contractor

United Defense Armament Systems Division, Minneapolis, Minnesota, USA.

Hughes Mk 15 Phalanx CIWS

There is one Hughes Mk 15 Phalanx close in weapons system (CIWS) situated on the quarterdeck. The mount consists of a 20 mm, six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,378 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA (system).

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

AN/SLQ-32(V)5 Sidekick ESM/ECM Suite

All ships have the AN/SLQ-32(V)2 EW suite, which was upgraded to (V)5 standard by the addition of the Sidekick modification kit while in US service. AN/SLQ-32(V)2 is the ESM system, which gives radar warning across the B to H-bands, while Raytheon's Sidekick adds jamming and deception capabilities.

Manufacturer/Contractor

Raytheon Company, Electromagnetic Systems Division, Goleta, California.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers

There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications

Launcher

Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds

Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

T-Mk 6 Fanfare

The T-Mk 6 torpedo decoy consists of two winches each with a cable and a 'fish' containing a mechanical acoustic device. It was introduced into the US Navy in the 1950s and was replaced in most ships by AN/SLQ-25 Nixie.

Masker/Prairie Masker noise suppression systems

The ships are fitted with both Masker and Prairie-Masker radiated noise suppression systems. In Masker, high-pressure air is bled off from either the ship's gas turbine or dedicated compressors and ejected from a pipe placed laterally across the ship's hull just forward of the machinery spaces. The forward motion of the ship causes the air to form a layer separating the hull from the water and thus masking the machinery noises which would otherwise be radiated directly into the water. Such a system is less effective at slow speeds where the air bubbles tend to rise to the surface rather than remain attached to the hull.

In Prairie Masker, air is passed down the propeller shaft and ejected from a groove in the leading edge of the blade, thus delaying the onset of cavitation.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Fast Frigate Integrated Shipboard Tactical System - 2 (FFISTS-2)

FFISTS-2 was developed from FFISTS-1 and replaces the star-network by a distributed architecture, which uses DTC-2 workstations interconnected by a dual fibre optic or a Thicknet local area network. The DTC-2 workstation is a SUN-4/110 SPARC station with either one or two 48 cm (19 in) raster scan screens, 32 Mbytes of RAM, a 200 Mbyte hard drive (eliminating the need for the shared hard drives used in FFISTS-1) and is rated at 7.5 Mips. A twin-screen DTC-2 monitors the sonars while a single-screen DTC-2 acts as the Link 11 interface. A third, single-screen, DTC-2 provides data fusion from onboard and offboard sensors including Link 11, Link 14 and satellite communications. FFISTS-2 is reported to be capable of conducting not only ASW operations but also anti-ship operations.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 14 (receive only)
AN/SRQ-4 (LAMPS 1 helicopter-ship datalink)
Tacan: AN/SRN 15
IFF: AN/UPX-12

WEAPONS CONTROL

AN/SWG-1A Harpoon Launch Control System (LCS)

SWG-1A is the Harpoon weapons control system, which activates the missile, selects the flight pattern and sets seeker search modes (with small, medium or large acquisition windows), as well as providing target range and bearing data. Alternatively, the missile can simply be launched along the bearing of the target, with the seeker activated early to scan a 90° sector; if, after a set time, no target has been acquired the missile commences a preset search pattern. SWG-1A takes account of other ships in the general target area and generates indirect flight plans for the missile, including waypoints to optimise angles of approach which will achieve the highest possibility of success while minimising the chances of the missile being destroyed by hostile fire. It can also be used to compute flight plans in a multiple attack so that several missiles, from either the same or different ships, arrive on target simultaneously, thus swamping the defences.

Mk 68 Gun Fire Control System (GFCS)

The Mk 68 GFCS provides target data, position orders and firing orders for the 127 mm (5 in) gun Mk 42 mountings for use against both surface and air targets. The system consists of a Mk 68 gun director and AN/SPG-53 I/J-band radar, a Mk 47 computer, a Mk 16 stable element and the gun mount. The system requires a crew of eight. The Mk 68 gun director has an optical rangefinder, two handwheels for optical tracking, the radar receiver, transmitter and antenna as well as a slip ring assembly. It transmits bearing, elevation and range data both to the computer and the radar operator's console. It can be operated in automatic radar and optical tracking modes.

The SPG-53 radar incorporates both spiral and conical scan for acquisition and tracking respectively. Later versions have monopulse and low-level tracking capabilities together with splash spotting and a missile launch alarm. The radar has both automatic and manual tracking modes. The former involves transmitting radar error signals in both bearing and elevation to the director power-drive amplifiers, where they are converted into control signals which drive the director. Manual tracking is achieved by operating the range, bearing and elevation handwheels at the radar operator's console. The Mk 47 analogue computer receives inputs from the director, the radar, the stable element, gyrocompass and underwater log system and processes this data to produce data on future target location, gun position and fuze orders. When engaging air targets its operation is automatic but, for engaging surface and land targets, manual rate control may be adopted.

Manufacturer/Contractor

Norden Systems, USA.

Mk 114 ASW fire-control system

The Mk 114 is the fire-control system for ASW operations. The main element is the Mk 53 Attack Console, an electromechanical analogue system which consists of two major units, the attack plotter and the ballistic computer. The latter conducts weapon presets for both ASROC and ASW torpedoes. The Mk 114 system also includes the Mk 33 underwater fire-control switchboard which accepts data from two Mk 19 gyrocompasses and other sensors, as well as from the Mk 134 sonar stabilisation computer. The consoles have an AN/UYK-44 reconfigurable processor with some 70,000 lines of CMS-2 language code. The system interfaces with the sonar.

Manufacturer/Contractor

Loral Librascope, USA.

RADARS

Set	AN/SPS-40B	AN/SPS 67*	AN/SPS-10*	LN-66	AN/SPG-53A/D/F
Company	Lockheed	Norden	Raytheon	Canadian Marconi	Western Electric
Role	2D surface search	Surface search	Surface search	Navigation	Fire control
Band	E/F	H (5.45-5.83 GHz)	G	I/J (9.3-9.4 GHz)	I/J
Beam	11 × 19°	1.5 × 16°	1.5 × 16°	2.5 × 22°	1.6°
Peak power	200 kW	500 kW	285 kW	75 kW	250 kW
Gain	21 dB	30 dB	30 dB	30 dB	39 dB
Pulsewidth	60 µs	0.1, 0.25, 1 µs	0.25-1.3 µs	1.0/0.1 µs	0.25 µs
PRF	300 pps	2,400, 1,200, 750 pps	312-325 pps	500/2,000 pps	1,000 pps
Scan rate	7.5/15 rpm	15/30 rpm	15 rpm	22 rpm	—
Range	175 n miles (320 km) 50,000 ft	—	Can detect a destroyer at 15 n miles	—	—

* Ships are fitted with either AN/SPS-10 or AN/SPS-67

SONARS

EDO AN/SQS-26CX

The hull-mounted AN/SQS-26CX works in surface duct, bottom bounce and convergence zone modes. Surface duct is for shorter range, bottom bounce for medium ranges and convergence zone for longer ranges. The last two modes require electronic beam-steering in elevation. SQS-26 is an active system transmitting at about 3.5 kHz with an output power of about 192 kW and receiving in seven channels between 1.5 and 4 kHz. The transducer is reported to be about 4.87 m (16.0 ft) in diameter and 1.68 m (5.5 ft) high, with 72 staves, each with eight elements. Ranges are reported to be approximately 10 n miles (18.5 km) in surface duct mode and 34.5 n miles (64 km) in convergence zone mode. SQS-26CX was developed specially for the 'Knox' class frigates and was the final version of the SQS-26, the next set in the series being the SQS-53A.

Manufacturer/Contractor

EDO, Government Systems Division, College Point, New York, USA.

AN/SQR-18A(V)1 (TACTAS)

AN/SQR-18A(V)1 (also known as TACTAS (Tactical Towed Array Sonar)). The low-noise array is 230 m (754 ft) long and is towed behind an SQS-35 VDS 'fish' on a cable some 0.73 km (2,400 ft) long. The system features an adaptive processor which acts to reduce interference from the towing ship's noise (and to a lesser extent from adjacent ships) and a tracked system to provide bearing resolution and target motion analysis. SQR-18 is integrated with the hull-mounted SQS-26CX and AN/SQR-17 sonobuoy processor.

Manufacturer/Contractor

EDO, Government Systems Division, College Point, New York, USA.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck:

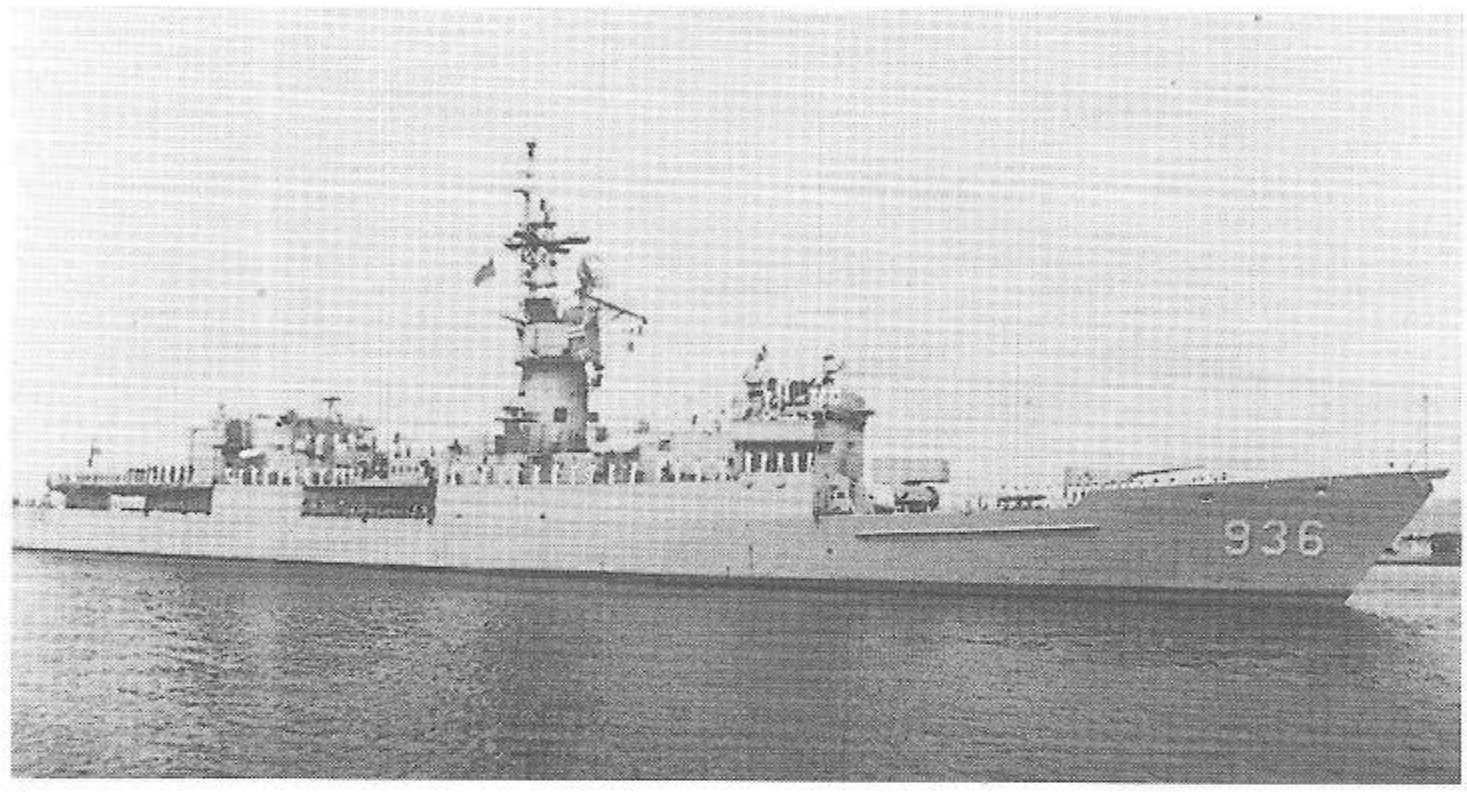
dimensions: 22.8 × 14 m (75 ft × 46 ft)

max helicopter take-off weight: 5,000 kg (11,000 lb)

Hangar: The hangar was originally designed to accommodate DASH helicopter drones, but was later enlarged to accommodate the SH-2 LAMPS I Kaman SH-2 Seasprite. The after end of the hangar is telescopic

HELICOPTERS

It is reported that the RoCN does not yet have suitable helicopters to operate from these ships. The S70C(M)1 Seahawks already in the inventory are too large and heavy, while the Kaman SH-2F/G LAMPS I helicopters are available but the funds have not yet been made available for their transfer.



Hae Yang *(936) is one of six ex-US Navy 'Knox' class frigates currently operated by the RoC Navy* (C Chung)

PROPULSION

Specifications

System: Steam turbines

Main machinery: 2 Combustion Engineering/Babcock & Wilcox boilers; 84.4 kg/cm² (1,200 psi); 510°C (950°F); one turbine; 26 MW (35,000 hp)

Shafts: 1

FURTHER INFORMATION

PROGRAMME

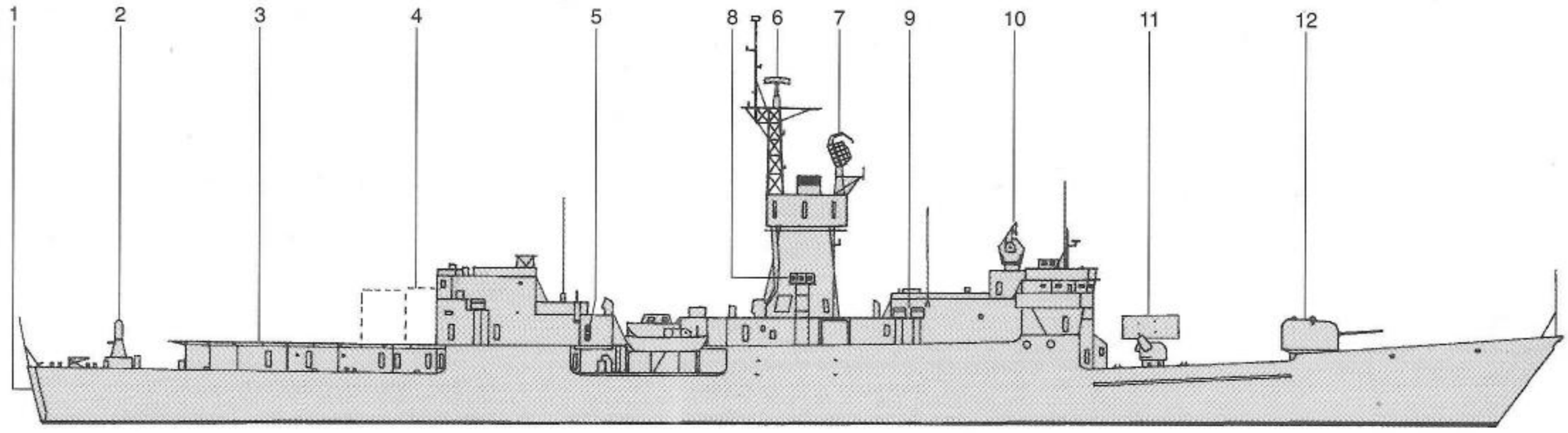
The first batch of three entered service with the RoCN in 1993, followed by the second three in 1995 and another three in 1996. It is also reported that the RoCN is interested in leasing another batch of three, to bring the total up to 12. All current ships are on a five-year lease and it is understood that both parties have agreed that they will be purchased outright as the leases expire. The second batch was overhauled and upgraded by Long Beach Shipyard, California before recommissioning in 1995.

OPERATIONAL

The first three ships achieved poor operational availability in 1994, but this may have been due to early problems with a class new to the RoCN.

These ships form the 168th Patrol Squadron, based at Suao, with the commander flying his flag in *Lan Yang* (935).

PHUTTHAYOTFA CHULALOK (KNOX)



Phutthayotfa Chulalok (461) (Ian Sturton)
1 *EDO SQR-18A(V)1 passive towed array* **2** *Hughes Mk 15 20 mm six-barrel Phalanx CIWS* **3** *Flight deck* **4** *Telescopic hangar* **5** *Twin fixed 324 mm torpedo tubes* **6** *Raytheon SPS-10 or Norden SPS-67 surface search radar* **7** *Lockheed SPS-40B air search radar* **8** *AN/SLQ-32(V)5 ESM/ECM suite* **9** *Loral Hycor SRBOC Mk 36 six-barrel chaff/IR launcher* **10** *Western Electric SPG-53 fire director* **11** *Mk 16 eight-cell launcher (Harpoon, ASROC)* **12** *United Defense 127 mm (5 in)/54 Mk 42 Mod 9 gun*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Thailand
Type: Knox

Class: PHUTTHAYOTFA CHULALOK

Leased: 2
Active: 2

Displacement:
standard: 3,011 t
full load: 4,260 t

Dimensions
Length: 134 m (439.6 ft)
Beam: 14.3 m (46.8 ft)
Draught: 4.6 m (15 ft)(hull); 7.8 m (25.5 ft) (sonar)

Speed: 27 kts
Range: 4,000 n miles at 22 kts (on 1 boiler)

Complement: 288 (17 officers)

SHIPS

PHUTTHAYOTFA CHULALOK (461)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	27 Apr 1972
Launched	3 Feb 1973
Commissioned (US Navy)	1 June 1974 (*Truett* (FF 1095))
Five year lease to RTN	30 Jul 1994

PHUTTHALOETLA NAPHALAI (462)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	15 Jan 1969
Launched	17 Jan 1970
Commissioned (US Navy)	12 Dec 1970 (*Ouellet* (FF 1077))
Five year lease to RTN	19 Aug 1996

WEAPONS SYSTEMS

MISSILE LAUNCHER

Mk 16 launcher group

The Thai ships are fitted with a Mk 16 Launcher Group located on the foredeck, with a single Mk 112 launcher, which consists of four pairs of launch tubes, each pair elevating independently. The version installed is the Mk 16 Mod 8, in which the port pair of tubes has been adapted to take RGM-84 Harpoon missiles. Maximum launch rate is three missiles per minute.

ANTI-SHIP MISSILES (ASM)

McDonnell Douglas UGM-84B Harpoon

The ship can carry 16 missiles, of which a maximum of four (two loaded, plus two reloads in the magazine) can be Harpoon. This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses or it can approach the target indirectly, using up to three preselected way-points, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns and, for the terminal phase, can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

ANTI-SUBMARINE MISSILES

Honeywell RUR-5A ASROC

The magazine houses up to 12 ASROC missiles. ASROC consists of a Mk 46 torpedo with strap-on aerodynamic surfaces and a rocket motor to enable it to fly to within range of its submarine target. Attached to the rear end of the torpedo is a short airframe assembly of clam-like construction, held together by a steel band, with a Naval Propulsion Plant solid propellant booster and four trapezoidal aerodynamic surfaces to provide stability in flight. The torpedo has a dome-shaped frangible plastic nose cap to protect the transducer as it enters the water. Payload is an Alliant Mk 46 Mod 5 torpedo, which has a seeker designed specifically to detect most types of target including submarines with anechoically coated hulls and has an estimated acquisition range of 460 m (1,509 ft).

When a submarine target is detected it is tracked and the attack console's fire-control computer predicts the target's position. The launcher is turned in the appropriate direction and elevated to an angle appropriate to the range. The fire-control computer then orders the launch and the booster burns for a programmed time of between 1 and 4 seconds, by which time the missile will have reached a height of between 60 and 305 m (197 and 1,001 ft), although the aerodynamically stable

airframe enables it to coast up to 600 m (1,968 ft). On reaching the programmed position, an explosive bolt cuts the steel band holding the airframe assembly sections together and, as they separate, the parachute deploys to retard the torpedo's fall, water entry taking place some 14 to 50 seconds after launch. As the torpedo enters the water the frangible nose cap breaks off and the torpedo begins its search for the target using a predetermined pattern.

Specifications

ASROC missile
Length: 4.6 m (15.1 ft)
Diameter: 32.5 cm (12.8 in)
Span: 84.5 cm (33.3 in)
Weight: 435 kg (959 lb)
Range: 0.86-5.39 n miles (1.6-10 km)
Speed: Mach 0.9

Mk 46 Mod 5 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Manufacturer/Contractor

Honeywell, USA.

TUBES

324 mm Mk 32 Mod 9 torpedo launchers

Two twin Mk 32 Mod 9 324 mm torpedo launchers are mounted at the forward end of the after deckhouse, angled outwards at 45°.

The torpedo magazine contains 22 torpedoes.

TORPEDOES

Mk 46 Mod 5 torpedo

Normal armament is the Honeywell Mk 46 Mod 5 anti-submarine torpedo.

Specification

Mk 46 Mod 5
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight:
torpedo: 230 kg (507 lb)
warhead: 44 kg (97 lb)
Speed: 40 kts (max)
Range: 5.9 n miles (11 km)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg; PBXN-103

GUNS

United Defense Mk 42 Mod 9 Single 127 mm (5 in)/54 gun mounting

There is one Mk 42 Mod 9 mounting, housing a single Mk 18 127 mm/54 gun. The Mk 18 gun has replaceable liner and a service life of some 2,000 rounds. A bayonet-type joint attaches the gun to the housing which includes a vertical sliding breech block and the entire gun assembly is supported on rollers in the slide. A separate rammer is mounted on the slide. The Mk 42 mounting was introduced in 1953 and the upper part of the mounting is fully power-driven and is enclosed in an armoured shield. The Mk 42 mounting requires a crew of 12: four men within the shield, and eight in the magazine and ammunition handling system.

Ammunition is loaded by a dual system with projectiles supplied automatically to the slide alternately from the right and left. The loading system consists of two manually loaded drums, one with 20 projectiles and the other with 20 charges which rotate to bring the projectile and cartridge together. Complete rounds are lifted from the lower hoist to the upper hoist and from there to the cradles which move them to the tray from where they are rammed into the breech.

Magazine capacity is 550 rounds and ammunition includes the Mk 41 AAC/HC, Mk 42 common, and Mk 48 illumination rounds, all of which weigh 31.75 kg (70.0 lb). All rounds have point detonating, proximity or mechanical time fuzes.

Specifications

Gun, 127 mm/54 Mk 18
Calibre: 127 mm
Length of barrel: 54 calibres
Muzzle velocity:
new barrel: 807 m/s (2,647 ft/s)
mid-life: 792 m/s (2,598 ft/s)
Max range: 13 n miles (24 km)
Max altitude: 14,400 m (47,000 ft)
Ammunition: 31.75 kg (70.0 lb)

Mounting, Mk 42 Mod 9
Traverse: 360° at 40°/s
Elevation: −15 to +85° at 25°/s
Rate of fire: 20-40 rds/min

Manufacturer/Contractor

United Defense Armament Systems Division, Minneapolis, Minnesota, USA.

Hughes Mk 15 CIWS Phalanx

There is one Hughes Mk 15 Phalanx close in weapons system (CIWS) situated on the quarterdeck. The mount consists of a 20 mm M61A1 Vulcan, six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,378 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA (system).

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

AN/SLQ-32(V)5 Sidekick ESM/ECM suite

Both ships have the AN/SLQ-32(V)2 EW suite, which was upgraded to (V)5 standard by the addition of the Sidekick modification kit while in US service. AN/SLQ-32(V)2 is the ESM system, which gives radar warning across the B to H-bands, while Raytheon's Sidekick adds jamming and deception capabilities.

Manufacturer/Contractor

Raytheon Company, Electromagnetic Systems Division, Goleta, California.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers

There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications

Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

T-Mk 6 Fanfare

The T-Mk 6 torpedo decoy consists of two winches each with a cable and a 'fish' containing a mechanical acoustic device. It was introduced into the US Navy in the 1950s and was replaced in most ships by AN/SLQ-25 Nixie.

Masker/Prairie Masker noise suppression systems

The ships are fitted with both Masker and Prairie Masker radiated noise suppression systems. In Masker, high-pressure air is bled off from either the ship's gas turbine or dedicated compressors and ejected from a pipe placed laterally across the ship's hull just forward of the machinery spaces. The forward motion of the ship causes the air to form a layer separating the hull from the water and thus masking the machinery noises which would otherwise be radiated directly into the water. Such a system is less effective at slow speeds where the air bubbles tend to rise to the surface rather than remain attached to the hull.

In Prairie Masker, air is passed down the propeller shaft and ejected from a groove in the leading edge of the blade, thus delaying the onset of cavitation.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Fast Frigate Integrated Shipboard Tactical System - 2 (FFISTS-2)

FFISTS-2 was developed from FFISTS-1 and replaces the star-network by a distributed architecture, which uses DTC-2 workstations interconnected by a dual fibre optic or a Thicknet local area network. The DTC-2 workstation is a SUN-4/110 SPARC station with either one or two 48 cm (19 in) raster scan screens, 32 Mbytes of RAM, a 200 Mbyte hard drive (eliminating the need for the shared hard drives used in FFISTS-1) and is rated at 7.5 Mips. A twin-screen DTC-2 monitors the sonars while a single-screen DTC-2 acts as the Link 11 interface. A third, single-screen, DTC-2 provides data fusion from onboard and offboard sensors including Link 11, Link 14 and satellite communications. FFISTS-2 is reported to be capable of conducting not only ASW operations but also anti-ship operations.

COMMUNICATIONS AND DATALINKS

Datalinks: Link 14 (receive only)
AN/SRQ-4 (LAMPS I helicopter-ship datalink)
Tacan: AN/SRN 15
IFF: AN/UPX-12

WEAPONS CONTROL

AN/SWG-1A Harpoon Launch Control System (LCS)

SWG-1A is the Harpoon weapons control system, which activates the missile, selects the flight pattern and sets seeker search modes (with small, medium or large acquisition windows), as well as providing target range and bearing data. Alternatively, the missile can simply be launched along the bearing of the target, with the seeker activated early to scan a 90° sector; if, after a set time, no target has been acquired the missile commences a preset search pattern. SWG-1A takes account of other ships in the general target area and generates indirect flight plans for the missile, including waypoints to optimise angles of approach which will achieve the highest possibility of success while minimising the chances of the missile being destroyed by hostile fire. It can also be used to compute flight plans in a multiple attack so that several missiles, from either the same or different ships, arrive on target simultaneously, thus swamping the defences.

Mk 68 Gun Fire Control System (GFCS)

The Mk 68 GFCS provides target data, position orders and firing orders for the 127 mm (5 in) gun Mk 42 mountings for use against both surface and air targets. The system consists of a Mk 68 gun director and AN/SPG-53 I/J-band radar, a Mk 47 computer, a Mk 16 stable element and the gun mount. The system requires a crew of eight. The Mk 68 gun director has an optical rangefinder, two handwheels for optical tracking, the radar receiver, transmitter and antenna as well as a slip ring assembly. It transmits bearing, elevation and range data both to the computer and the radar operator's console. It can be operated in automatic radar and optical tracking modes.

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Manufacturer/Contractor

Norden Systems, USA.

Mk 114 ASW fire-control system

The Mk 114 is the fire-control system for ASW operations. The main element is the Mk 53 Attack Console, an electromechanical analogue system which consists of two major units, the attack plotter and the ballistic computer. The latter conducts weapon presets for both ASROC and ASW torpedoes. The Mk 114 system also includes the Mk 33 underwater fire-control switchboard which accepts data from two Mk 19 gyrocompasses and other sensors, as well as from the Mk 134 sonar stabilisation computer. The consoles have an AN/UYK-44 reconfigurable processor with some 70,000 lines of CMS-2 language code. The system interfaces with the sonar.

Manufacturer/Contractor

Loral Librascope, USA.

NMMS electro-optic surveillance system

The NMMS was included in the transfer package to the RTN. NMMS is designed to detect mines, low-flying aircraft and small boats by day or night in all weather conditions. It can also be used to support gunfire missions and to assist in helicopter landing control. NMMS consists of a systems electro-optronic package housed in a composite casing and mounted on a pedestal. The sensor package comprises multiplexer electronics, the boresight assembly and the sensors (a Si-Vidicon television camera and a thermal imager), which float on high-energy, rare-earth magnets which create an energy field designed to produce unblurred images. The thermal imager is based upon the US MCTNS (Man-portable Common Thermal Night Sights) modules and has 120 elements with split Stirling cooling system. The sensor package also includes a Litton MMS Laser RangeFinder/ Designator (LRF/D) operating in the 1.06 micron range. Supporting the sensor package is a video tracker which can be used for manual or automatic tracking of targets. There is also a digital scan converter which enhances the thermal imager picture and also provides freeze frame and ×2 zoom capabilities. The system is used for both manual and automatic tracking but can also conduct continuous horizon scanning of designated sectors.

It should be noted that the designation 'Mast Mounted Sight' derives from the device's US Army title and it does not necessarily follow that in naval use the device is mounted on the ship's mast. The control console can be collocated with the sight, installed in the bridge or the combat information centre according to the operational requirement.

Specifications

Weight (sensor head): 72.57 kg (160 lb)
Diameter: 64.77 cm (25.5 in)
Stabilisation: less than 20 mrad
Fields of view
thermal imager: 2 × 10°
television: 2 × 8°

Manufacturers/Contractors

McDonnell Douglas Electronic Systems, USA (system).
Northrop Electronics Division, USA (sensor package).

RADARS

Set	AN/SPS-40B	AN/SPS 67*	AN/SPS-10*	LN-66	AN/SPG-53A/D/F
Company	Lockheed	Norden	Raytheon	Canadian Marconi	Western Electric
Role	2D surface search	Surface search	Surface search	Navigation	Fire control
Band	E/F	H (5.45-5.83 GHz)	G	I/J (9.3-9.4 GHz)	I/J
Beam	11 × 19°	1.5 × 16°	1.5 × 16°	2.5 × 22°	1.6°
Peak power	200 kW	500 kW	285 kW	75 kW	250 kW
Gain	21 dB	30 dB	30 dB	30 dB	39 dB
Pulsewidth	60 µs	0.1, 0.25, 1 µs	0.25-1.3 µs	1.0/0.1 µs	0.25 µs
PRF	300 pps	2,400, 1,200, 750 pps	312-325 pps	500/2,000 pps	1,000 pps
Scan rate	7.5/15 rpm	15/30 rpm	15 rpm	22 rpm	–
Range	175 n miles (320 km) 50,000 ft		Can detect a destroyer at 15 n miles		

* Ships are fitted with either AN/SPS-10 or AN/SPS-67

SONARS

EDO AN/SQS-26CX

The hull-mounted AN/SQS-26CX works in surface duct, bottom bounce and convergence zone modes. Surface duct is for shorter range, bottom bounce for medium ranges and convergence zone for longer ranges. The last two modes require electronic beam-steering in elevation. SQS-26 is an active system transmitting at about 3.5 kHz with an output power of about 192 kW and receiving in seven channels between 1.5 and 4 kHz. The transducer is reported to be about 4.87 m (16.0 ft) in diameter and 1.68 m (5.5 ft) high, with 72 staves, each with eight elements. Ranges are reported to be approximately 10 n miles (18.5 km) in surface duct mode and 34.5 n miles (64 km) in convergence zone mode. SQS-26CX was developed specially for the 'Knox' class frigates and was the final version of the SQS-26, the next set in the series being the SQS-53A.

AN/SQR-18A(V)1 (TACTAS)

AN/SQR-18A(V)1 (also known as TACTAS (Tactical Towed Array Sonar)). The low noise array is 230 m (754 ft) long and is towed behind an SQS-35 VDS 'fish' on a cable some 0.73 km (2,400 ft) long. The system features an adaptive processor which acts to reduce interference from the towing ship's noise (and to a lesser extent from adjacent ships) and a tracked system to provide bearing resolution and target motion analysis. SQR-18 is integrated with the hull-mounted SQS-26 and AN/SQR-17 sonobuoy processor.

Manufacturer/Contractor

EDO, Government Systems Division, College Point, New York, USA.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck:
dimensions: 22.8 × 14 m (75 ft × 46 ft)
max helicopter take-off weight: 5,000 kg (11,000 lb)

Hangar: The hangar was originally designed to accommodate DASH helicopter drones, but was later enlarged to accommodate the SH-2 LAMPS-I Kaman SH-2 Seasprite. The after end of the hangar is telescopic

HELICOPTERS

The Royal Thai Navy does not currently operate a helicopter of a size or type suitable for use from these two ships.

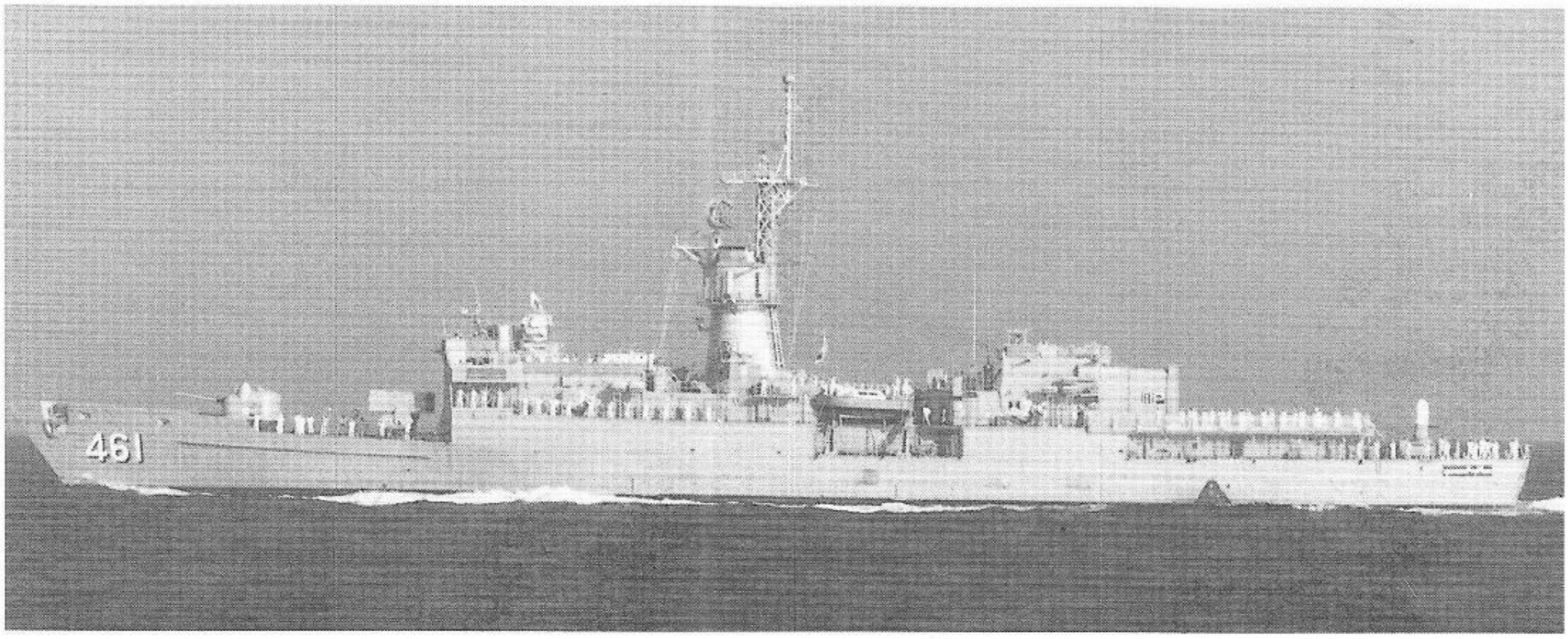
PROPULSION

Specifications
System: Steam turbines
Main machinery: 2 Combustion Engineering/Babcock & Wilcox boilers; 84.4 kg/cm² (1,200 psi); 510°C (950°F); 1 turbine; 26 MW (35,000 hp)
Shafts: 1

FURTHER INFORMATION

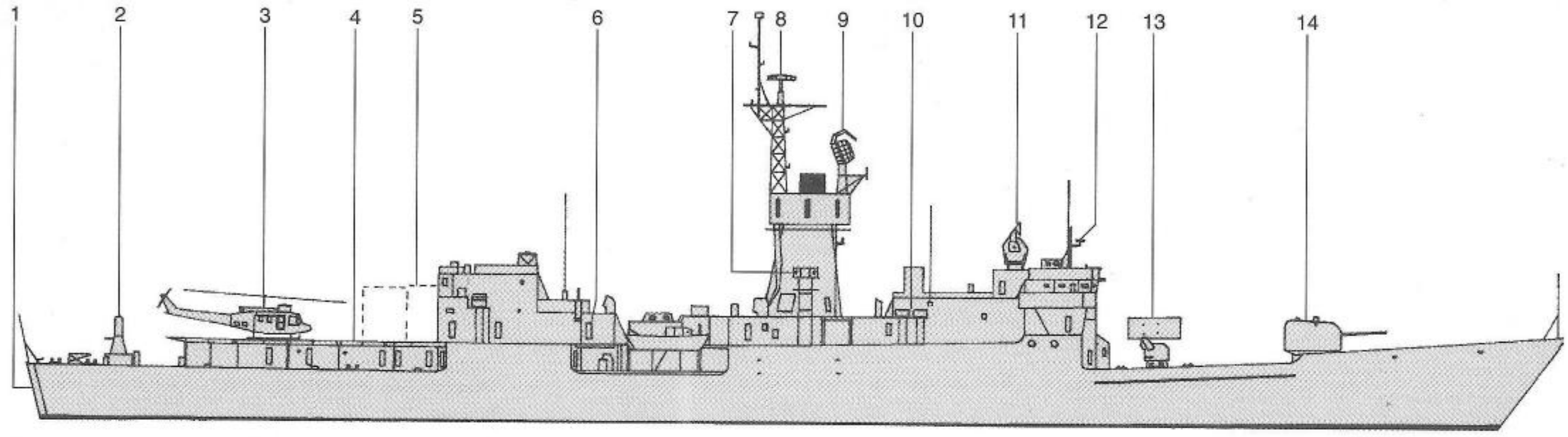
PROGRAMME

The first ship was transferred on a five-year lease from the US on 30 July 1994, followed by the second on 19 August 1996.



Phutthayotfa Chulalok *(461), the former US Navy frigate* Truett *(FF 1095). Two of these ships have been leased for five years* (Royal Thai Navy)

TEPE (KNOX)



Tepe (Ian Sturton)

1 *EDO SQR-18A(V)1 variable depth sonar* **2** *Hughes Mk 15 20 mm Phalanx CIWS* **3** *AB212 ASW helicopter* **4** *Flight deck* **5** *Telescopic hangar* **6** *Two Mk 32 324 mm torpedo tubes* **7** *SLQ-32 (V)2 ESM* **8** *Raytheon SPS-10 or Norden SPS-67* **9** *Lockheed SPS-40B air search radar* **10** *Loral Hycor Mk 36 SRBOC chaff/IR launcher* **11** *Western Electric SPG-53A fire control* **12** *Canadian Marconi LN-66 navigation radar* **13** *Mk 16 launcher (ASROC, Harpoon)* **14** *United Defense 127 mm (5 in) Mk 42 Mod 9 gun*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Turkey
Type: Knox

Class: TEPE

Acquired on lease: 8
Active: 8

Displacement:
standard: 3,011 t
full load: 4,260 t

Dimensions
Length: 134 m (439.6 ft)
Beam: 14.3 m (46.9 ft)
Draught: 4.6 m (15.0 ft)(hull); 7.8 m (25.5 ft)(sonar)

Speed: 27 kts
Range: 4,000 n miles at 22 kts (on 1 boiler)

Complement: 288 (20 officers)

SHIPS

MUAVENET (F 250)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	12 Oct 1971
Launched	21 Oct 1972
Commissioned (US Navy)	17 Nov 1973 (*Capodanno* (FF 1093))
Transferred to RTN	12 Sep 1993

ADATEPE (F 251)

Builder	Todd Shipyards, San Pedro, California, USA
Laid down	7 Dec 1968
Launched	24 Jan 1970
Commissioned (US Navy)	23 July 1971 (*Fanning* (FF 1076))
Transferred to RTN	27 Sep 1993

KOCATEPE (F 252)

Builder	Lockheed Shipbuilding, Seattle, Washington, USA
Laid down	6 Jan 1969
Launched	1 Aug 1970
Commissioned (US Navy)	31 July 1971 (*Reasoner* (FF 1063))
Transferred to RTN	28 Aug 1993

ZAFER (F 253)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	8 Oct 1971
Launched	12 Aug 1972
Commissioned (US Navy)	28 July 1973 (*Thomas C Hart* (FF 1092))
Transferred to RTN	30 Aug 1993

TRAKYA (F 254)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	4 June 1970
Launched	20 Mar 1971
Commissioned (US Navy)	18 Mar 1972 (*McCandless* (FF 1084))
Transferred to RTN	6 May 1994

KARADENIZ (F 255)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	24 July 1970
Launched	22 May 1971
Commissioned (US Navy)	22 July 1972 (*Donald B Beary* (FF 1085))
Transferred to RTN	20 May 1994

EGE (F 256)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	11 June 1971
Launched	15 Apr 1972
Commissioned (US Navy)	31 Mar 1973 (*Ainsworth* (FF 1090))
Transferred to RTN	27 May 1994

AKDENIZ (F 257)

Builder	Avondale Shipyards, New Orleans, Louisiana, USA
Laid down	11 July 1969
Launched	2 May 1970
Commissioned (US Navy)	22 May 1971 (*Bowen* (FF 1079))
Transferred to RTN	3 June 1994

WEAPONS SYSTEMS

MISSILE LAUNCHER

Mk 16 launcher group

The Thai ships are fitted with a Mk 16 Launcher Group located on the foredeck, with a single Mk 112 launcher, which consists of four pairs of launch tubes, each pair elevating independently. The version installed is the Mk 16 Mod 8, in which the port pair of tubes has been adapted to take RGM-84 Harpoon missiles. Maximum launch rate is three missiles per minute.

ANTI-SHIP MISSILES (ASM)

McDonnell Douglas UGM-84B Harpoon

A maximum of four missiles (two loaded, plus two reloads in the magazine) can be Harpoon. This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low land-masses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns, and for the terminal phase can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)

Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

ANTI-SUBMARINE MISSILES

Honeywell RUR-5A ASROC

The ship also carries 12 ASROC missiles. ASROC consists of a Mk 46 torpedo with strap-on aerodynamic surfaces and a rocket motor to enable it to fly to within range of its submarine target. Attached to the rear end of the torpedo is a short airframe assembly of clam-like construction, held together by a steel band, with a Naval Propulsion Plant solid propellant booster and four trapezoidal aerodynamic surfaces to provide stability in flight. The torpedo has a dome-shaped frangible plastic nose cap to protect the transducer as it enters the water. Payload is an Alliant Mk 46 Mod 5 torpedo, which has a seeker designed specifically to detect most types of target including submarines with anechoically coated hulls and has an estimated acquisition range of 460 m (1,508 ft).

When a submarine target is detected it is tracked and the attack console's fire-control computer predicts the target's position. The launcher is turned in the appropriate direction and elevated to an angle appropriate to the range. The fire-control computer then orders the launch and the booster burns for a programmed time of between 1 and 4 seconds, by which time the missile will have reached a height of between 60 and 305 m (197 and 1,001 ft), although the aerodynamically stable airframe enables it to coast up to 600 m (1,968 ft). On reaching the programmed position, an explosive bolt cuts the steel band holding the airframe assembly sections together and as they separate the parachute deploys to retard the torpedo's fall, water entry taking place some 14 to 50 seconds after launch. As the torpedo enters the water the frangible nose cap breaks off and the torpedo begins its search for the target using a predetermined pattern.

Specifications

ASROC missile
Length: 4.6 m (15.1 ft)
Diameter: 32.5 cm (12.8 in)
Span: 84.5 cm (33.3 in)
Weight: 435 kg (959 lb)
Range: 0.86-5.39 n miles (1.6-10 km)
Speed: Mach 0.9

Mk 46 Mod 5 torpedo
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight: 230 kg (507 lb)
Speed: 40 kts (max)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg (97 lb); PBXN-103

Manufacturer/Contractor

Honeywell, USA.

TUBES

324 mm Mk 32 Mod 9 torpedo launchers

Two twin Mk 32 Mod 9 324 mm torpedo launchers are mounted at the forward end of the after deckhouse, angled outwards at 45°.

The torpedo magazine contains 22 torpedoes.

TORPEDOES

Mk 46 Mod 5 torpedo

Normal armament is the Honeywell Mk 46 Mod 5 anti-submarine torpedo.

Specifications

Mk 46 Mod 5
Diameter: 324 mm (12.75 in)
Length: 2.95 m (9.68 ft)
Weight:
torpedo: 230 kg (507 lb)
warhead: 44 kg (97 lb)
Speed: 40 kts (max)
Range: 5.9 n miles (11 km)
Homing: Active/passive acoustic homing head
Motor: 5-cylinder liquid mono-propellant (Otto) motor
Warhead: Mk 103 Mod 1; 44 kg; PBXN-103

GUNS

United Defense Mk 42 Mod 9 Single 127 mm (5 in)/54 gun mounting

There is one Mk 42 Mod 9 mounting, housing a single Mk 18 127 mm/54 gun. The Mk 18 gun has replaceable liner and a service life of some 2,000 rounds. A bayonet-type joint attaches the gun to the housing which includes a vertical sliding breech block and the entire gun assembly is supported on rollers in the slide. A separate rammer is mounted on the slide. The Mk 42 mounting was introduced in 1953 and the upper part of the mounting is fully power driven and is enclosed in an armoured shield. The Mk 42 mounting requires a crew of 12: four men within the shield, and eight in the magazine and ammunition handling system.

Ammunition is loaded by a dual system with projectiles supplied automatically to the slide alternately from the right and left. The loading system consists of two manually loaded drums, one with 20 projectiles and the other with 20 charges, which rotate to bring the projectile and cartridge together. Complete rounds are lifted from the lower hoist to the upper hoist and from there to the cradles which move them to the tray where they are rammed into the breech.

Magazine capacity is 550 rounds and ammunition includes the Mk 41 AAC/HC, Mk 42 common, and Mk 48 illumination rounds, all of which weigh 31.75 kg (70 lb). All rounds have point detonating, proximity or mechanical time fuzes.

Specifications

Gun, 127 mm/54 Mk 18
Calibre: 127 mm
Length of barrel: 54 calibres
Muzzle velocity:
new barrel: 807 m/s (2,647 ft/s)
mid-life: 792 m/s (2,597 ft/s)
Max range: 13 n miles (24 km)
Max altitude: 14,400 m (47,000 ft)
Ammunition: 31.75 kg (70 lb)

Mounting, Mk 42 Mod 9
Traverse: 360° at 40°/s
Elevation: −15 to +85° at 25°/s
Rate of fire: 20-40 rds/min

Manufacturer/Contractor

United Defense Armament Systems Division, Minneapolis, Minnesota, USA.

Hughes Mk 15 CIWS Phalanx

There is one Hughes Mk 15 Phalanx close in weapons system (CIWS) situated on the quarterdeck. The mount consists of a 20 mm, six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,378 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA (system).

Akdeniz *(F 257) the last of eight ex-US Navy 'Knox' class transferred to Turkey on five-year leases* (C D Yalali)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

AN/SLQ-32(V)2 ESM Suite

These ships have the AN/SLQ-32(V)2 EW suite, but there is some uncertainty as to whether they were fitted with the Sidekick 'add-on' prior to transfer. AN/SLQ-32(V)2 is the ESM system, which gives radar warning across the B to H-bands.

Manufacturer/Contractor

Raytheon Company, Electromagnetic Systems Division, Goleta, California.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers

There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications

Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

T-Mk 6 Fanfare

The T-Mk 6 torpedo decoy consists of two winches each with a cable and a 'fish' containing a mechanical acoustic device. It was introduced into the US Navy in the 1950s and was replaced in most ships by AN/SLQ-25 Nixie.

Masker/Prairie Masker noise suppression systems

The ships are fitted with both Masker and Prairie Masker radiated noise suppression systems. In Masker, high-pressure air is bled off from either the ship's gas turbine or dedicated compressors and ejected from a pipe placed laterally across the ship's hull just forward of the machinery spaces. The forward motion of the ship causes the air to form a layer separating the hull from the water and thus masking the machinery noises which would otherwise be radiated directly into the water. Such a system is less effective at slow speeds where the air bubbles tend to rise to the surface rather than remain attached to the hull.

In Prairie Masker, air is passed down the propeller shaft and ejected from a groove in the leading edge of the blade, thus delaying the onset of cavitation.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Fast Frigate Integrated Shipboard Tactical System - 2 (FFISTS-2)

The eight Turkish ships are all fitted with FFISTS and while some may have the FFISTS-1 version, the majority will have FFISTS-2. FFISTS-2 was developed from FFISTS-1 and replaces the star-network by a distributed architecture, which uses DTC-2 workstations interconnected by a dual fibre optic or a Thicknet local area network. The DTC-2 workstation is a SUN-4/110 SPARC station with either one or two 48 cm (19 in) raster scan screens, 32 Mbytes of RAM, a 200 Mbyte hard drive (eliminating the need for the shared hard drives used in FFISTS-1) and is rated at 7.5 Mips. A twin-screen DTC-2 monitors the sonars while a single-screen DTC-2 acts as the Link 11 interface. A third, single-screen, DTC-2 provides data fusion from onboard and offboard sensors including Link 11, Link 14 and satellite communications. FFISTS-2 is reported to be capable of conducting not only ASW operations but also anti-ship operations.

COMMUNICATIONS AND DATALINKS

Datalinks: Signaal Link 11; Link 14 receive only.
Tacan: SRN 15
IFF: UPX-12

WEAPONS CONTROL

AN/SWG-1A Harpoon Launch Control System (LCS)

SWG-1A is the Harpoon weapons control system, which activates the missile, selects the flight pattern and sets seeker search modes (with small, medium or large acquisition windows), as well as providing target range and bearing data. Alternatively, the missile can simply be launched along the bearing of the target, with the seeker activated early to scan a 90° sector; if, after a set time, no target has been acquired the missile commences a preset search pattern. SWG-1A takes account of other ships in the general target area and generates indirect flight plans for the missile, including waypoints to optimise angles of approach which will achieve the highest possibility of success while minimising the chances of the missile being destroyed by hostile fire. It can also be used to compute flight plans in a multiple attack so that several missiles, from either the same or different ships, arrive on target simultaneously, thus swamping the defences.

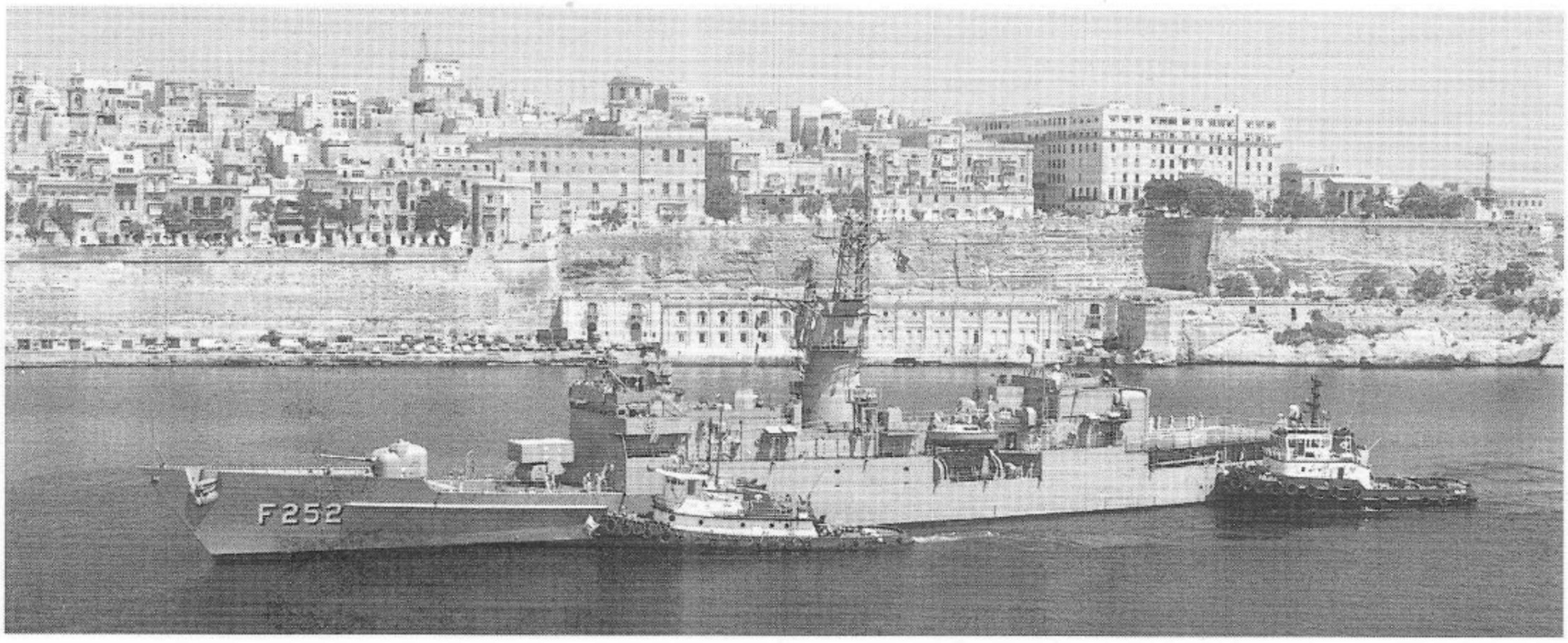
Mk 68 Gun Fire Control System (GFCS)

The Mk 68 GFCS provides target data, position orders and firing orders for the 127 mm (5 in) gun Mk 42 mountings for use against both surface and air targets. The system consists of a Mk 68 gun director and AN/SPG-53 I/J-band radar, a Mk 47 computer, a Mk 16 stable element and the gun mount. The system requires a crew of eight. The Mk 68 gun director has an optical rangefinder, two handwheels for optical tracking, the radar receiver, transmitter and antenna as well as a slip ring assembly. It transmits bearing, elevation and range data both to the computer and the radar operator's console. It can be operated in automatic radar and optical tracking modes.

The SPG-53 radar incorporates both spiral and conical scan for acquisition and tracking respectively. Later versions have monopulse and low-level tracking capabilities together with splash spotting and a missile launch alarm. The radar has both automatic and manual tracking modes. The former involves transmitting radar error signals in both bearing and elevation to the director power-driven amplifiers, where they are converted into control signals which drive the director. Manual tracking is achieved by operating the range, bearing and elevation handwheels at the radar operator's console. The Mk 47 analogue computer receives inputs from the director, the radar, the stable element, gyrocompass and underwater log system and processes this data to produce data on future target location, gun position and fuze orders. When engaging air targets its operation is automatic but, for engaging surface and land targets, manual rate control may be adopted.

Manufacturer/Contractor

Norden Systems, USA.



Kocatepe *(F 252), the former US Navy* Reasoner *(F 1063), entering Grand Harbour, Malta in 1986* (Jane's)

Mk 114 ASW fire-control system

The Mk 114 is the fire-control system for ASW operations. The main element is the Mk 53 Attack Console, an electromechanical analogue system which consists of two major units, the attack plotter and the ballistic computer. The latter conducts weapon presets for both ASROC and ASW torpedoes. The Mk 114 system also includes the Mk 33 underwater fire-control switchboard which accepts data from two Mk 19 gyrocompasses and other sensors, as well as from the Mk 134 sonar stabilisation computer. The consoles have an AN/UYK-44 reconfigurable processor with some 70,000 lines of CMS-2 language code. The system interfaces with the sonar.

Manufacturer/Contractor

Loral Librascope, USA.

NMMS electro-optic surveillance system

The NMMS was included in the transfer package. NMMS is designed to detect mines, low-flying aircraft and small boats by day or night in all weather conditions. It can also be used to support gunfire missions and to assist in helicopter landing control. NMMS consists of a systems electro-optic package housed in a composite casing and mounted on a pedestal. The sensor package comprises multiplexer electronics, the boresight assembly and the sensors (a Si-Vidicon television camera and a thermal imager), which float on high-energy, rare-earth magnets which create an energy field designed to produce unblurred images. The thermal imager is based upon the US MCTNS (Man-portable Common Thermal Night Sights) modules and has 120 elements with split Stirling cooling system. The sensor package also includes a Litton MMS Laser RangeFinder/ Designator (LRF/D) operating in the 1.06 micron range. Supporting the sensor package is a video tracker which can be used for manual or automatic tracking of targets. There is also a digital scan converter which enhances the thermal imager picture and also provides freeze frame and ×2 zoom capabilities. The system is used for both manual and automatic tracking but can also conduct continuous horizon scanning of designated sectors.

It should be noted that the designation 'Mast Mounted Sight' derives from the device's US Army title and it does not necessarily follow that in naval use the device is mounted on the ship's mast. The control console can be collocated with the sight, installed in the bridge or the combat information centre according to the operational requirement.

Specifications

Weight (sensor head): 72.57 kg (160 lb)
Diameter: 64.77 cm (25.5 in)
Stabilisation: less than 20 mrad
Fields of view
Thermal imager: 2 × 10°
Television: 2 × 8°

Manufacturers/Contractors

McDonnell Douglas Electronic Systems Company (system).
Northrop Electronics Division, Electronics Systems Group (sensor package).

RADARS

Set	AN/SPS-40B	AN/SPS 67*	AN/SPS-10*	LN-66	AN/SPG-53A/D/F
Company	Lockheed	Norden	Raytheon	Canadian Marconi	Western Electric
Role	2D surface search	Surface search	Surface search	Navigation	Fire control
Band	E/F	H (5.45-5.83 GHz)	G	I/J (9.3-9.4 GHz)	I/J
Beam	11 × 19°	1.5 × 16°	1.5 × 16°	2.5 × 22°	1.6°
Peak power	200 kW	500 kW	285 kW	75 kW	250 kW
Gain	21 dB	30 dB	30 dB	30 dB	39 dB
Pulsewidth	60 µs	0.1, 0.25, 1 µs	0.25-1.3 µs	1.0/0.1 µs	0.25 µs
PRF	300 pps	2,400, 1,200, 750 pps	312-325 pps	500/2,000 pps	1,000 pps
Scan rate	7.5/15 rpm	15/30 rpm	15 rpm	22 rpm	—
Range	175 n miles (320 km) 50,000 ft		Can detect a destroyer at 15 n miles		

* Ships are fitted with either AN/SPS-10 or AN/SPS-67.

SONARS

EDO AN/SQS-26CX

The hull-mounted AN/SQS-26CX works in surface duct, bottom bounce and convergence zone modes. Surface duct is for shorter range, bottom bounce for medium ranges and convergence zone for longer ranges. The last two modes require electronic beam-steering in elevation. SQS-26 is an active system transmitting at about 3.5 kHz with an output power of about 192 kW and receiving in seven channels between 1.5 and 4 kHz. The transducer is reported to be about 4.87 m (16.0 ft) in diameter and 1.68 m (5.5 ft) high, with 72 staves, each with eight elements. Ranges are reported to be approximately 10 n miles (18.5 km) in surface duct mode, and 34.5 n miles (64 km) in convergence zone mode. SQS-26CX was developed specially for the 'Knox' class frigates and was the final version of the SQS-26, the next set in the series being the SQS-53A.

Manufacturer/Contractor

EDO, Government Systems Division, College Point, New York, USA.

AN/SQR-18A(V)1 (TACTAS)

AN/SQR-18A(V)1 (also known as TACTAS (Tactical Towed Array Sonar). The low noise array is 230 m long and is towed behind an SQS-35 VDS 'fish' on a cable some 0.73 km (2,400 ft) long. The system features an adaptive processor which acts to reduce interference from the towing ship's noise (and to a lesser extent from adjacent ships) and a tracked system to provide bearing resolution and TMA. SQR-18 is integrated with the hull-mounted SQS-26 and AN/SQR-17 sonobuoy processor.

Manufacturer/Contractor

EDO, Government Systems Division, College Point, New York, USA.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck:
dimensions: 22.8 × 14 m (75 ft × 46 ft)
max helicopter take-off weight: 5,000 kg (11,000 lb)

Hangar: The hangar was originally designed to accommodate DASH helicopter drones, but was later enlarged to accommodate the SH-2 LAMPS-I Kaman SH-2 Seasprite. The after end of the hangar is telescopic.

HELICOPTERS

The Turkish Navy's shipborne ASW helicopter is the AB 212ASW, which type is seen embarked in these frigates. However, it is likely that the navy will acquire a smaller ASW helicopter.

PROPULSION

Specifications

System: Steam turbines
Main machinery: 2 Combustion Engineering/Babcock & Wilcox boilers; 84.4 kg/cm² (1,200 psi); 510°C (950°F); 1 turbine; 26 MW (35,000 hp)
Shafts: 1

FURTHER INFORMATION

PROGRAMME

The Turkish Navy was offered four 'Knox' class frigates in late 1992 and an official proposal was put to Congress in June 1993. Four were approved for transfer on a five-year lease, followed by a second batch of four in 1994. A ninth 'Knox' class ship, *Elmer Montgomery* (FF 1082), was transferred on a grant basis under the Foreign Assistance Act to replace the former destroyer *Muavenet* (scrapped after being hit by a Sea Sparrow missile) and is used as a source of spares.

MODERNISATION

The purchase of ASW helicopters has been authorised.

OLIVER HAZARD PERRY

OVERVIEW

The 'Perry' class was designed in the early 1970s to provide a successor to the 'Knox' class and to meet a requirement for a large number of escorts at a reduced unit price, although it was recognised from the start that such an approach would inevitably reduce their overall capabilities. Strict limits were set on cost, displacement and manpower to produce the cheaper component in a high/low technology mix of ships and thus act as a counterbalance to the very expensive and sophisticated specialised ASW and AAW ships, which were being built to protect carrier and surface action groups.

The primary mission for these new ships was to serve as ocean escorts, protecting amphibious forces, merchant ship convoys and underway replenishment groups. A further factor was that it was intended that they should be produced in smaller yards and so a deliberate effort was made to require simpler construction techniques, with maximum use being made of flat panels and bulkheads, with internal passageways being kept as straight as possible. Also in the interest of simplicity and economy, propulsion was by two gas turbines and, as with earlier US frigates, there is only one propeller. The ships can attain 25 knots on one engine and 28 knots on both, although Perry actually achieved 31 knots on trials. One unusual feature is that two small, retractable propulsion pods are fitted to provide a 'get you home' facility and to assist in docking. Each pod has a 325 hp engine and can propel the ship at 6 knots.

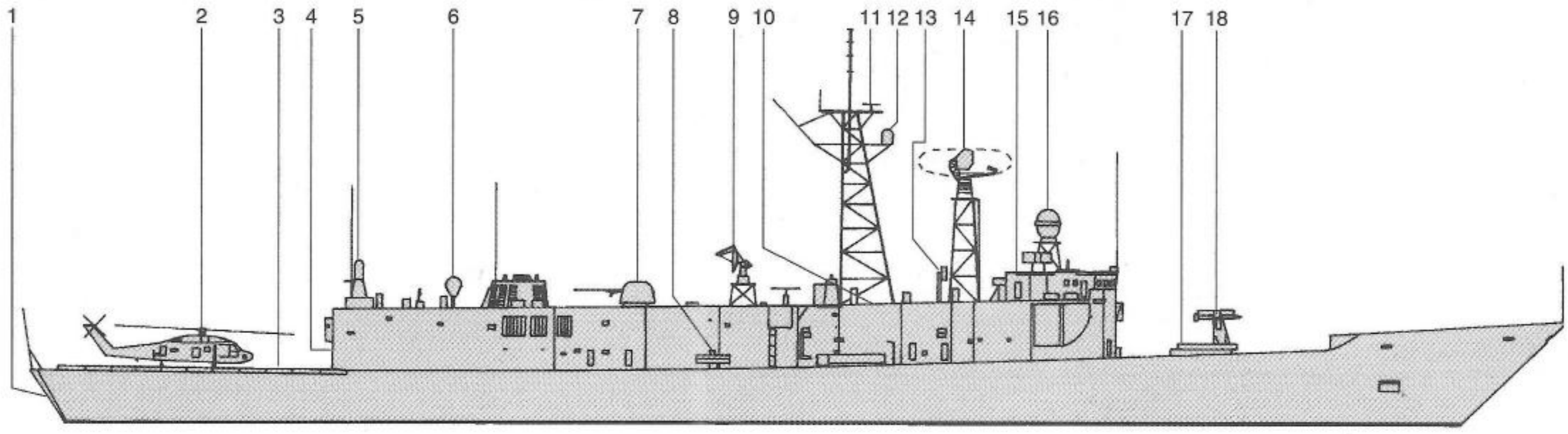
The weapon fit reflects the design philosophy. There is a single Mk 13 launcher on the foredeck with the magazine below containing 40 missiles, usually 36 Standard SM-1MR and four Harpoon. The gun is an OTOBREDA 76 mm Compact and is located atop the superstructure, just forward of the stack. A CIWS mount was not fitted initially, but all ships now have a single Mk 15 Phalanx mount in the hangar roof.

ASW capability includes two triple torpedo tubes and two helicopters (LAMPS I in the earlier ships, LAMPS III in others), but, unlike previous frigate classes, ASROC missiles are not carried.

A total of 70 has been built with more under construction. Of these 55 were built in the USA, 51 for the US Navy and four for Australia. A further two were later built in Australia, and six were built in Spain. In Taiwan seven have been completed to the standard 'Perry' class design, while construction is about to start on a further number to a considerably modified design.

Mahlon S Tisdale *(FFG 27) one of the very successful 'Oliver Hazard Perry' class frigates. 70 were built for four navies (Australia — six, Spain — six, Taiwan — seven, USA — 51) and more, to a somewhat modified design are under construction in Taiwan. A number of US Navy ships have however, already been sold to foreign navies and more are likely to follow* (H & L van Ginderen Collection)

ADELAIDE (OLIVER HAZARD PERRY)



Adelaide (Ian Sturton)
1 *Angled transom* **2** *SH-60B LAMPS III helicopter* **3** *Flight deck* **4** *Twin hangars* **5** *Mk 15 CIWS* **6** *Satcom antenna* **7** *76 mm OTOBREDA Mk 75 gun* **8** *Triple Mk 32 324 mm torpedo tubes* **9** *Lockheed STIR fire control* **10** *Loral Hycor SRBOC launcher* **11** *ISC Cardion AN/SPS-55 surface search* **12** *ECM antenna* **13** *AN/WSC-3 Satcom antenna* **14** *Raytheon AN/SPS-49(V)5* **15** *AN/SLQ-32(V)2 ESM array* **16** *Sperry Mk 92 (Signaal WM 28) fire control* **17** *Magazine: 4 Harpoon; 36 SM-1M* **18** *Mk 13 Mod 4 launcher*

GENERAL SPECIFICATIONS

Operator: Australia
Type: Oliver Hazard Perry

Class: ADELAIDE

Purchased: 4
Built: 2
Active: 6

Displacement:
standard: 3,073 t
full load: 4,100 t

Dimensions
Length: 138.1 m (453 ft)
Beam: 13.7 m (45 ft)
Draught: 7.5 m (24.5 ft) (sonar); 4.5 m (14.8 ft) (keel)

Speed: 29 kts (4 kts on propulsors)
Range: 4,500 n miles at 20 kts

Complement: 184 (15 officers) plus aircrew

SHIPS

ADELAIDE (01)
Builder Todd Pacific Shipyard, Seattle, Washington, USA
Laid down 29 Jul 1977
Launched 21 Jun 1978
Commissioned 15 Nov 1980

CANBERRA (02)
Builder Todd Pacific Shipyard, Seattle, Washington, USA
Laid down 1 Mar 1978
Launched 1 Dec 1978
Commissioned 21 Mar 1981

SYDNEY (03)
Builder Todd Pacific Shipyard, Seattle, Washington, USA
Laid down 16 Jan 1980
Launched 26 Sep 1980
Commissioned 29 Jan 1983

DARWIN (04)
Builder Todd Pacific Shipyard, Seattle, Washington, USA
Laid down 3 Jul 1981
Launched 26 Mar 1982
Commissioned 21 Jul 1984

MELBOURNE (05)
Builder Australian Marine Engineering, Williamstown, Australia
Laid down 12 Jul 1985
Launched 5 May 1989
Commissioned 15 Feb 1992

NEWCASTLE (06)
Builder Australian Marine Engineering, Williamstown, Australia
Laid down 21 Jul 1989
Launched 21 Feb 1992
Commissioned 11 Dec 1993

WEAPONS SYSTEMS

MISSILE LAUNCHER

Mk 13 Mod 4 launcher

There is a single Mk 13 Mod 4 launcher located on the foredeck, used to launch both Harpoon SSM and Standard SM-1MR SAMs. There are 40 missiles (a mix of Harpoon and Standard SM-1MR) stored vertically in a below-decks magazine in two concentric rings. Launching rate is one missile every 10 seconds. Mod 4 introduced solid-state technology, replacing the electromechanical relays in Mods 1-3.

ANTI-SHIP MISSILES (ASM)

McDonnell Douglas UGM-84B Harpoon

The missile magazine contains eight Harpoon Block 1C anti-ship missiles. This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns and, for the terminal phase, can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg (11,905 kg) thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR-MISSILES (SAM)

Standard Missile-1 Medium Range (SM-1MR)

Main air defence armament is the SM-1MR, of which 32 are normally carried in the magazine and are launched from the Mk 13 Mod 4 launcher on the foredeck. SM-1MR Block IV missiles have a Naval Weapons Center Mk 51 expanding rod warhead, while Block V missiles have a Naval Weapons Center Mk 90 blast fragmentation warhead.

Specifications
Length: 4.48 m (14.7 ft)

Diameter: 34.3 cm (13.5 in)
Wing span: 1.06 m (3.48 ft)
Weight: 642.3 kg (1,416 lb)
Speed: Mach 2
Range: 20.5 n miles (38 km)
Altitude: 19,800 m (65,000 ft)

Manufacturers/Contractors
Hughes Missile Systems, Tucson, Arizona, USA.
Raytheon, Missile Systems Division, Bedford, Maryland, USA.

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited amidships, one on either beam. Mk 46 Mod 5 torpedoes are normally used, although a small stock of Mk 44 is still held.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

Manufacturer/Contractor
GEC-Marconi Naval Systems, UK.

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Mk 75 Compact
There is one OTOBREDA 76 mm (3 in) gun sited amidships atop the superstructure. It should be noted that the guns for ships *Melbourne* (05) and *Newcastle* (06) were manufactured in Australia.

Specifications
Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/sec
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range: 8.6 n miles (16 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Hughes Mk 15 CIWS Phalanx
There is one Hughes Mk 15 CIWS Phalanx close in weapons system (CIWS) situated at the after end of the hangar roof. These were installed in ships 03-06 during construction and were retrofitted to the first two in 1985.

The mount consists of a 20 mm M61A1 six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min (Block 0, Block 1 Baseline 0), 4,500 rds/min (Block 1 Baseline 1)
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA.

M2HB 12.7 mm (0.50 in) machine guns
Up to six M2HB 12.7 mm machine guns are carried and can be mounted on flexible mounts.

Specifications
Calibre: 12.7 mm (0.50 in)
Muzzle velocity: 883 m/s (2,900 ft/s)
Rate of fire: 450-550 rds/min
Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-air: 1,380 m (4,500 ft)

Newcastle *(06) launching a Standard SM-1MR SAM with the onlookers standing at a respectful distance on the quarterdeck.* Newcastle *was the last of the six to be commissioned and the second of the two to be built in Australia* (RAN)

ELECTRONIC WARFARE SYSTEMS

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers
There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

Nulka expendable rocket-launched hovering decoy system
Four Nulka launchers are being mounted. This is an expendable, active decoy, providing all-weather self-protection for naval vessels against anti-ship missiles and is designed for use either as part of a multilayer defence system or for stand-alone ship protection. The Winnin rocket is held in a hermetically sealed canister which acts both as storage container and launch tube. Control of the decoy's hovering flight is achieved by a thrust-control mechanism, which acts on the motor's efflux, and a spin-control unit mounted on top of the decoy. The combination of thrust- and flight-control enables successful launches to be made in severe sea states and high winds. Once launched, the decoy operates autonomously and, following its stored flight demands, moves away from the ship at its programmed height and speed to present an alternative and more attractive target to incoming missiles.

Manufacturers/Contractors
AWA Defence Industries (AWADI) Pty Ltd (system).
Sippican, USA (payload).

AN/SLQ-25A Nixie noisemaker
One AN/SLQ-25A Nixie electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch

and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm (3.10 ft) long, 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.

AN/SLQ-32(V)2 ESM suite
The Australian ships have the Raytheon AN/SLQ32(V)2 ESM-only suite, which gives radar warning on B to J-bands, but has no ECM (jamming) capability.

Manufacturer/Contractor
Raytheon Company, Electromagnetic Systems Division, Goleta, California.

Elbit EA-2118 jammer
The jammer is the Israeli Elbit EA-2118.

Manufacturer/Contractor
Elbit, Israel.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

ACDS Advanced Combat Direction System
The Australian ships are fitted with ACDS, an enhanced version of the Naval Tactical Data System (NTDS) tactical data handling and target designation system. This uses two AN/UYK-43B processors and features software modules similar to those in the original NTDS, with a software package containing a database of approximately 1 million lines of code with an additional dedicated ship-fit of code. The Block 0 system also features improvements in the Link 11 interface, interfaces to new weapon and sensor systems as well as the replacement of the Hughes Video Signal Simulator (VSS) by the Republic Electronics AN/USQ-93 Radar Environmental Simulator System (RESS). Like NTDS, ACDS Block 0 provides Link 4A, Link 11 and Link 14 communications.

Manufacturers/Contractors
Unisys (computers).
Hughes Aircraft Company (displays).
Collins (radios).

COMMUNICATIONS AND DATALINKS

Satcom: OE-2
Datalink: Link 11
IFF: AIMS Mk XII.
Tacan: URN-25.

WEAPONS CONTROL

Mk 92 Mod 2 fire-control system
Mk 92 is an Americanised version of the Signaal WM28 system, produced under licence by Unisys, with Mk 92 Mod 2 being installed in all ships 'as built.' The Mk 92 Mod 2 system uses a combined antenna system with its distinctive egg-shaped housing, together with the STIR (Signaal Track and Illuminating Radar) and provides continuous air and surface search around a ship even in an ECCM environment. It has a fast reaction time and is capable of simultaneous engagement of up to four surface targets, or two air and two surface targets. The system can engage air, surface or shore targets with guns or missiles. It is fully compatible with NTDS and interfaces with the Mk 13 Mod 4 missile handling/launching system, the Mk 75 gun and the Mk 15 Phalanx CIWS.

The Mk 92 consists of a combined antenna system, a separate track illuminating radar, a computer system, weapon control consoles, and ancillary equipment, and has a crew of four. The Mk 53 Combined Antenna System (CAS) consists of a monopulse track radar with CW injection above and a track-while-scan (TWS) radar. Their antennas share a stabilised mount with the monopulse antenna above and the TWS antenna below. The monopulse radar can detect, track and illuminate one target in the air or on the surface. The TWS radar can detect and track up to two surface or shore targets simultaneously, as well as low-altitude targets.

The Lockheed STIR (in American terminology 'Separate' Track Illuminating Radar) is an I/K-band monopulse tracking radar with CW injection which is designed to provide an additional channel of fire for a single air or surface target. It consists of a Mk 54 director with antenna.

There are two 32-bit AN/UYK-7 computers, each with 256 k memory and an optimum operating speed of 667 Kops, the second computer having been added to improve the processing of ASW data. There are two Weapons Control Consoles in the CIC to provide an MMI for acquiring and tracking targets, engagement control, launcher assignment, missile firing and post-engagement evaluation. The Mk 106 WCC supports the CAS and the Mk 107 WCC supports the STIR, but both also receive video data from ship search radars. Between the WCCs are the CIWS and Harpoon control stations and the CIC also has five consoles from the AN/UYA-4 family.

Manufacturer/Contractor
Unisys Corporation, Government Systems Group.

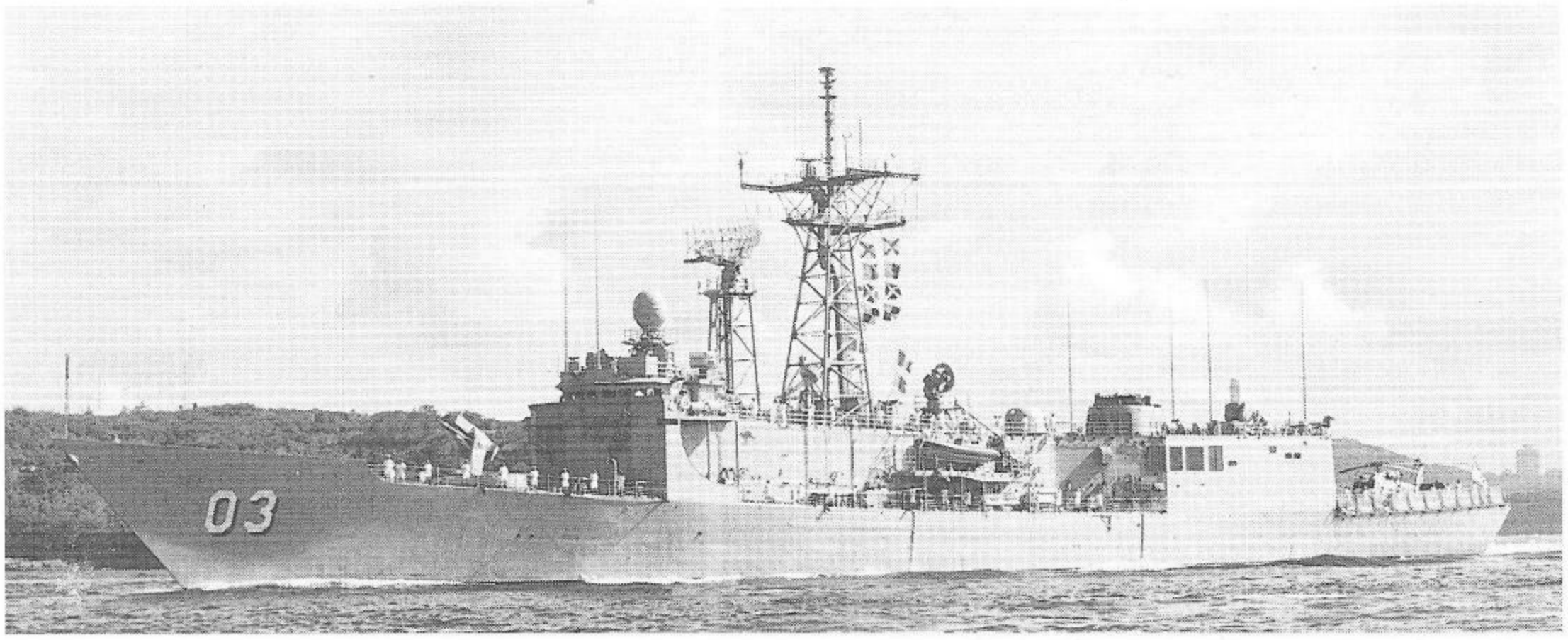
NMMS electro-optic surveillance system
The RAN purchased two sets of NMMS which are permanently installed in *Adelaide* and *Sydney* only. This US Navy equipment is designed to detect mines, low-flying aircraft and small boats by day or night in all weather conditions. It can also be used to support gunfire missions and to assist in helicopter landing control. NMMS consists of a systems electro-optronic package housed in a composite casing and mounted on a pedestal. The sensor package comprises multiplexer electronics, the boresight assembly and the sensors (a Si-Vidicon television camera and a thermal imager), which float on high-energy, rare-earth magnets which create an energy field designed to produce unblurred images. The thermal imager is based upon the US MCTNS (Man-portable Common Thermal Night Sights) modules and has 120 elements with split Stirling cooling system. The sensor package also includes a Litton MMS Laser RangeFinder/Designator (LRF/D) operating in the 1.06 micron range. Supporting the sensor package is a video tracker which can be used for manual or automatic tracking of targets. There is also a digital scan converter which enhances the thermal imager picture and also provides freeze frame and ×2 zoom capabilities. The system is used for both manual and automatic tracking but can also conduct continuous horizon scanning of designated sectors.

It should be noted that the designation 'Mast Mounted Sight' derives from the device's US Army title and it does not necessarily follow that in naval use the device is mounted on the ship's mast. The control console can be collocated with the sight, installed in the bridge or the combat information centre according to the operational requirement.

Specifications
Weight (sensor head): 72.57 kg (160 lb)
Diameter: 64.77 cm (25.5 in)
Stabilisation: Less than 20 mrad
Fields of view
thermal imager: 2 × 10°
television: 2 × 8°

Manufacturers/Contractors
McDonnell Douglas Electronic Systems Company (system).
Northrop Electronics Division, Electronics Systems Group (sensor package).

Radamec 2500 electro-optic director
One Radamec 2500 director is being fitted in each ship. This director includes TV, laser and IR imagers.



Sydney *(03), one of four built in the USA for the RAN, was originally intended for the US Navy as FG 35* (H & L van Ginderen Collection)

RADARS

	AN/SPS-49(V)2	AN/SPS-55	AN/SPG-60 (STIR)	Mk 92
Company	Raytheon	Cardion	Lockheed	Unisys
Role	Air search	Surface search/ navigation	Fire control	Fire control
Band	C/D (0.5-2 GHz)	I/J (8-20 GHz)	I/J	I/J
Beam	3.4 × 30° csc²	1.5 × 20°	12 × 1.2°	1.5 × 4.7°
Peak power	360 kW	130 kW	5.5 kW	200 kW
Gain	28.5 dB	31 dB	41.5 dB	33.5 dB
Pulsewidth	125 µs/2 µs	1/12 µs	0.27/1/6 µs	0.22/0.45 µs
PRF	280/800/1,000 pps	750/2,250 pps	25,000-35,000 pps	3,600-1,800 pps
Scan rate	6/12 rpm	16 rpm	—	60 rpm
Range	250 n miles (457 km)		60 n miles (110 km)	

SONARS

Raytheon AN/SQS-56 hull-mounted sonar

The first four Australian ships (which were also those built in the USA) all have the AN/SQS-56 hull-mounted sonar, which was developed specifically for the US Navy's 'Perry' (FFG 7) class frigates. This equipment has been provided by the US Navy to various foreign navies, including that of Australia, via the FMS programme under the designation AN/SQS-56. (Note that identical sets exported as a commercial sale from Raytheon are designated DE 1160.) Digital implementation allows packaging of the complete multifunction active and passive sonar in five medium-size electronics cabinets and one operator's console. System control uses a built-in mini-computer and an advanced display system. The sonar is an active/passive, preformed beam, digital sonar providing panoramic echo ranging and panoramic (DIMUS) passive surveillance. All signal processing, except transducer-received signal amplification and linear transducer transmit drive, is accomplished in digital hardware, most of which is implemented using US Navy SEMP (Standard Electronic Module Programme) components in compact water-cooled cabinets small enough to allow installation through standard size hatches.

The basic system includes the transducer array, transducer junction box, five electronics cabinets (array interface, transmitter(s), receiver and controller), operator console, sonar dome and control unit. Options in production include a loudspeaker/intercom, a water-cooling unit, a remote display and a performance prediction subsystem.

A single operator can search, track, classify and designate multiple targets from the active system while simultaneously maintaining anti-torpedo surveillance on the passive display.

Computer-assisted system control permits the operator to concentrate on the sonar data being displayed rather than on the system control. Operating frequencies are 5.6, 7.5 and 8.4 kHz.

Manufacturer/Contractor

Raytheon Company, Submarine Signal Division, Portsmouth, Rhode Island.

Mulloka hull-mounted scanning sonar system

Mulloka is installed in *Melbourne* (05) and *Newcastle* (06). This is an Australian-developed, lightweight, hull-mounted scanning sonar, which was designed especially for use in coastal waters around Australia. It operates at relatively high frequencies: active — 6-11 kHz; passive — 3.4-14 kHz. The cylindrical transducer array consists of 96 staves, each with 25 transducers, which are driven in differing combinations and phases under computer control to form the required sonar beams. The length of the transmit period is selectable over a range of 1 to 4 seconds. The formation of the beam transmit pattern is random in nature from one transmission to the next in order to prevent the submarine commander having any indication of detection. Immediately following the transmission, the sonar reverts to the listening mode for a period determined by the range scale selected by the operator. Range is about 10,000 yd.

Manufacturer/Contractor

EMI/Honeywell.

Kariwara towed passive array

Under current plans it is intended to install the Kariwara towed array in due course.

AVIATION

AVIATION FACILITIES

Specifications

Helicopters: 2 Sikorsky S-70B-2 Seahawks or 1 Seahawk and 1 Squirrel

Sikorsky S-70B-2(RAN) Seahawk

Specifications

Dimensions:
- **main rotor diameter:** 16.36 m (53.66 ft)
- **tail rotor diameter:** 3.35 m (11.00 ft)
- **length overall:** 15.26 m (50.0 ft)
- **height to top of rotor head:** 3.79 m (12.43 ft)

Weights:
- **empty:** 6,191 kg (13,648 lb)
- **mission gross weight:** 9,182 kg (20,244 lb)

Performance:
- **maximum at 1,525 m (5,000 ft):** 126 kts (234 km/h)
- **vertical rate of climb:** 213 m (700 ft)/min
- **service ceiling:** 4,800 m (15,750 ft)
- **range:** 360 n miles (666 km)

Power plant: 2 General Electric T700-GE-401C turboshafts rated at 1,417 kW (1,900 shp); transmission rating 2,535 kW (3,400 shp)

Accommodation: 3 (pilot and airborne tactical officer/back-up pilot in cockpit, sensor operator in specially equipped station in cabin)

Communications: Collins AN/ARC-159(V)2 UHF, Collins AN/ARC-174(V)2 HF, Hazeltine AN/APX-76A(V) and Bendix/King AN/APX-100(V)1 IFF transponders, TSEC/KG-45(E-1) communications security set, TSEC/KY-75 voice security set, Telephonics OK-374/ASC communications system control group

Radar: Thomson Thorn SuperSearcher

Mission: Sikorsky sonobuoy launcher, Edmac AN/ARR-84; CAE AN/ASQ-504(V) internal MAD; Raymond MU-670/ASQ magnetic tape memory unit, Astronautics IO-2177/ASQ altitude indicator, Fairchild AN/ASQ-164 control indicator set, Fairchild AN/ASQ-165 armament control indicator set, Computing Devices UYS-503 and CV-3252/A converter display, Control Data AN/AYK-14 (XN-1A) digital computer, Raytheon AN/ALQ-142 ESM, Rockwell Collins DHS-901 datalink and telemetry. AN/AAQ-16 FLIR was fitted in Gulf War.

Self-defence: AN/ALE-47 chaff/flare dispensers and AN/AAR-47 missile detectors during Gulf War

Armament: 2 Mk 46 torpedoes

Eurocopter (Aerospatiale) AS 350/355 Ecureuil

Specifications

Dimensions
- **main rotor diameter:** 10.69 m (35.07 ft)
- **tail rotor diameter:** 1.86 m (6.10 ft)
- **length overall, rotors turning:** 12.94 m (42.45 ft)
- **height overall:** 3.14 m (10.30 ft)

Weights:
- **empty:** 1,220 kg (2,689 lb)
- **max take-off:** 2,250 kg (4,960 lb)

Performance:
- **never-exceed speed (VNE) at sea level:** 155 kts (287 km/h)
- **max cruising speed:** 133 kts (246 km/h)
- **max rate of climb:** 456 m (1,500 ft)/min

Power plant: 1 546 kW (732 shp) Turbomeca Arriel 1D1

Accommodation: 6 (pilot, co-pilot, four passengers)

Avionics: VHF/AM radios, HF/SSB transponder and ICS

Armament: There is provision for a wide range of weapons, including machine guns and rockets

S-70B-2 of the RAN (Scott Connolly, RAN)

PROPULSION

Specifications
System: Gas turbine
Main machinery: 2 General Electric LM-2500 gas turbines; 30.6 MW (41,000 hp) sustained

Shafts: 1
Propeller: cp
Auxiliary propulsion: 2 retractable electrical propulsors; 650 hp (490 kW)

FURTHER INFORMATION

PROGRAMME

The RAN planned to build a class of three light destroyers (DDL) in the 1970s and undertook a joint design study with the UK Royal Navy, starting in 1966. The ship would have resembled the British Type 42, but with a broader beam, US weapons, and some Australian equipment. The project was, however, postponed in 1973 and cancelled in 1974, and then replaced by the order for the US 'Perry' class.

The first four ships were built in the USA and were, in fact, taken from the US Navy programme. Thus, *Adelaide* was originally the US Navy's FFG 17; *Canberra,* FFG 18; *Sydney,* FFG 35; and *Darwin,* FFG 44.

It was then planned to build six ships in Australia, bringing the total in service to ten. However, the last four were cancelled, leaving only *Melbourne* (05) and *Newcastle* (06) to be built in the AMECON yard in Melbourne, Australia.

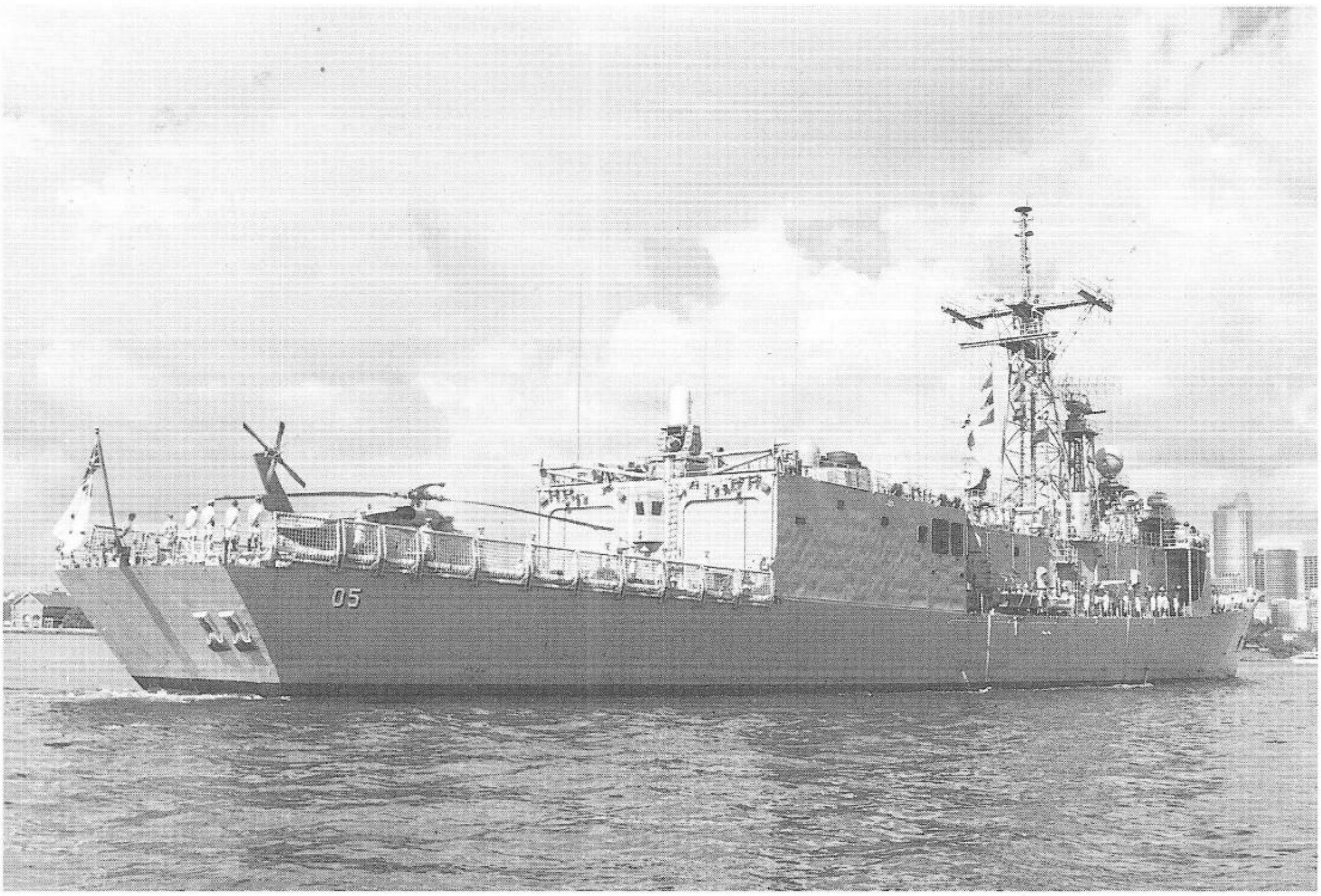
MODERNISATION

The first three ships were built to the original 'Perry' class design with a perpendicular transom. Thus, when the RAN selected the Sikorsky SH-70B-2 helicopter it became necessary to angle out the transom which was then being done in the US Navy's ships. This modification involved 12 months' work and was completed in *Sydney* in February 1989, in *Adelaide* in November 1989, and in *Canberra* in December 1991. For the remaining three ships the modification was incorporated into the building programme. The complete helicopter modification programme included angling the transom to 45°, which increased the ship's overall length by 2.4 m (8 ft), fitting the RAST helicopter recovery system, longitudinal strengthening and buoyancy upgrades.

Several options are under consideration for the Progressive Upgrade Project which was originally scheduled to start in 1996 but has slipped, with contracts now due to be let in 1997 and the work due to be done over the period 1998-2003. Options under consideration include obtaining SM-2 missiles (for which improved radars would be required), or installing a VLS Mk 41 launcher for a mix of Standard SM-1 Block IV and Evolved Sea Sparrow missiles. Other possibilities include towed arrays, updated combat data systems and a mine avoidance sonar.

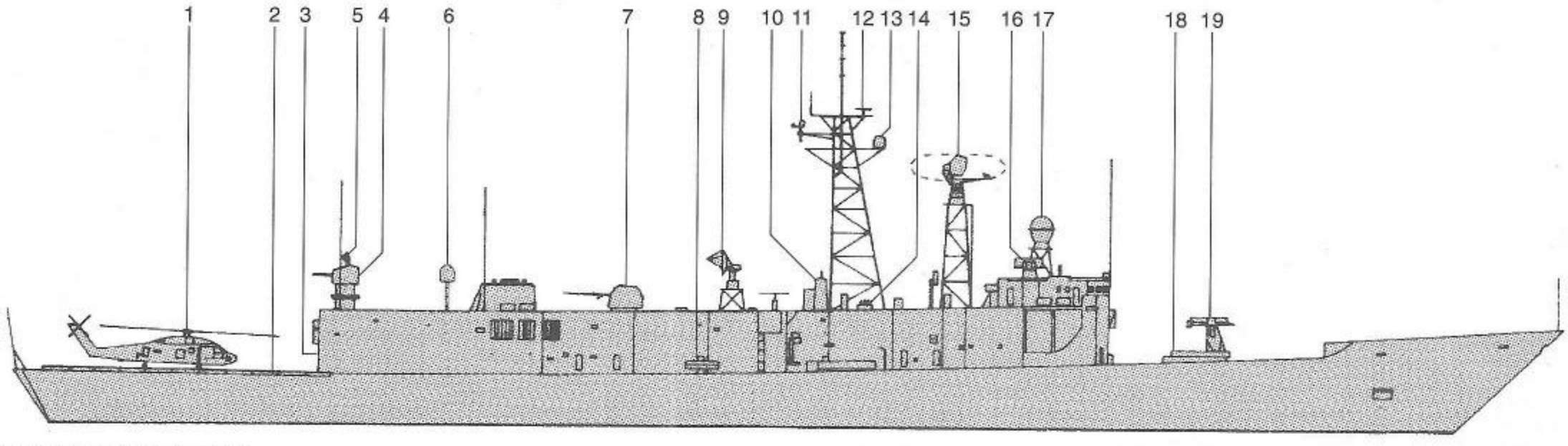
OPERATIONAL

Adelaide and *Darwin* are based at Fleet Base West, while the other four are at Fleet Base East. For operational tasks such as deployment to the Gulf, the ships are fitted with enhanced communications, electro-optical sights, rigid inflatable boats (RIBs) and portable RAM panels. All ships are capable of exercising a fighter-control function.



Melbourne *(05). The two fairleads in the transom are for the current towed decoys and will be used, in due course, for the Australian-designed Kariwara towed array*

SANTA MARIA (OLIVER HAZARD PERRY)



Santa Maria (Ian Sturton)
1 *S-70L Seahawk helicopter* **2** *Flight deck* **3** *Twin hangar* **4** *Bazan 12-barrel 20 mm CIWS* **5** *Sperry VPS-2 radar (Meroka system)* **6** *Saturn Satcom* **7** *OTOBREDA 76 mm/62 gun* **8** *Triple US Mk 32 324 mm torpedo tubes* **9** *Signaal STIR fire director* **10** *ECM array* **11** *Selenia RAN-30L/X fire control (Meroka)* **12** *Raytheon AN/SPS-55 surface search radar* **13** *ECM array* **14** *Loral Hycor Mk 37 flare/chaff launcher* **15** *Raytheon AN/SPS-49(V)5 air search radar* **16** *Elettronica Nettunel ESM/ECM array* **17** *RCA Mk 92 fire director* **18** *Magazine for eight Harpoon SSM, 32 SM-1MR SAM* **19** *Mk 13 Mod 4 launcher*

GENERAL SPECIFICATIONS

Operator: Spain
Type: Oliver Hazard Perry

Class: SANTA MARIA (FFG)

Built: 6
Active: 6

Displacement:
standard: 3,610 t
full load: 4,017 full load

Dimensions
Length: 137.7 m (451.2 ft)
Beam: 14.3 m (46.9 ft)

Draught: 7.5 m (24.6 ft)

Speed: 29 kts; 4.5 kts on auxiliary
Range: 4,500 n miles at 20 kts

Complement: 223 (13 officers)

SHIPS

SANTA MARIA (F 81)
Builder Bazan, Ferrol, Spain
Laid down 23 May 1982
Launched 24 Nov 1984
Commissioned 12 Oct 1986

VICTORIA (F 82)
Builder Bazan, Ferrol, Spain
Laid down 16 Aug 1983
Launched 23 Jul 1986
Commissioned 11 Nov 1987

NUMANCIA (F 83)
Builder Bazan, Ferrol, Spain
Laid down 8 Jan 1986
Launched 30 Jan 1987
Commissioned 8 Nov 1988

REINA SOFIA (F 84)
Builder Bazan, Ferrol, Spain
Laid down 12 Dec 1987
Launched 19 Jul 1989
Commissioned 18 Oct 1990

NAVARRA (F 85)
Builder Bazan, Ferrol, Spain
Laid down 15 Apr 1991
Launched 23 Oct 1992
Commissioned 30 May 1994

CANARIAS (F 86)
Builder Bazan, Ferrol, Spain
Laid down 15 Apr 1992
Launched 21 Jun 1993
Commissioned 14 Dec 1994

WEAPONS SYSTEMS

MISSILE LAUNCHER

Mk 13 Mod 4 launcher

There is a single Mk 13 Mod 4 launcher located on the foredeck, used to launch both Harpoon SSM and Standard SM-1MR SAMs. There are 40 missiles stored vertically in a below-decks magazine in two concentric rings. Launching rate is one missile every 10 seconds. Mod 4 introduced solid-state technology, replacing the electromechanical relays in Mods 1-3.

ANTI-SHIP MISSILES (ASM)

McDonnell Douglas UGM-84B Harpoon

The missile magazine contains eight Harpoon Block 1C anti-ship missiles. This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns and, for the terminal phase, can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Navarra *(F 85)* (H & L van Ginderen Collection)

Specifications

Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

Standard Missile-1 Medium Range (SM-1MR)

Main air defence armament is the SM-1MR which is launched from the Mk 13 Mod 4 launcher on the foredeck. The magazine normally contains 32 rounds. SM-1MR Block IV missiles have a Naval Weapons Center Mk 51 expanding rod warhead, while Block V missiles have a Naval Weapons Center Mk 90 blast fragmentation warhead.

Specifications

Length: 4.48 m (14.7 ft)
Diameter: 34.3 cm (13.5 in)
Wing span: 1.06 m (3.48 ft)
Weight: 642.3 kg (1,416 lb)
Speed: Mach 2
Range: 20.5 n miles (38 km)
Altitude: 19,800 m (65,000 ft)

Manufacturers/Contractors

Hughes Missile Systems, Tucson, Arizona, USA.
Raytheon, Missile Systems Division, Bedford, Maryland, USA.

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited amidships, one set on either beam.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

Manufacturer/Contractor

GEC-Marconi Naval Systems, UK.

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications

Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Mk 75 Compact

There is one OTOBREDA 76 mm (3 in) gun sited amidships atop the superstructure.

Specifications

Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/sec
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range: 8.6 n miles (16 km)

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

Bazan Meroka

One Bazan Meroka Mod 2A/2B 12-barrelled 20 mm/120 close in weapons system (CIWS) is mounted at the after end of the hangar roof. This Spanish-designed weapon is unique in its configuration and operation. The weapon itself consists of 12 Oerlikon 20 mm KAA barrels and uses standard Oerlikon 20 mm ammunition, but these barrels are arranged in a single unit of two superimposed rows of six with a common breech block. All operations, such as loading, feeding and unlocking, are carried out using compressed air from reservoirs on the mounting, which are recharged from an onboard compressor. Ammunition is brought to the barrels by two belt feeds, supplied by a hydraulically powered, rotating, 72-round magazine.

Specifications

Calibre: 20 mm
Length of barrel: 120 calibres
Muzzle velocity: 1,215 m/s (3,986 ft/s)
Traverse: 360° at 90°/s
Elevation: −20 to +85°
Crew: 0
Range: 0.75 n miles (1.5 km)
Rate of fire: 2,700-3,600 rds/min
Ammunition: 337 g (11.9 oz) (TP-T, HEI, SAPHEI-T, AP-T); 310 g (10.9 oz) (APDS-T)

Manufacturer/Contractor

Fabrica de Artilleria de Bazan, Spain.

Part of the Spanish Navy's 'Group Alfa' at sea including the flagship, the carrier Principe de Asturias *and two 'Santa Maria' class frigates* (Bazan)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Elettronica Nettunel

Nettunel is the Spanish name for the Elettronica Nettuno system, which is made under licence in Spain. Nettuno is an integrated radar ESM/ECM system claimed to have a 100 per cent intercept of emitters, using passive surveillance based on environmental synthesis. A very high level of automation ensures immediate and automatic identification based on a powerful threat library, and accurate tracking of emitters. Computer-controlled processing employs structured modular software using a high-level language. There is full, interactive integration with the command and control systems, and also with the flare/chaff launcher systems. Roll-stabilised, multibeam DF antennas provide high bearing accuracy and feature high sensitivity, wide dynamic range logarithmic amplifiers and completely digital processing. The ECM section provides self-protection by environment adaptive instant-by-instant automatic jamming, even against simultaneous multiple threats. However, command and control, or the operator, can override the system if necessary. The high-power jammer antennas are roll-stabilised and consist of linear arrays that electronically steer a precise and narrow high-gain beam. Jamming implementation follows automatic instructions provided by the ESM section and by the power management computer. High ERP is achieved by using a transmitter design employing paralleled matched high-power Elettronica-designed TWTs.

Manufacturer/Contractor

Elettronica SpA, Rome, Italy.

Mk 3000

F 84 to F 86 are fitted with a new intercept/jammer suite, the Mk 3000.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers

There are two Mk 37 Mod 1 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications

Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

AN/SLQ-25 Nixie noisemaker

One AN/SLQ-25 Nixie (Phase 1), solid-state, modular design electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm (3.10 ft) long, 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor

Aerojet ElectroSystems, Sacramento, California, USA.

Prairie Masker noise suppression systems

The ships are fitted with Prairie Masker radiated noise suppression systems in which air is passed down the propeller shaft and ejected from a groove in the leading edge of the blade, thus delaying the onset of cavitation.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

IPN-10

IPN-10 is the export version of SADOC 2 *(Systema Direzione della Operazioni di Combattimento),* which was developed by Selenia (now Alenia Elsag Sistemi Navali) in the late 1970s. The SADOC 2/IPN-10 data handling system is designed to produce an up-to-date picture of the tactical situation within the vicinity of both the ship and its task group. SADOC 2/IPN-10 is a mainframe system, designed primarily to acquire, process and present data acquired by the ship's principle sensors, but can also be used for other functions, including evaluation, threat evaluation, weapons control, ECM management, aircraft control, conducting ASW operations, and datalink databank management. In addition to the data received from onboard sensors the system is also capable of receiving and processing data received from offboard sensors via datalinks such as Link 11.

There are several Selenia (now Alenia) 32-bit CDG-3032 central processing units (CPU), each with a 128 K memory, one of which normally acts as the primary, with another acting as an immediate back-up in the event of system failure. Each of the consoles also contains a Selenia (now Alenia) 16-bit NDC-160 minicomputer, with 64 K memory. Both types possess mass memory modules for handling programmes and large amounts of data and interface with each other via a 10 Mbit/s serial databus. The basic software of the latter is under the control of two TAVITAC operating systems; the disk operating system and a time-sharing executive.

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome, Italy.

COMMUNICATIONS AND DATALINKS

Datalink: Link 11
Helo datalink: AN/SSQ-28 LAMPS III
Satcom: Saturn 3S (SCOT 3 Satcom may also be fitted in due course)
Tacan: AN/URN-25.

WEAPONS CONTROL

Enosa electro-optic tracker

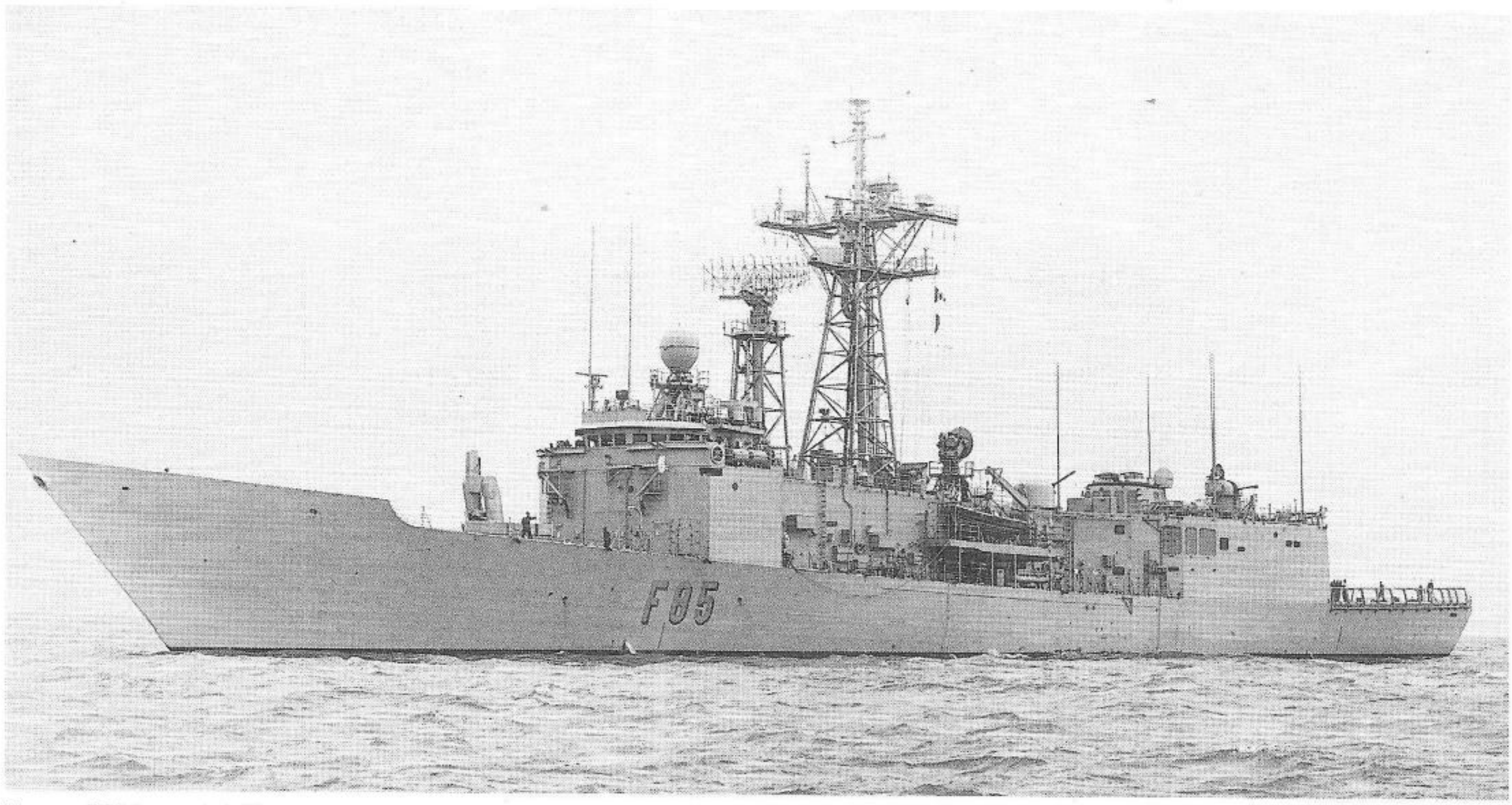
There is an Enosa electro-optic tracker for Meroka 2B.

Mk 92 Mod 2/6 fire-control system

F 81 to F 84 are fitted with the Mk 92 Mod 2 fire-control system, while the last two ships, F 85 and F 86, have the Mod 6 version with CORT (COherent Receive/Transmit). Mk 92 is an Americanised version of the Signaal WM28 system, produced under licence by Unisys. Mk 92 Mod 2 uses a combined antenna system with its distinctive egg-shaped housing, together with the STIR (Signaal Track and Illuminating Radar) and provides continuous air and surface search around a ship even in an ECCM environment. It has a fast reaction time and is capable of simultaneous engagement of up to four surface targets, or two air and two surface targets. The system can engage air, surface or shore targets with guns or missiles. It is fully compatible with IPN-10 and interfaces with the Mk 13 Mod 4 missile handling/launching system, the 76 mm gun and the Meroka CIWS. The Mk 92 consists of a combined antenna system, a separate track illuminating radar, a computer system, weapon control consoles, and ancillary equipment, and has a crew of four. The Mk 53 Combined Antenna System (CAS) consists of a monopulse track radar with CW injection above and a track-while-scan radar. Their antennas share a stabilised mount with the monopulse antenna above and the TWS antenna below. The monopulse radar can detect, track and illuminate one target in the air or on the surface. The TWS radar can detect and track up to two surface or shore targets simultaneously, as well as low-altitude targets.

The Signaal STIR is an I/K-band monopulse tracking radar with CW injection which is designed to provide an additional channel of fire for a single air or surface target. It consists of a Mk 54 director with antenna. There are two 32-bit AN/UYK-7 computers, each with 256 k memory and an optimum operating speed of 667 Kops, the second computer having been added to improve the processing of ASW data. There are two Weapons Control Consoles in the CIC to provide an MMI for acquiring and tracking targets, engagement control, launcher assignment, missile firing and post-engagement evaluation. The Mk 106 WCC supports the CAS and the Mk 107 WCC supports the STIR, but both also receive video data from ship search radars. Between the WCCs are the CIWS and Harpoon control stations and the CIC also has five consoles from the AN/UYA-4 family.

Mk 92 Mod 6 fitted in the last two ships is an improved version, which provides earlier detection and longer tracking ranges. The system includes improved clutter and ECCM performance and the track-while-scan element has six air target channels. The prime modification is the replacement of the CAS and STIR



Navarra *(F 85) one of six 'Oliver Hazard Perry' class frigates built in Spain. The Spanish ships are 0.6 m (2 ft) wider than any others in the 'Perry' class to enable additional topweight to be carried. Note the Meroka CIWS on the hangar roof which is also unique to the Spanish ships*

RADARS

	SPS-49(V)5	SPS-55	STIR	Mk 92*	RAN 12L**	VPS-2	1650/9
Ships	All	All	F81-84: one F85-86: two	F 81-84: Mod 2 F 85-86: Mod 6	All	All	Some have SPS-67
Company	Raytheon	Cardion	Lockheed	Unisys	Selenia	Sperry	Raytheon
Role	Air search	Surface search	Fire control	Fire control	Fire control (Meroka)	Fire control (Meroka)	Navigation
Band	C/D (0.5-2 GHz)	I/J (8-20 GHz)	I/J	I/J	D/I	I	I/J
Beam	3.4 × 30° csc²	1.5 × 20°	12 × 1.2°	1.5 × 4.7°	D: 6.6 × 16° plus csc² I: 1.1 × 6 plus csc²	4° conical	
Peak power	360 kW	130 kW	5.5 kW	200 kW	D:1.1 kW I:180 kW	1.4 kW	
Gain	28.5 dB	31 dB	41.5 dB	33.5 dB	D: 22 dB I: 35 dB		
Pulsewidth	125 µs/2 µs	1/12 µs	0.27/1/6 µs	0.22/0.45 µs	D: 2.9 µs I: 1.5/0.15 µs		
PRF	280/800/1,000 pps	750/2,250 pps	25,000-35,000 pps	3,600-1,800 pps	D: 450-550 pps		
Scan rate	6/12 rpm	16 rpm	—	60 rpm	15/30 rpm		
Range	250 n miles (457 km)		60 n miles (110 km)		Fighter: low altitude >20 n miles; medium altitude >14 n miles	sea-skimming missile/aircraft — 2.5 n miles (5 km)	

Notes:
* To be replaced by Signaal STING in due course.
** All are being modified with a combined RAN 12L and RAN 30X fire-control radar for Meroka. The combined system is called RAN 30L/X.

transmitter-receivers with COherent Receiver Transmitters (CORT) which incorporate test sets. A Unisys AN/UYK-44B is added to the computer system to act as a converter control processor; it has a core memory of 256,000 words or a semiconductor memory of 4 million words, together with up to 16 input-output channels.

Manufacturer/Contractor
Unisys Corporation, Government Systems Group.

SONARS

Raytheon AN/SQS-56 hull-mounted sonar
The AN/SQS-56 hull-mounted sonar was originally developed specifically for the 'Oliver Hazard Perry' (FFG 7) class frigates. Digital implementation allows packaging of the complete multifunction active and passive sonar in five medium-size electronics cabinets and one operator's console. System control uses a built-in mini-computer and an advanced display system. The sonar is an active/passive, preformed beam, digital sonar providing panoramic echo ranging and panoramic (DIMUS) passive surveillance. All signal processing, except transducer-received signal amplification and linear transducer transmit drive, is accomplished in digital hardware, most of which is implemented using US Navy SEMP (Standard Electronic Module Programme) components in compact water-cooled cabinets small enough to allow installation through standard size hatches.

The basic system includes the transducer array, transducer junction box, five electronics cabinets (array interface, transmitter(s), receiver and controller), operator console, sonar dome and control unit. Options in production include a loudspeaker/intercom, a water-cooling unit, a remote display and a performance prediction subsystem.

A single operator can search, track, classify and designate multiple targets from the active system while simultaneously maintaining anti-torpedo surveillance on the passive display. Computer-assisted system control permits the operator to concentrate on the sonar data being displayed rather than on the system control. Operating frequencies are 5.6, 7.5 and 8.4 kHz.

Manufacturer/Contractor
Raytheon Company, Submarine Signal Division, Portsmouth, Rhode Island.

AN/SQR-19(V)2
The AN/SQR-19(V)2 towed sonar array is a passive, long-range omnidirectional system for detecting and classifying submarine targets. Its OA-9056/SQR-19 towed array group consists of an array 244 m (800 ft) long and 82 mm (3.2) in diameter, which is towed on a 1 n mile (1.85 km) cable. The array can reach depths of up to 365 m (1,200 ft), but is so designed that it can achieve this without needing a 'fish' to depress it. The other two major subsystems are the Ship-based Electronic Subsystem (SES) and the OK-410/SQR-19 Handling and Stowage Group (H&SG). Early versions of AN/SQR-19 use the AN/UYK-20 Data Processing Set (DPS) but systems produced from FY87 onwards use the AN/UYK-44-based Signal Data Processing Unit (SDPU).

AVIATION

AVIATION FACILITIES

Specifications
Helicopter: 2 Sikorsky S-70L Seahawk (LAMPS III) are carried

Sikorsky S-70L Seahawk (LAMPS III)

Specifications
Dimensions
Main rotor diameter: 16.36 m (53.66 ft)
Tail rotor diameter: 3.35 m (11.00 ft)
Length overall (fuselage): 15.26 m (50.0 ft)
Height to top of rotor head: 3.79 m (12.43 ft)
Weights:
empty: 6,191 kg (13,648 lb)
mission gross weight: 9,182 kg (20,244 lb)

Performance:
dash speed (typical): 126 kts (234 km/h)
vertical rate of climb at sea level: 213 m (700 ft)/min
Power plant: 2 General Electric T700-GE-401C turboshafts rated at 1,417 kW (1,900 shp)
Accommodation: 3 (pilot and airborne tactical officer/back-up pilot in cockpit, sensor operator in specially equipped station in cabin)
Communications: Collins AN/ARC-159(V)2 UHF, Collins AN/ARC-174(V)2 HF, Hazeltine AN/APX-76A(V) and Bendix/King AN/APX-100(V)1 IFF transponders, TSEC/KG-45(E-1) communications security set, TSEC/KY-75 voice security set, Telephonics OK-374/ASC communications system control group
Mission avionics: Sikorsky sonobuoy launcher, Edmac AN/ARR-75 and R-1651/ARA sonobuoy receiving sets (AN/ARR-84 receiver in Block 1 upgrade), Texas Instruments AN/ASQ-81(V)2 towed MAD, Raymond MU-670/ASQ magnetic tape memory unit, Astronautics IO-2177/ASQ altitude indicator, Fairchild AN/ASQ-164 control indicator set, Fairchild AN/ASQ-165 armament control indicator set, IBM AN/UYS-1(V)2 Proteus acoustic processor and CV-3252/A converter display, Control Data AN/AYK-14 (XN-1A) digital computer, Raytheon AN/ALQ-142 ESM, Sierra Research AN/ARQ-44 datalink and telemetry
Armament:
2 Mk 46 torpedoes
2 AGM-119B Penguin 2 Mod 7 anti-shipping missiles
2 Honeywell 50 Advanced Lightweight Torpedoes

PROPULSION

Specifications
System: Gas turbine
Main machinery: 2 General Electric LM-2500 gas turbines; 30.59 MW (41,000 hp) sustained

Shafts: 1
Propeller: cp
Auxiliary motors: 2—1.18 MW (1,600 hp(m)); 1 retractable prop

FURTHER INFORMATION

PROGRAMME

The first three hulls were ordered on 29 June 1977, but there was considerable delay in starting construction due to the priority being given to the *Principe de Asturias* carrier programme. The fourth ship was ordered on 19 June 1986, followed by the fifth and sixth on 26 December 1989. F 85 and F 86 were delayed by a shortage of funds, not being commissioned until 1994 and 1995, respectively. The original plan to build four more has been shelved in favour of the F 100 air defence frigate programme.

DESIGN

The design is based on that of the later 'Perry' class, with the lengthened stern, but in a feature unique to these six Spanish ships, the beam has been increased by 0.6 m (2 ft) to enable them to carry more topweight. Also, as in the later US ships, fin stabilisers are fitted.

The last two ships, *Navarra* (F 85) and *Canarias* (F 86) have the indigenous CONAM combat data system, which increases the national input to 75 per cent. They also have improved fire-control systems.

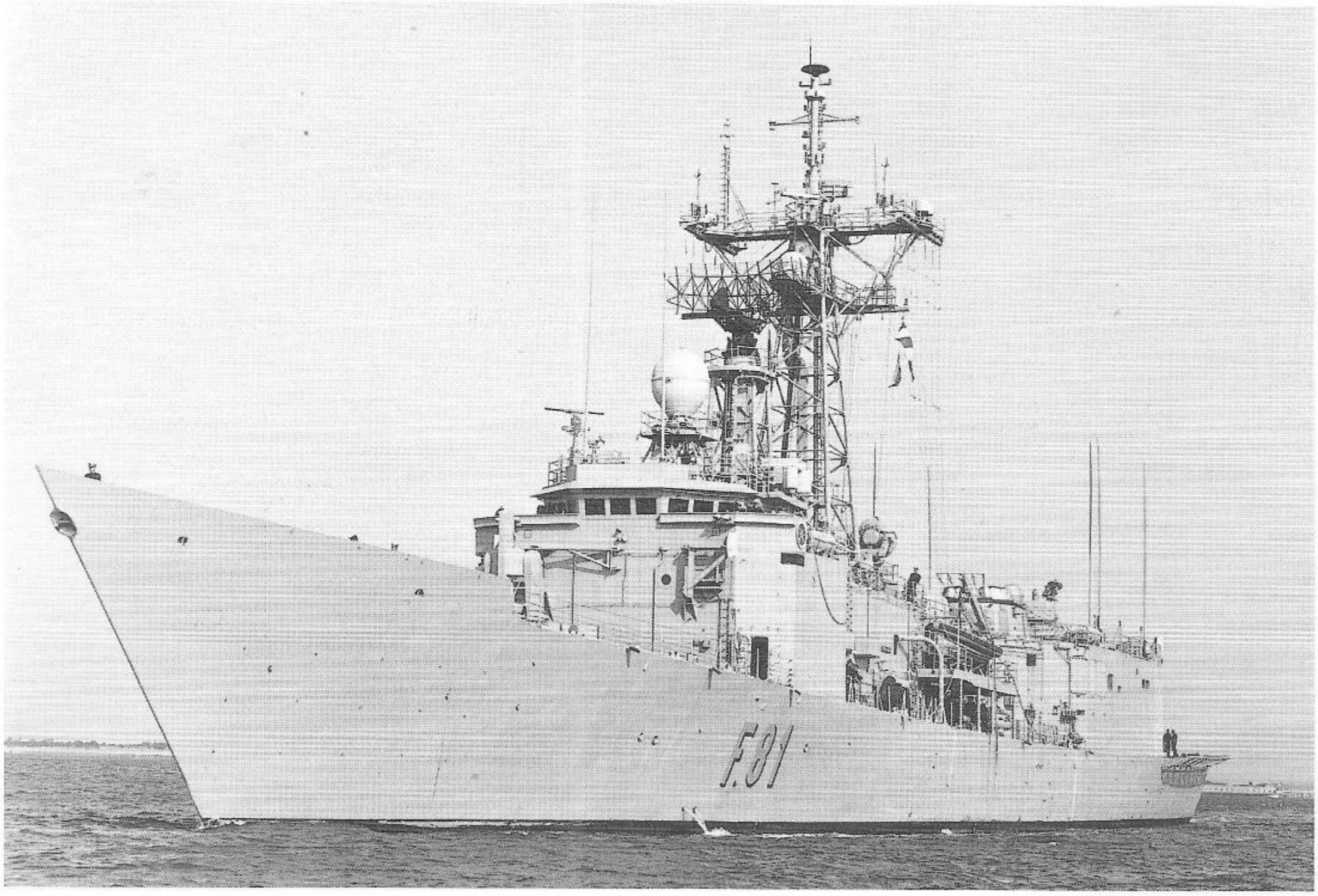
All six ships carry the Spanish Meroka CIWS, with the last two ships mounting the latest Mod 2B version.

MODERNISATION

The new FABA DORNA *(Direccion de tiro Optronica y Radarica Naval)* electro-optic director and fire-control radar, which includes the Signaal STING has been under test since 1995 for the 76 mm gun. All ships are receiving advanced ESM/ECM suites and the Meroka fire-control radars are being upgraded.

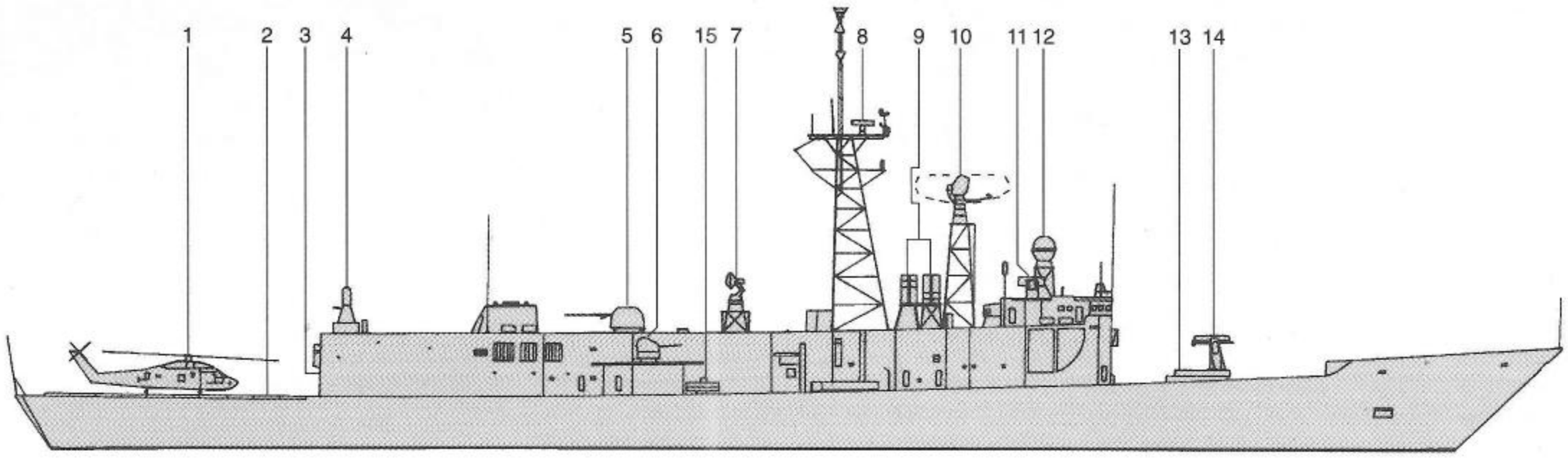
OPERATIONAL

All six ships are based at Rota as the 41st Squadron and on deployment form the escort/ASW element of the Spanish Navy's Group Alfa.



Name ship of the class, Santa Maria *(F 81)* (H & L van Ginderen Collection)

CHENG KUNG



Cheng Kung (Ian Sturton)
1 *Sikorsky S-70C(M) helicopter* **2** *Flight deck* **3** *Hangar* **4** *Mk 15 CIWS* **5** *OTOBREDA 76 mm gun* **6** *Twin Bofors 40 mm* **7** *USN UD 417 STIR* **8** *ISC Cardion AN/SPS-55 surface search radar* **9** *Eight Hsiung Feng II anti-ship missiles* **10** *Raytheon AN/SPS-49(V)5 air search radar* **11** *Chang Feng IV (licence-built AN/SLQ-32(V)2)* **12** *Unisys Mk 92 Mod 6* **13** *Magazine for 40 Standard SM-1MR* **14** *Mk 13 Mod 4 launcher* **15** *Three Mk 32 324 mm torpedo tubes*

GENERAL SPECIFICATIONS

Operator: Taiwan

Class: 'CHENG KUNG' (KWANG HUA PROJECT) (FLIGHT I) (FFG)

Active: 5
Building: 2

Displacement:
light: 2,750 t
full load: 4,105 t

Dimensions
Length: 138.1 m (453 ft)
Beam: 13.7 m (45 ft)

Draught: 4.5 m (14.8 ft) (hull); 7.5 m (24.5 ft) (sonar)

Speed: 29 kts
Range: 4,500 n miles at 20 kts

Complement: 234 (15 officers) including 19 aircrew

SHIPS

CHENG KUNG (1101)
Builder China SB Corporation, Kaohsiung, Taiwan
Laid down 7 Jan 1990
Launched 5 Oct 1991
Commissioned 7 May 1993

CHENG HO (1103)
Builder China SB Corporation, Kaohsiung, Taiwan
Laid down 21 Dec 1990
Launched 15 Oct 1992
Commissioned 28 Mar 1994

CHI KUANG (1105)
Builder China SB Corporation, Kaohsiung, Taiwan
Laid down 4 Oct 1991
Launched 27 Sep 1993
Commissioned Mar 1995

YUEH FEI (1106)
Builder China SB Corporation, Kaohsiung, Taiwan
Laid down 5 Sep 1992
Launched 26 Aug 1994
Commissioned Feb 1996

TZU-I (1107)
Builder China SB Corporation, Kaohsiung, Taiwan
Laid down 7 Aug 1994
Launched Jul 1995
Commissioned Jan 1997

Chi Kuang *(1105) departs Simon's Town in June 1996 at the end of a visit to South Africa. Note the launch canisters for the Hsiung Feng II missiles immediately before the mast. Using such launchers frees the main magazine to accommodate its full load of 40 Standard SM-1MR SAMs* (H & L van Ginderen Collection)

PAN CHAO (1108)
Builder China SB Corporation, Kaohsiung, Taiwan
Laid down Jan 1995
Launched Dec 1995
Commissioned Dec 1997

CHANG CHIEN (1109)
Builder China SB Corporation, Kaohsiung, Taiwan
Laid down Dec 1995
Launched Nov 1996
Commissioned Nov 1998

WEAPONS SYSTEMS

MISSILE LAUNCHER

Mk 13 Mod 4 launcher

There is a single Mk 13 Mod 4 launcher located on the foredeck, but since the Hsiung Feng II ASMs have their own launch canisters the Mk 13 launcher and the associated magazine are devoted entirely to Standard SM-1MR SAMs. There are 40 missiles stored vertically in a below-decks magazine in two concentric rings. Launching rate is one missile every 10 seconds.

ANTI-SHIP MISSILES (ASM)

Hsiung Feng II short/medium-range anti-ship missile

There are two quad launchers for Hsiung Feng II short-range anti-ship missiles, which are derived from the Israeli Gabriel, and are powered by a turbojet cruise engine with rocket boosters for take-off. The fire-control system is similar to that used in Gabriel with a radar tracker, a display control and processing unit, a vertical reference unit and an optical sight which is usually the Kollmorgen Mk 35 or Model 985. The launcher-containers are also identical to those used in Gabriel and are generally similar to the Harpoon's Mk 141.

The launcher operation is likely to follow that of most conventional medium-range anti-ship missiles with the target acquired by long-range surface search radars with over-the-horizon targeting facilities through a Ta Chen datalink. The launcher and target locations are inserted into the inertial guidance system, the missile is launched and adopts a low-level cruising altitude. The target is acquired by both the radar and the IR sensors and the returns are compared with an onboard library. If significant deviations in one sensor's returns occur then the guidance system assumes it is being jammed and gives priority to the other as the missile enters the sea-skimming terminal phase.

Specifications

Hsiung Feng II
Length: 3.9 m (12.8 ft)
Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)
Weight: 540 kg (1,190 lb)
Speed: Mach 0.85
Range: 32 n miles (60 km)
Guidance: Semi-active radar, manual or IR homing
Warhead: 150 kg (330 lb) HE
Engine: Microturbo TRI-60 single spool turbojet

SURFACE-TO-AIR MISSILES (SAM)

Standard Missile-1 Medium Range (SM-1MR)

Main air defence armament is the SM-1MR which is launched from the Mk 13 Mod 4 launcher on the foredeck. All 40 rounds in the magazine are SM-1MR Block IV missiles and have a Naval Weapons Center Mk 51 expanding rod warhead.

Specifications

Length: 4.48 m (14.7 ft)
Diameter: 34.3 cm (13.5 in)
Wing span: 1.06 m (3.48 ft)
Weight: 642.3 kg (1,416 lb)
Speed: Mach 2
Range: 20.5 n miles (38 km)
Altitude: 19,800 m (65,000 ft)

Manufacturers/Contractors

Hughes Missile Systems, Tucson, Arizona, USA.
Raytheon, Missile Systems Division, Bedford, Maryland, USA.

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited amidships, one set on either beam.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

Manufacturer/Contractor

GEC-Marconi Naval Systems, UK.

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications

Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Mk 75 Compact

There is one OTOBREDA 76 mm (3 in) gun sited amidships atop the superstructure.

Specifications

Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range: 8.6 n miles (16 km)

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

Bofors 40 mm/70

All have two single Bofors 40 mm mountings, which are on small platform decks immediately below the 76 mm mounting.

Specifications

Traverse: 360° (nominal) at 90°/s
Elevation: −3 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Type 75 20 mm

Three of these weapons are mounted on the hangar roof. The Type 75 is a Taiwanese-produced weapon, which combines a Pontiac M39E 20 mm aircraft cannon with a locally produced mount. The M39E was developed from the German Second World War Mauser MG213C revolver cannon and is the weapon installed in the Northrop F-5E fighter aircraft operated by the RoC Air Force. This has, apparently, been modified for use as a naval close in weapons system (CIWS), and fires 1,600 rds/min with a muzzle velocity of 870 m/s (2,850 ft/s).

M2HB 12.7 mm (0.50 in) machine guns

All ships carry up to six M2HB 12.7 mm machine guns, which can be mounted on the ship's rails on flexible mounts.

Specifications

Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rds/min
Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-air: 1,380 m (4,500 ft)

Hughes Mk 15 CIWS Phalanx

There is one Hughes Mk 15 CIWS Phalanx close in weapons system (CIWS) situated at the after end of the hangar roof. The mount consists of a 20 mm, six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

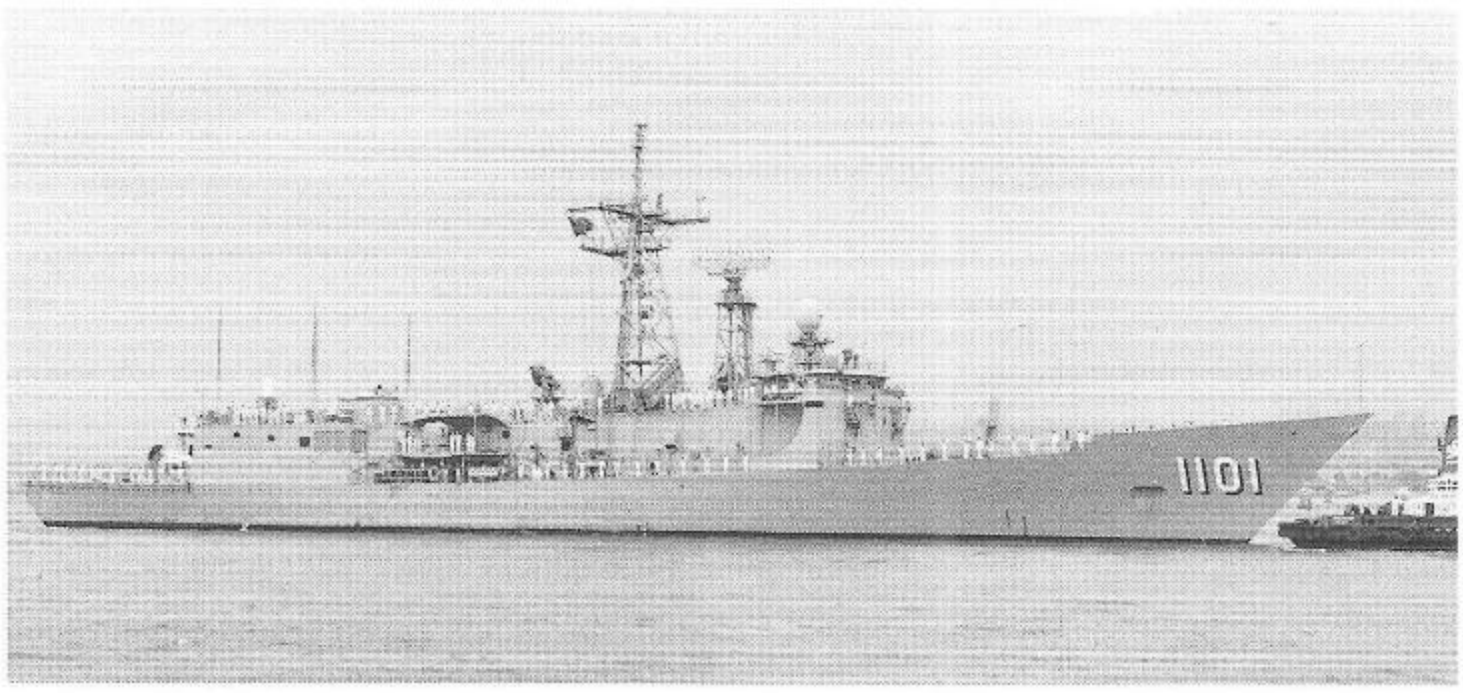
Specifications

Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min (Block 0, Block 1 Baseline 0), 4,500 rds/min (Block 1 Baseline 1)
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA (system).



Cheng Kung *(1101)* (H & L van Ginderen Collection)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Chang Feng IV (AN/SLQ-32(V)5) ESM/ ECM suite

An order was placed with the Hughes Company to deliver eight AN/SLQ-32(V)5 systems to the US Navy and one to Taiwan, an order which was eventually taken over and completed by Raytheon. AN/SLQ-35(V)5 is now produced in Taiwan as the Chang Feng IV system.

The ESM component gives radar warning on B to J-bands, while the additional Sidekick ECM element provides active onboard countermeasures, employing a high-gain, multibeam antenna system and with full ECM techniques repertoire for both ship defence and counter-targeting roles. Sidekick can counter simultaneous threats from any azimuth angle.

Manufacturer/Contractor

Raytheon Company, Electromagnetic Systems Division, Goleta, California.

Prairie Masker noise suppression systems

The ships are fitted with Prairie Masker radiated noise suppression systems in which air is passed down the propeller shaft and ejected from a groove in the leading edge of the blade, thus delaying the onset of cavitation.

DECOYS

Kung Fen 6 chaff launchers

These ships carry four Kung Fen 6, locally produced copies of the Hycor RBOC (Rapid-Blooming-Chaff system), which was used in the US Navy as the Mk 33/34, prior to the entry into service of the Mk 36 (5.1 in) SRBOC system. Each unit comprises six fixed (4.4 in) launch tubes, which are mounted in pairs at angles of 55°, 65°, and 75°. Rounds for the system include a chaff cartridge, a chaff decoy, an IR decoy, and a combined chaff/IR decoy.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

AN/SYS-2(V)2 data fusion system

AN/SYS-2(V)2 is fitted in all ships in the class. The role of the SYS-2(V)2 IADT (Integrated Automatic Detection and Tracking system) is to increase the number of air and surface targets which may be detected and tracked in all types of electronic environments. The system accepts contacts from each radar, seeks potential targets, correlates the data by comparing all the sensors' returns and then produces a single file of valid tracks, while avoiding duplication. The different radar characteristics provide an overlapping volume of coverage in a variety of clutter and ECM environments which may be monitored to obtain the best possible search coverage. The data is then fed to the ship's command and weapon control systems, and accepts inputs from fire-control radars.

Each system consists of two 16-bit Paramax AN/UYK-44 computers and two display consoles. In later systems 32-bit digital microprocessors are added to improve sensor data fusion. Supplementary processors are the Motorola 68020, the INMOS Transputer (801/5) and the Intel i860 RISC. The UYK-44 uses Ultra-16 Assembly language and Ada is planned for SYS-2. The transputer uses OCCAM software language. In most systems one computer is used to interface with the sensors and the inertial navigation system while the other supports the display consoles and interfaces with the combat direction system, and fire/weapon control systems.

In SYS-2 (V)2 one computer supports the AN/SPS-49 radar which acts as the long-range tracker while the second interfaces with the Mk 92 fire-control system and, through the preprocessor, with the AN/SPS-55 radar which acts as the medium-range tracker.

Manufacturer/Contractor

Norden Systems, Melville, New York, USA.

Ta Chen

The Ta Chen is a datalink used in targeting for the Hsiung Feng missile system. It is being installed in *Chi Kuang* onwards and is being back-fitted into the first two ships.

WEAPONS CONTROL

UniSys Mk 92 Mod 6 fire-control system

All the Taiwanese ships have the Mk 92 Mod 6 fire-control system with CORT. This is the latest version of the system, which provides earlier detection and longer tracking ranges. The system includes improved clutter and ECCM performance and the track-while-scan element has six air target channels. The prime modification is the replacement of the CAS and STIR transmitter-receivers with COherent Receiver Transmitters (CORT) which incorporate test sets. A Unisys AN/UYK-44B is added to the computer system to act as a converter control processor; it has a core memory of 256,000 words or a semiconductor memory of 4 million words, together with up to 16 input-output channels.

Manufacturer/Contractor

Unisys Corporation, Government Systems Group, USA.

Weapon Direction System Mk 13 Mod 4 target designation system

'Perry' class frigates are fitted with WDS Mk 13 Mod 2. In these ships the NTDS evaluates search radar data on the display system, tracks targets, evaluates them, and then indicates hostile targets and assigns their engagement to the WDS. The WDS then evaluates target engageability, assigns priorities and transmits this data to the missile fire-control system, while retaining responsibility for weapon assignment, loading orders and firing. Having launched the missile, the system conducts in-flight monitoring and control, and finally carries out post-firing evaluation of the engagement. The WDS monitors data flow between the NTDS computer, the fire-control and the launching systems. Depending upon the tactical situation and computer recommendations, operators can also control both the fire-control and the launching systems and then fire missiles. The Mk 13 has a two-operator position weapon control panel group and features target scheduling. This allows the computer to provide operators with a recommended or automatically scheduled target engagement order thus simplifying the fire-control and launching system assignment orders. In the Mk 13 Mod 2 system, used in the 'Oliver Hazard Perry' (FFG 7) class frigates, there are no launch system consoles. Both use a pair of Mk 152 Mod 7 computers which each support a Mk 72 signal data converter, both computers interfacing with a single Mk 95 input-output console.

Manufacturer/Contractor

Vitro Corporation, USA.

Mk 114 ASW

It is reported that these ships are fitted with the Mk 114 ASW weapon direction system, which is normally associated with the ASROC ASW missile, which is not carried. If the reports are correct, then the system will presumably be used only with the 'over-the-side' Mk 32 torpedo launch system.,

Mk 24 Target Designation Transmitter (TDT)

There are two Mk 24 TDTs. These comprise a pair of binoculars on a pedestal, which are manually trained and then pass target bearing and elevation information to the combat system.

Mk 309 Mod 1 anti-submarine fire-control system

Officially designated Control Panel Mk 309, this compact anti-submarine fire-control system was developed in the late 1960s and combines basic displays with the capabilities needed to direct anti-submarine operations involving tube-launched torpedoes. The bulkhead-mounted panel combines the functions of a target bearing and range indicator, a repeater of 'own ship' heading, a torpedo presetter and a firing panel. It also displays attack recommendations, defining the direction of the torpedo track and the firing range most suitable for a given tactical situation, as well as generating course-to-steer orders for transmission to remote indicating equipment. Where interlocks are required they are related only to basic safety requirements. The panel does not have a computer but uses a memory based upon a series of shore-developed simulations incorporating the experience of 40,000 torpedo attack exercises, which have been analysed to produce a range of attack solutions for both ship and weapons. During an attack, data is fed to the panel from the gyrocompass and the hull-mounted sonar (range and bearing) and the data is then compared with the attack solutions in the memory to find the appropriate one. The Mk 309 recommends which courses to steer for interception then launching the torpedoes. It also indicates the minimum and maximum ranges at which the torpedo should be launched, based upon the tubes being at a 45° angle, and which angle-on-bow approach should be taken. It will also indicate when the ship should turn to unmask the launchers.

Chi Kuang *(1105)* (H & L van Ginderen Collection)

RADARS

	SPS-49(V)5	SPS-55	STIR*	Mk 92 Mod 6
Company	Raytheon	Cardion	Lockheed	Unisys
Role	Air search	Surface search	Fire control	Fire control
Band	C/D (0.5-2 GHz)	I/J (8-20 GHz)	I/J	I/J
Beam	3.4 × 30° csc²	1.5 × 20°	12 × 1.2°	1.5 × 4.7°
Peak power	360 kW	130 kW	5.5 kW	200 kW
Gain	28.5 dB	31 dB	41.5 dB	33.5 dB
Pulsewidth	125 µs/2 µs	1/12 µs	0.27/1/6 µs	0.22/0.45 µs
PRF	280/800/1,000 pps	750/2,250 pps	25,000-35,000 pps	3,600-1,800 pps
Scan rate	6/12 rpm	16 rpm	—	60 rpm
Range	250 n miles (457 km)		60 n miles (110 km)	

Note:
* In these ships the STIR radar uses the US Navy UD 417 antenna group.

SONARS

Raytheon AN/SQS-56 hull-mounted sonar

The AN/SQS-56 hull-mounted sonar was originally developed specifically for the 'Oliver Hazard Perry' (FFG 7) class frigates. Digital implementation allows packaging of the complete multifunction active and passive sonar in five medium-size electronics cabinets and one operator's console. System control uses a built-in mini-computer and an advanced display system. The sonar is an active/passive, preformed beam, digital sonar providing panoramic echo ranging and panoramic (DIMUS) passive surveillance. All signal processing, except transducer-received signal amplification and linear transducer transmit drive, is accomplished in digital hardware, most of which is implemented using US Navy SEMP (Standard Electronic Module Programme) components in compact water-cooled cabinets small enough to allow installation through standard-size hatches.

The basic system includes the transducer array, transducer junction box, five electronics cabinets (array interface, transmitter(s), receiver and controller), operator console, sonar dome and control unit. Options in production include a loudspeaker/intercom, a water-cooling unit, a remote display and a performance prediction subsystem.

A single operator can search, track, classify and designate multiple targets from the active system while simultaneously maintaining anti-torpedo surveillance on the passive display. Computer-assisted system control permits the operator to concentrate on the sonar data being displayed rather than on the system control. Operating frequencies are 5.6, 7.5 and 8.4 kHz.

Manufacturer/Contractor

Raytheon Company, Submarine Signal Division, Portsmouth, Rhode Island.

ATAS active towed array sonar

BAe/Thomson ATAS is installed in the third (*Chi Kuang* (1105)) and subsequent ships, with the first two only having AN/SQR-18A(V)2. ATAS comprises a high-power, low-frequency transmitter, operating in three frequencies around the 3 kHz band, which can be deployed at up to 900 m (2,953 ft) behind the towing platform, together with an in-line receiver array towed a further 300 m (984 ft) behind the transmitter, all of which may be towed at depths suited to prevailing oceanographic conditions. The port/starboard ambiguity normally associated with a towed array is automatically and instantaneously resolved within the system without the need for ship manoeuvre. ATAS can be operated at depths of 235 m (771 ft). The transmitter has a high-power acoustic sound source consisting of a vertical stave of 10 in low-frequency flextensional transducers. Transmissions in CW or FM are omnidirectional in the horizontal plane with a vertical beamwidth of 25°. The receiver array is a 30 m (98.4 ft) long flexible tube housing a line of hydrophones and associated electronics to condition and digitise hydrophone signals. The receiver gives full azimuth cover and in the broadside direction a bearing resolution of up to 0.5°. The receiver uses 96 preformed beams with bearing stabilisation. The processing equipment uses current technology to provide high processing capability within a single compact unit.

Manufacturers/Contractors

BAeSEMA Marine Division, Bristol, UK.
Thomson Sintra Activités Sous-Marines, Sophia Antipolis Cedex, France.

AVIATION

AVIATION FACILITIES

Specifications

Helicopters: 2 Sikorsky S-70C(M) (only 1 to be embarked).

Sikorsky S-70C(M)

Specifications

SH-70C(M)
Dimensions
Main rotor diameter: 16.36 m (53.66 ft)
Tail rotor diameter: 3.35 m (11.00 ft)
Length overall:
fuselage: 15.26 m (50.0 ft)
rotors turning: 19.76 m (64.83 ft)
Height to top of rotor head: 3.79 m (12.43 ft)
Weights:
empty: 6,191 kg (13,648 lb)
mission gross weight: 9,182 kg (20,244 lb)
Performance:
cruising speed at sea level: 147 kts (272 km/h)
dash speed at 1,525 m (5,000 ft): 126 kts (234 km/h)
vertical rate of climb at sea level: 213 m (700 ft)/min
Power plant: 2 General Electric T700-GE-401C turboshafts rated at 1,417 kW (1,900 shp)
Accommodation: 3 (pilot, airborne tactical officer/back-up pilot, sensor operator)
Communications: Collins AN/ARC-159(V)2 UHF, Collins AN/ARC-174(V)2 HF, Hazeltine AN/APX-76A(V) and Bendix/King AN/APX-100(V)1 IFF transponders, TSEC/KG-45(E-1) communications security set, TSEC/KY-75 voice security set, Telephonics OK-374/ASC communications system control group.
Radar: Telephonics AN/APS-128PC
Flight: Collins AN/ARN-118(V) Tacan, Teledyne Ryan AN/APN-127 Doppler, Collins AN/ARA-50 UHF DF, Honeywell AN/APN-194(V) radar altimeter
Mission: Sikorsky sonobuoy launcher, Edmac AN/ARR-75 and R-1651/ARA sonobuoy receiving sets; Control Data AN/AYK-14 (XN-1A) digital computer, Sierra Research AN/ARQ-44 datalink and telemetry; Bendix AN/AQS-18(V) dipping sonar; Bendix AN/AQS-18(V) dipping sonar and Litton AN/ALR-606(V)-2 ESM integrated with radar antenna
Armament: 2 Mk 46 torpedoes

PROPULSION

Specifications

System: Gas turbine
Main machinery: 2 General Electric LM-2500 gas turbines; 30.59 MW (41,000 hp) sustained
Shafts: 1
Propeller: cp
Auxiliary propulsion: 2 retractable propulsors; 650 hp (484 kW)

FURTHER INFORMATION

PROGRAMME

The first two were ordered on 8 May 1989. The first seven of the class are designated Flight I; for Flight II see next entry.

NAMES

The ships are named after generals, admirals and warriors of ancient China. Admiral Cheng Ho, for example, was a famous navigator and his discovery of the Spratlys is used as part of the basis for the Chinese claim to the islands.

DESIGN

These ships are generally similar to USS *Ingraham*, the last of the 'Perry' class to be built in the USA. The ships do, however, have a number of Taiwanese weapons and electronics systems.

The use of containerised anti-ship missiles has freed the missile magazine to take a full load (40) of SM-1MR SAMs, although the area between the mast had to be strengthened to take the Hsiung Feng II missiles, which may have had an adverse effect on topweight.

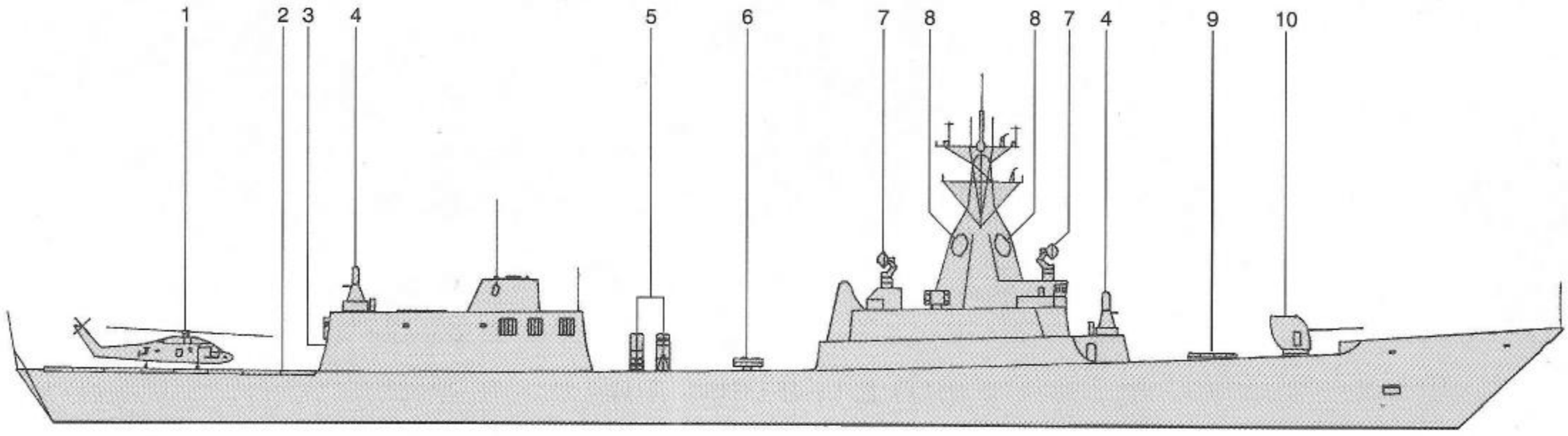
The two single 40 mm Bofors are unique to the Taiwanese ships, and it should be noted that the existing platform deck has had to be extended to take the port mounting, while a completely new platform deck has had to be built on the starboard side. In addition there are the three Type 75 20 mm cannon on the hangar roof. These, added to the Mk 15 Phalanx CIWS and OTOBREDA 76 mm, make these the most heavily armed 'Perry' class frigates, although they must add yet more to the topweight problem.

DEPLOYMENT

Cheng Kung joined the 124th Attack Squadron on 15 January 1994 and the remainder are following as they complete operational work ups.

Chi Kuang *(1105). Note the Bofors 40 mm on its special platform deck amidships* (H & L van Ginderen Collection)

TIEN TAN



Tien Tan (Ian Sturton)
1 *Sikorsky S-70C(M)1 helicopter* **2** *Flight deck* **3** *Hangar* **4** *Mk 15 CIWS* **5** *Eight Hsiung Feng II anti-ship missiles* **6** *Three Mk 32 324 mm torpedo tubes* **7** *USN UD 417 STIR* **8** *Martin Marietta ADAR-2N air search radar* **9** *Mk 41 VLS; 48 Standard SM2 SAM* **10** *United Defense 127 mm/54 Mk 45*

GENERAL SPECIFICATIONS

Operator: Taiwan

Class: TIEN TAN (PFG-2) (KWANG HUA PROJECT) (FLIGHT II) (FFG)

Proposed: 3

Displacement:
full load: 4,300 t

Dimensions
Length: 143.3 m (470 ft)
Beam: 13.7 m (45 ft)

Draught: 13.7 m (14.8 ft) (hull); 7.5 m (24.5 ft) (sonar)

Speed: 29 kts

Complement: 240

SHIPS

TIEN TAN (1110)

Builder	China SB Corporation, Kaohsiung, Taiwan
Laid down	Nov 1996
Launched	Oct 1997
Commissioned	Jan 2001

WEAPONS SYSTEMS

MISSILE LAUNCHER

Mk 41 VLS
There will be one Mk 41 VLS in the foredeck and consideration is being given to a second unit in the space currently occupied by the starboard hangar.

SURFACE-TO-SURFACE MISSILES (SSM)

Hsiung Feng II
Two quad launchers will be mounted in the superstructure break.

SURFACE-TO-AIR MISSILES (SAM)

Standard SM-2
There will be 48 SM-2s in the forward Mk 41 VLS.

Sea Sparrow/Tien Chung II
The after Mk 41 VLS would be used to house either Sea Sparrow, Enhanced Sea Sparrow or Tien Chung II missiles.

TORPEDOES

Torpedo armament will remain as now, with two 324 mm Mk 32 triple launchers and Alliant Techsystems Mk 46 Mod 5 torpedoes.

GUNS

FMC 127 mm/54 Mk 45 Mod 2
Following the trend for larger calibre naval guns, these ships will mount a 127 mm gun in place of the earlier 76 mm weapon.

20 mm/76 6-barrelled Phalanx Mk 15 Mod 1
The current ships have just one Phalanx on the hangar roof aft. In the new ships there will be a second mount forward of the bridge screen on a new platform.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

The ADAR-2N will require a new and much more sophisticated command system, which will be provided by the Unisys CSIST.

RADARS

The most important change in the new ships will be the installation of a four-faced, phased array radar. This will not be the SPY-1 of the US Navy's Aegis system, but will be the ADAR-2N, which is being developed in co-operation with Lockheed Martin, the company that developed Aegis. Lockheed Martin also worked on FARS (Frigate Array Radar System), a D/E-band radar whose individual arrays would have an area some 25 per cent smaller than that of the SPY-1 panels. The system is being dubbed a 'mini-Aegis' and Taiwanese electronic ingenuity will doubtless ensure that its performance is as near as possible to that of the original Aegis. The system will be able to track 300 targets simultaneously and carry out 16 concurrent engagements. There will also be a second STIR.

AVIATION

AVIATION FACILITIES

If the plan to use the starboard hangar to accommodate Mk 41 VLS comes to fruition, then only one helicopter, the Sikorsky S-70C(M)1 will be accommodated.

PROPULSION

Specifications
System: Gas turbine
Main machinery: 2 GE LM 2500 gas turbines; 30.59 MW (41,000 hp) sustained (see 'Further Information' below)
Shafts: 2
Propeller: cp
Auxiliary propulsion: 2 retractable units

FURTHER INFORMATION

PROGRAMME

Flight II of the 'PFG-2' class project has been delayed by six months. The plan is to build only one of the class and then go on to Flight III with the emphasis on fleet area air defence.

DESIGN

A number of design and equipment options have not yet been finalised and the details listed could change.

Modifications to Flight I include inserting a 17 ft plug in the hull, immediately forward of the bridge. This would enable a 157 mm gun to be mounted in 'A' position, the Mk 13 launcher and the 40-round magazine to be removed and replaced by a 48-cell Mk 41 vertical launch system (VLS), and a second Phalanx (or alternative CIWS) added on a step forward of the bridge.

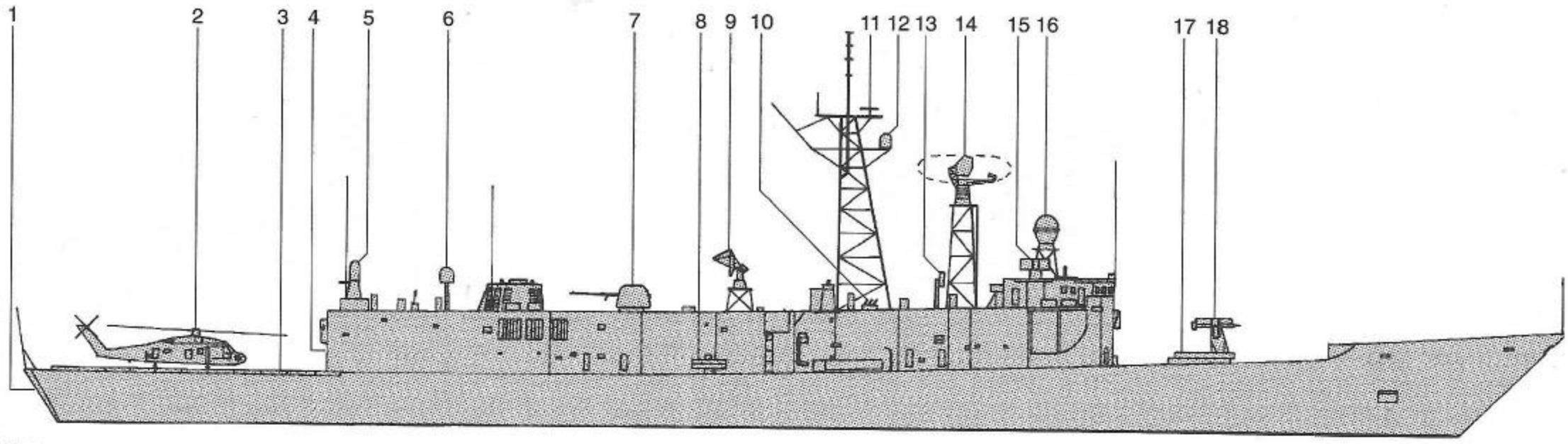
Another element in the plan is to replace the starboard hangar by four Mk 41 VLS, each of which would be subdivided into four, each quarter housing one Lockheed Martin Sea Sparrow quad-pack.

The superstructure will be cut down amidships and the CIC moved from the superstructure down into the hull. A back-up CIC would be located aft, well away from the main CIC, as a survivability measure.

A phased array radar system similar to the SPY-1 will be fitted. Two STIRs provide target illumination. In the break in the superstructure amidships, eight Hsiung Feng II launchers are fitted with options for either Bofors guns or ASW missiles.

The hull will be longer and the displacement greater. It is, therefore, highly probable that the opportunity will be taken to modify the propulsion system, possibly by adding two more gas turbines in a COGOG arrangement, and adding a second shaft. In such a situation there would seem to be little need for the two auxiliary 'get-you-home' propulsors.

OLIVER HAZARD PERRY



'Oliver Hazard Perry' class (Ian Sturton)
1 *Angled transom* **2** *SH-60B LAMPS III helicopter* **3** *Flight deck* **4** *Twin hangars* **5** *Mk 15 CIWS* **6** *Satcom antenna* **7** *76 mm OTOBREDA Mk 75 gun* **8** *Triple Mk 32 324 mm torpedo tubes* **9** *Lockheed STIR fire control* **10** *Loral Hycor SRBOC launcher* **11** *ISC Cardion AN/SPS-55 surface search* **12** *ECM antenna* **13** *AN/WSC-3 Satcom antenna* **14** *Raytheon AN/SPS-49(V)5* **15** *AN/SLQ-32(V)2 ESM array* **16** *Sperry Mk 92 (Signaal WM 28) fire control* **17** *Magazine: 4 Harpoon; 36 SM-1M* **18** *Mk 13 Mod 4 launcher*

GENERAL SPECIFICATIONS

Operator: United States of America

Class: OLIVER HAZARD PERRY (FFG)

Built: 51
Active: 45

Displacement:
light: 2,750 t
full load:
FFG 7, 8, 15, 28, 29, 32, 36-61: 4,100 t
others: 3,638 t

Dimensions
Length:
FFG 7, 8, 15, 28, 29, 32, 36-61: 138.1 m (453 ft)
others: 135.6 m (445 ft)
Beam: 13.7 m (45 ft)

Draught: 4.5 m (14.8 ft) (hull); 7.5 m (24.5 ft) (sonar)

Speed: 29 kts
Range: 4,500 n miles at 20 kts

Complement: 206 (13 officers) including 19 aircrew

SHIPS

* denotes 'long hull' ships

OLIVER HAZARD PERRY (FFG 7)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 12 June 1975
Launched 25 Sep 1976
Commissioned 17 Dec 1977

McINERNEY (FFG 8)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 7 Nov 1977
Launched 4 Nov 1978
Commissioned 19 Nov 1979

WADSWORTH (FFG 9)
Builder Todd Shipyards, San Pedro, California, USA
Laid down 13 Jul 1977
Launched 29 Jul 1978
Commissioned 28 Feb 1980

CLARK (FFG 11)
Builder Bath Iron Works, Bath, Maine, USA
Laid down 17 Jul 1978
Launched 24 Mar 1979
Commissioned 9 May 1980

GEORGE PHILIP (FFG 12)
Builder Todd Shipyards, San Pedro, California, USA
Laid down 14 Dec 1977
Launched 16 Dec 1978
Commissioned 10 Oct 1980

SAMUEL ELIOT MORISON (FFG 13)
Builder Bath Iron Works, Bath, Maine, USA
Laid down 4 Dec 1978
Launched 14 Jul 1979
Commissioned 11 Oct 1980

JOHN H SIDES (FFG 14)
Builder Todd Shipyards, San Pedro, California, USA
Laid down 7 Aug 1978
Launched 19 May 1979
Commissioned 30 May 1981

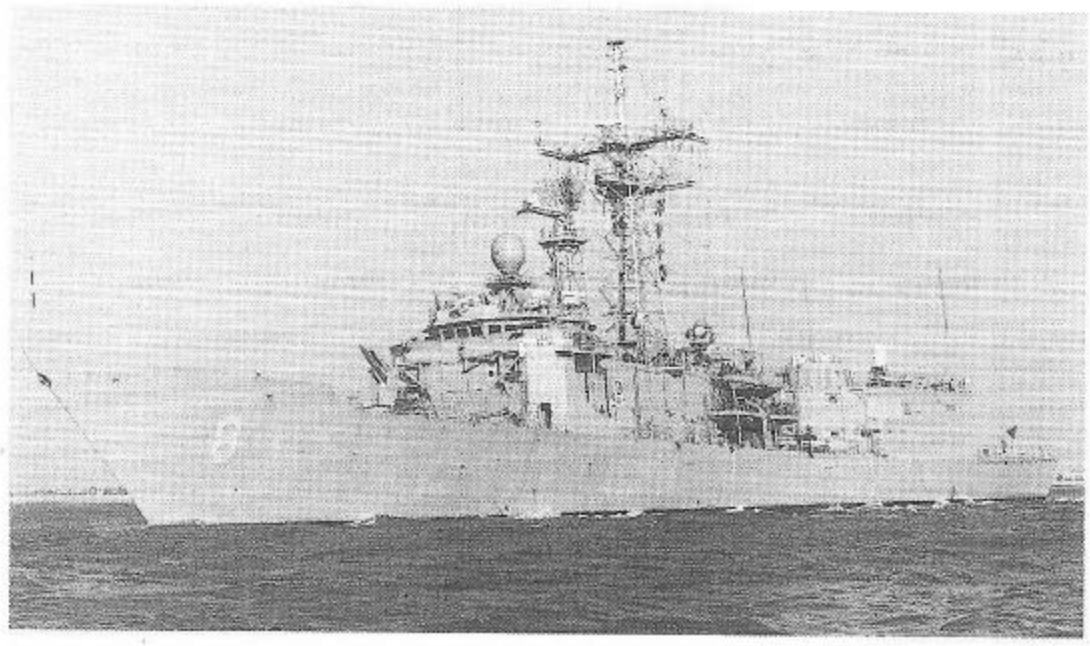
ESTOCIN (FFG 15) *
Builder Bath Iron Works, Bath, Maine, USA
Laid down 2 Apr 1979
Launched 3 Nov 1979
Commissioned 10 Jan 1981

JOHN A MOORE (FFG 19)
Builder Todd Shipyards, San Pedro, California, USA
Laid down 19 Dec 1978
Launched 20 Oct 1979
Commissioned 14 Nov 1981

FAHRION (FFG 22)
Builder Todd Shipyards, Seattle, Washington, USA
Laid down 1 Dec 1978
Launched 24 Aug 1979
Commissioned 16 Jan 1982

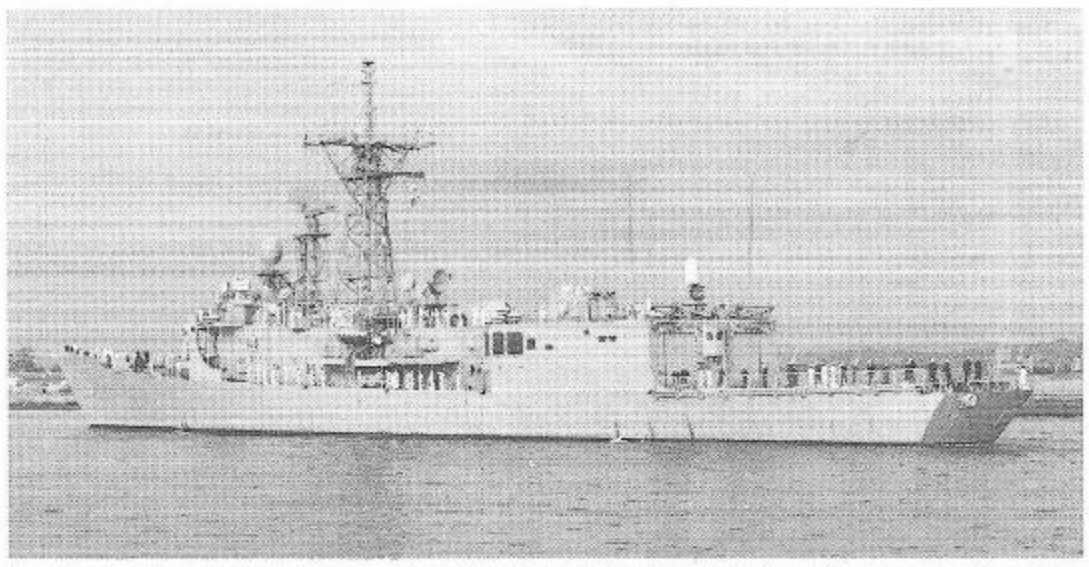
LEWIS B PULLER (FFG 23)
Builder Todd Shipyards, San Pedro, California, USA
Laid down 23 May 1979
Launched 15 Mar 1980
Commissioned 17 Apr 1982

COPELAND (FFG 25)
Builder Todd Shipyards, San Pedro, California, USA
Laid down 24 Oct 1979

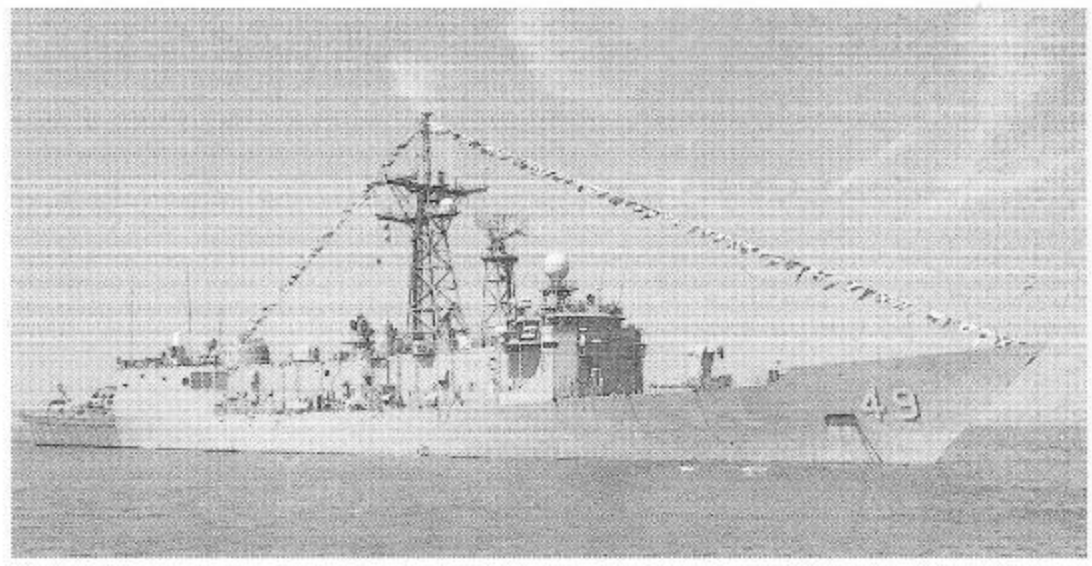


McInerney *(FFG 8)* (H & L Van Ginderen Collection)

John A Moore *(FFG 19)* (H & L Van Ginderen Collection)



Underwood *(FFG 36)* (H & L Van Ginderen Collection)



Robert G Bradley *(FFG 49)* (H & L Van Ginderen Collection)

Launched 26 Jul 1980
Commissioned 7 Aug 1982

MAHLON S TISDALE (FFG 27)
Builder Todd Shipyards, San Pedro, California, USA
Laid down 19 Mar 1980
Launched 7 Feb 1981
Commissioned 27 Nov 1982

BOONE (FFG 28)*
Builder Todd Shipyards, Seattle, Washington, USA
Laid down 27 Mar 1979
Launched 16 Jan 1980
Commissioned 15 May 1982

STEPHEN W GROVES (FFG 29)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 16 Sep 1980
Launched 4 Apr 1981
Commissioned 17 Apr 1982

REID (FFG 30)
Builder Todd Shipyards, San Pedro, California, USA
Laid down 8 Oct 1980
Launched 27 Jun 1981
Commissioned 19 Feb 1983

STARK (FFG 31)
Builder Todd Shipyards, Seattle, Washington, USA
Laid down 24 Aug 1979
Launched 30 May 1980
Commissioned 23 Oct 1982

JOHN L HALL (FFG 32)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 5 Jan 1981
Launched 24 Jul 1981
Commissioned 26 Jun 1982

JARRETT (FFG 33)
Builder Todd Shipyards, San Pedro, California, USA
Laid down 11 Feb 1981
Launched 17 Oct 1981
Commissioned 2 Jul 1983

AUBREY FITCH (FFG 34)
Builder Bath Iron Works, Bath, Maine, USA
Laid down 10 Apr 1981
Launched 17 Oct 1981
Commissioned 9 Oct 1982

UNDERWOOD (FFG 36)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 3 Aug 1981
Launched 6 Feb 1982
Commissioned 29 Jan 1983

CROMMELIN (FFG 37)*
Builder Todd Shipyards, Seattle, Washington, USA
Laid down 30 May 1980
Launched 1 Jul 1981
Commissioned 18 Jun 1983

CURTS (FFG 38)*
Builder Todd Shipyards, San Pedro, California, USA
Laid down 1 Jul 1981
Launched 6 Mar 1982
Commissioned 8 Oct 1983

DOYLE (FFG 39)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 16 Nov 1981
Launched 22 May 1982
Commissioned 21 May 1983

HALYBURTON (FFG 40)*
Builder Todd Shipyards, Seattle, Washington, USA
Laid down 26 Sep 1980
Launched 15 Oct 1981
Commissioned 7 Jan 1984

McCLUSKY (FFG 41)*
Builder Todd Shipyards, San Pedro, California, USA
Laid down 21 Oct 1981
Launched 18 Sep 1982
Commissioned 10 Dec 1983

KLAKRING (FFG 42)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 19 Feb 1982
Launched 18 Sep 1982
Commissioned 20 Aug 1983

THACH (FFG 43)*
Builder Todd Shipyards, San Pedro, California, USA
Laid down 10 Mar 1982
Launched 18 Dec 1982
Commissioned 17 Mar 1984

De WERT (FFG 45)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 14 Jun 1982
Launched 18 Dec 1982
Commissioned 19 Nov 1983

RENTZ (FFG 46)*
Builder Todd Shipyards, San Pedro, California, USA
Laid down 18 Sep 1982
Launched 16 Jul 1983
Commissioned 30 Jun 1984

NICHOLAS (FFG 47)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 27 Sep 1982
Launched 23 Apr 1983
Commissioned 10 Mar 1984

VANDEGRIFT (FFG 48)*
Builder Todd Shipyards, Seattle, Washington, USA
Laid down 13 Oct 1981
Launched 15 Oct 1982
Commissioned 24 Nov 1984

ROBERT G BRADLEY (FFG 49)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 28 Dec 1982
Launched 13 Aug 1983
Commissioned 11 Aug 1984

TAYLOR (FFG 50)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 5 May 1983
Launched 5 Nov 1983
Commissioned 1 Dec 1984

GARY (FFG 51)*
Builder Todd Shipyards, San Pedro, California, USA
Laid down 18 Dec 1982
Launched 19 Nov 1983
Commissioned 17 Nov 1984

CARR (FFG 52)*
Builder Todd Shipyards, Seattle, Washington, USA
Laid down 26 Mar 1982
Launched 26 Feb 1983
Commissioned 27 Jul 1985

HAWES (FFG 53)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 22 Aug 1983
Launched 18 Feb 1984
Commissioned 9 Feb 1985

FORD (FFG 54)*
Builder Todd Shipyards, San Pedro, California, USA

Samuel B Roberts *(FFG 58) entering harbour in Portsmouth, England in May 1996. This ship was seriously damaged by a mine in the Gulf in 1988 and was rebuilt in the USA* (Jane's/H M Steele)

Laid down 16 Jul 1983
Launched 23 Jun 1984
Commissioned 29 Jun 1985

ELROD (FFG 55)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 21 Nov 1983
Launched 12 May 1984
Commissioned 18 May 1985

SIMPSON (FFG 56)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 27 Feb 1984
Launched 21 Aug 1984
Commissioned 10 Aug 1985

REUBEN JAMES (FFG 57)*
Builder Todd Shipyards, San Pedro, California, USA
Laid down 19 Nov 1983
Launched 8 Feb 1985
Commissioned 22 Mar 1986

SAMUEL B ROBERTS (FFG 58)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 21 May 1984
Launched 8 Dec 1984
Commissioned 12 Apr 1986

KAUFFMAN (FFG 59)*
Builder Bath Iron Works, Bath, Maine, USA
Laid down 8 Apr 1985
Launched 29 Mar 1986
Commissioned 28 Feb 1987

RODNEY M DAVIS (FFG 60)*
Builder Todd Shipyards, San Pedro, California, USA
Laid down 8 Feb 1985
Launched 11 Jan 1986
Commissioned 9 May 1987

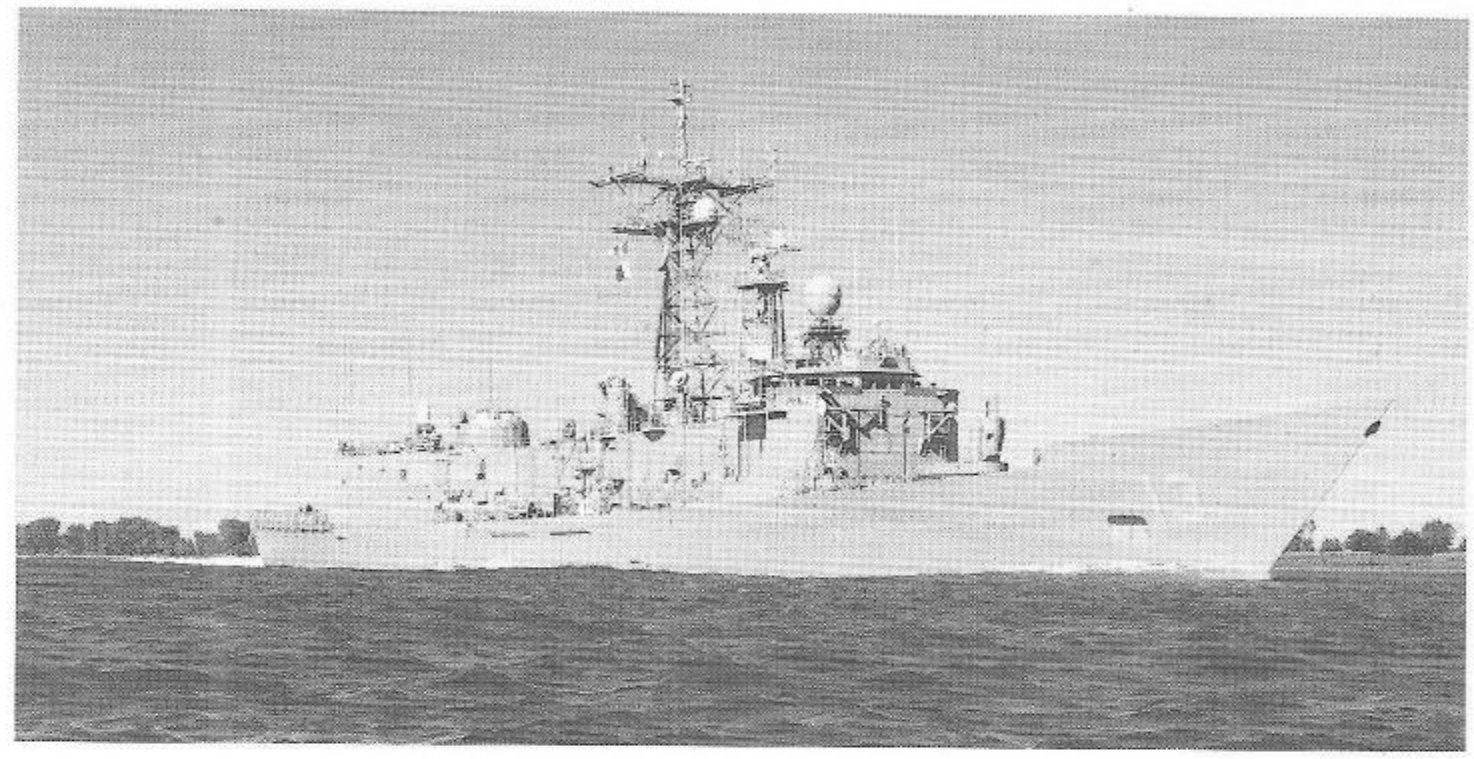
INGRAHAM (FFG 61)*
Builder Todd Shipyards, San Pedro, California, USA
Laid down 30 Mar 1987
Launched 25 Jun 1988
Commissioned 5 Aug 1989

WEAPONS SYSTEMS

MISSILE LAUNCHER

Mk 13 Mod 4 launcher

There is a single Mk 13 Mod 4 launcher located on the foredeck, used to launch both Harpoon SSM and Standard SM-1MR SAMs. There are 40 missiles stored vertically in a below-decks magazine in two concentric rings. Launching rate is one missile every 10 seconds. Mod 4 introduced solid-state technology, replacing the electromechanical relays in Mods 1-3.



Samuel Eliot Morison *(FFG 13) showing the class' weapons systems. On the foredeck is the Mk 13 Mod 4 launcher, with, beneath it, a magazine holding four Harpoon SSMs and 36 Standard SM-1MR SAMs. The main gun, an OTOBREDA 76 mm Mk 75 is on the superstructure forward of the stack and on the hangar roof is the Mk 15 CIWS. One of two triple 324 mm torpedo launchers can be seen immediately below the 76 mm gun* (H & L van Ginderen Collection)

ANTI-SHIP MISSILES (ASM)

McDonnell Douglas UGM-84B Harpoon

The missile magazine contains four Harpoon Block 1C anti-ship missiles. This missile can either fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses or it can approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. It can also use selectable seeker search expansion patterns, and for the terminal phase can use either a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications

Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg (11,905 lb) thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

Standard Missile-1 Medium Range (SM-1MR)

Main air defence armament is the SM-1MR which is launched from the Mk 13 Mod 4 launcher on the foredeck. SM-1MR Block IV missiles have a Naval Weapons Center Mk 51 expanding rod warhead, while Block V missiles have a Naval Weapons Center Mk 90 blast fragmentation warhead.

Specifications

Length: 4.48 m (14.7 ft)
Diameter: 34.3 cm (13.5 in)
Wing span: 1.06 m (3.48 ft)
Weight: 642.3 kg (1,416 lb)
Speed: Mach 2
Range: 20.5 n miles (38 km)
Altitude: 19,800 m (65,000 ft)

Manufacturers/Contractors

Hughes Missile Systems, Tucson, Arizona, USA.
Raytheon, Missile Systems Division, Bedford, Maryland, USA.

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited amidships, one set on either beam.

Specifications

Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

Manufacturer/Contractor

GEC-Marconi Naval Systems, UK.

Another view of Samuel Eliot Morison *(FFG 13) showing an SH-2F LAMP I helicopter and the vertical transom. FFG 9 to 16 (both inclusive) are the only US Navy 'Perry' class ships not to be either built with or converted to the LAMPS III system*

TORPEDOES

Alliant Techsystems Mk 46 Mod 5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 76 mm (3 in)/62 Mk 75 Compact

There is one OTOBREDA 76 mm (3 in) gun sited amidships atop the superstructure.

Specifications
Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range: 8.6 n miles (16 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy

Hughes Mk 15 CIWS Phalanx

There is one Hughes Mk 15 CIWS Phalanx close in weapons system (CIWS) situated at the after end of the hangar roof. The mount consists of a 20 mm M61A1 six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min (Block 0, Block 1 Baseline 0), 4,500 rds/min (Block 1 Baseline 1)
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA (system).

M2HB 12.7 mm (0.50 in) machine guns

Four M2HB 12.7 mm machine guns are carried and can be mounted on flexible mounts.

Specifications
Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rds/min
Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-air: 1,380 m (4,500 ft)

Mk 38 Bushmaster 25 mm cannon

Up to four Bushmasters can be mounted amidships and are usually carried by 'Perry' class ships deploying to the Gulf. The Bushmaster automatic cannon consists of the Mk 38 25 mm automatic cannon ('chain gun') on a Mk 88 mount. The Mk 38 is a single barrel, externally powered weapon, incorporating a rotating bolt mechanism driven by a chain and firing either single shots or automatic at 180 rds/min. Ammunition is supplied from a box containing 150 linked rounds, which is located on the left side of the weapon. Ammunition used in the Mk 38 is the M-792 HEI-T and M-793 TP-T 25 × 137 mm rimless, bottle-necked, Oerlikon KBA rounds, both being manufactured by Aerojet Ordnance, Alliant Techsystems Inc, and Loral Aeronutronic.

Specifications
Calibre: 25 mm
Length of barrel: 81 calibres
Muzzle velocity: 1,100 m/s (3,609 ft/s)
Traverse: 360°
Elevation: −20 to +55°
Weight: 589 kg (1,298 lb) (loaded)
Crew: 1 (often supported by a spotter)
Range: 1.33 n miles (2.47 km)
Rate of fire: 180 rds/min (max)
Ammunition: 184 g HEI-T
Barrel life: <13,000 rounds
Reliability: 22,000 rounds between stoppages

Manufacturer/Contractor
McDonnell Douglas Helicopter Company.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

AN/SLQ-32(V)2 ESM or AN/SLQ-32(V)5 ESM/ECM suites

As built, FFG7 to FFG 35 were fitted with the AN/SLQ32(V)2 ESM-only suite, which gives radar warning on B to J-bands, but has no ECM (jamming) capability. All these ships are being upgraded to SLQ-32(V)5 standard by adding the Raytheon 'Sidekick' which provides active onboard countermeasures, employing a high-gain, multibeam antenna system and has a full ECM techniques repertoire for both ship defence and counter-targeting roles. System software is a modification of that used with AN/SLQ-32(V)3. Sidekick can counter simultaneous threats from any azimuth angle.

FFG 36 to FFG 60 were fitted with AN/SLQ-32(V)5 (essentially, AN/SLQ-32 plus Sidekick) integrated ESM/ECM suite from the start.

Manufacturer/Contractor
Raytheon Company, Electromagnetic Systems Division, Goleta, California.

The officer is standing beside the AN/SLQ-32(V)2 ESM array and the back of the other array can be seen on the other side of bridge roof. The rectangular, flat dielectric plates cover the direction-finding arrays, while the semicircular plates cover semi-omni arrays

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers

There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

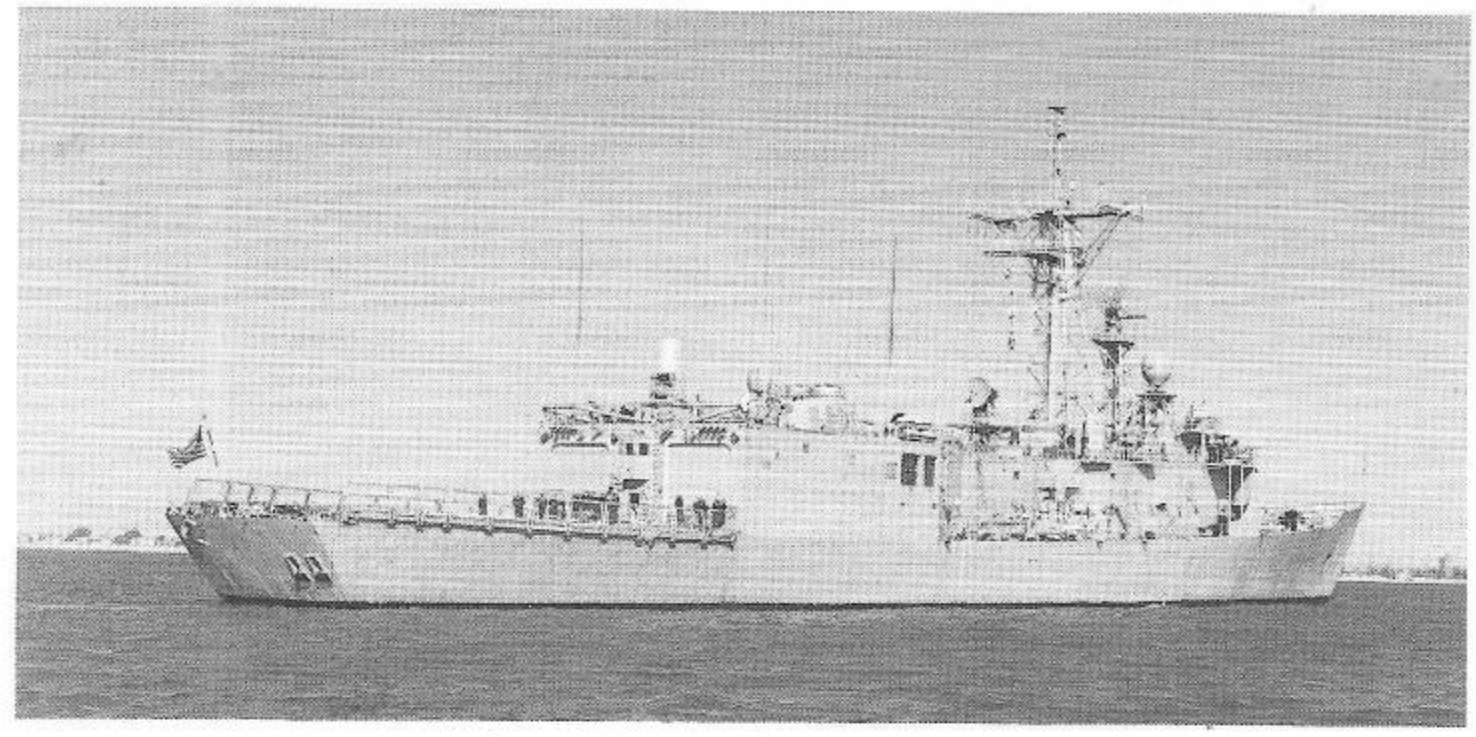
Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

AN/SLQ-25 Nixie noisemaker

One AN/SLQ-25 Nixie (Phase 1), solid-state, modular design electroacoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads, and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm (3.10 ft) long, 15.24 cm (6 in) in

diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body at a time is deployed.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.



McInerney *(FFG 8). Sensors visible in this picture include: Mk 92 fire-control director (large 'egg' on bridge roof) with AN/SLQ-32(V)2 below and to the right. The tower on the bridge roof supports the AN/SPS-49(V) antenna. Abaft the mast is the Lockheed STIR fire-control director and the white 'thimble' atop the Mk 15 CIWS houses the AN/UPS-20 radar. A Satcom terminal is also situated on the hangar roof*

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEM

NTDS tactical data handling system

NTDS (Naval Tactical Data System) provides an up-to-date picture of the tactical situation around individual warships and task groups using inputs from onboard and, via datalinks, offboard sensors. The data is also used to designate targets with priorities for aircraft and for shipborne Weapons Direction Systems (WDS), which assigns them to the appropriate weapon system.

NTDS does not receive direct inputs from ESM or ASW systems, data from the latter coming via the underwater fire-control system. In the anti-ship role, NTDS has a direct output into the SWG-1A Harpoon fire-control system. NTDS consists of a data processing group, a display group and data transmission equipment. The data processing group includes computers, software and ancillary equipment. Sensor data enters the system through the central equipment group and sensor switchboard and is transferred to the computer. The data is then processed with the aid of the radar video processor and with inputs from both the beacon video processor (IFF data), Link 11 and (where fitted) Link 14. Once the data has been evaluated and correlated it is transmitted both to relevant 'own ship' systems and to offboard platforms on land, sea and air.

The sensor data is presented to the display group which consists of PPI display consoles. The display systems are associated with specific sensors and the operators may enter tactical data and decisions into the computer for incorporation on other display systems. The Link 11 data transmission equipment provides automatic, high-speed, computer-to-computer digital communications between NTDS ships as well as air and land-based tactical data handling systems. A separate switchboard is responsible for communications. Other hardware associated with NTDS includes:

Digital datalink: Harris AN/ASW-25A
Airborne communications set: Litton AN/ASW-27
Radar information display: Hazeltine AN/SPA-41
Communications central: Collins AN/SRC-16, 17
Shipboard radio: Collins AN/SRC-23A
Digital data terminal: ECI AN/SRC-31A
Data terminal: Jetronic AN/SYW-1, Collins AN/USQ-36.

The mainframe data processing group in the 'Perry' class version of NTDS consists of two UYK-7 computers, which will remain in service into the early part of the next century, when they will be replaced by AN/UYK-43 computers, which incorporate Very Large Scale Integrated Circuits (VLSIC) technology. UYK-7 has a memory of 256,000, 32-bit words and an optimum processing power of 667 Kops.

NTDS software is in the US Navy's own CMS-2 language and is being constantly updated to meet new operational requirements. It is organised into large modules for air control, surface operations and tracking operations with each module consisting of tens of thousands of lines of code. Consideration is being given to replacing this with Ada but no decisions have been made.

Manufacturers/Contractors
Unisys (computers).
Hughes Aircraft Company (displays).
Collins (communications).

COMMUNICATIONS AND DATALINKS

Datalinks:
Active navy ships: Link 11 and Link 14
NRF ships: Link 14 only
Satcom: SRR-1, WSC-3 (UHF)
LAMPS III datalink: AN/SQQ-28; AN/SRQ-4
LAMPS I datalink: AN/SKR-4A
Tacan: URN 25.
IFF: Mk XII AIMS UPX-29

WEAPONS CONTROL

AN/SWG-1A Harpoon Launch Control System (LCS)

SWG-1A is the Harpoon weapons control system, which activates the missile, selects the flight pattern and sets seeker search modes (with small-, medium- or large-acquisition windows), as well as providing target range and bearing data. Alternatively, the missile can simply be launched along the bearing of the target, with the seeker activated early to scan a 90° sector; if, after a set time, no target has been acquired the missile commences a preset search pattern. SWG-1A takes account of other ships in the general target area and generates indirect flight plans for the missile, including waypoints to optimise angles of approach which will achieve the highest possibility of success while minimising the chances of the missile being destroyed by hostile fire. It can also be used to compute flight plans in a multiple attack so that several missiles, from either the same or different ships, arrive on target simultaneously, thus swamping the defences.

Mk 92 Mod 2/6 fire-control system

Mk 92 is an Americanised version of the Signaal WM28 system, produced under licence by Unisys. Mk 92 Mod 2 was installed in all ships 'as built' except for the final ship, *Ingraham* (FFG 61), which received the improved Mk 92 Mod 6, which will be retrofitted to the earlier ships.

The Mk 92 Mod 2 system uses a combined antenna system with its distinctive egg-shaped housing, together with the STIR (Signaal Track and Illuminating Radar) and provides continuous air and surface search around a ship even in an ECCM environment. It has a fast reaction time and is capable of simultaneous engagement of up to four surface targets, or two air and two surface targets. The system can engage air, surface or shore targets with guns or missiles. It is fully compatible with NTDS and interfaces with the Mk 13 Mod 4 missile handling/launching system, the Mk 75 gun and the Mk 15 Phalanx CIWS.

The Mk 92 consists of a combined antenna system, a separate track illuminating radar, a computer system, weapon control consoles, and ancillary equipment, and has a crew of four. The Mk 53 Combined Antenna System (CAS) consists of a monopulse track radar with CW injection above and a track-while-scan radar. Their antennas share a stabilised mount with the monopulse antenna above and the TWS antenna below. The monopulse radar can detect, track and illuminate one target in the air or on the surface. The TWS radar can detect and track up to two surface or shore targets simultaneously, as well as low-altitude targets.

The Lockheed STIR (in American terminology Separate Track Illuminating Radar) is an I/K-band monopulse tracking radar with CW injection which is designed to provide an additional channel of fire for a single air or surface target. It consists of a Mk 54 director with antenna.

There are two 32-bit AN/UYK-7 computers, each with 256 k memory and an optimum operating speed of 667 Kops, the second computer having been added to improve the processing of ASW data. There are two Weapons Control Consoles in the CIC to provide an MMI for acquiring and tracking targets, engagement control, launcher assignment, missile firing and post-engagement evaluation. The Mk 106 WCC supports the CAS and the Mk 107 WCC supports the STIR, but both also receive video data from ship search radars. Between the WCCs are the CIWS and Harpoon control stations and the CIC also has five consoles from the AN/UYA-4 family.

Mk 92 Mod 6 is an improved version of the Mod 2 which provides earlier detection and longer tracking ranges. The system includes improved clutter and ECCM performance and the track-while-scan element has six air target channels. The prime modification is the replacement of the CAS and STIR transmitter-receivers with COherent Receiver Transmitters (CORT) which incorporate test sets. A Unisys AN/UYK-44B is added to the computer system to act as a converter control processor; it has a core memory of 256,000 words or a semiconductor memory of 4 million words, together with up to 16 input-output channels. An AN/SYS-2 Integrated Automatic Detection and Tracking (IADT) system interfaces with the Mod 6 and the AN/SPS-49(V)4 radar is replaced by the (V)5 model.

Manufacturer/Contractor
Unisys Corporation, Government Systems Group.

Weapon Direction System Mk 13 Mod 2 target designation system

'Perry' class frigates are fitted with WDS Mk 13 Mod 2. In these ships the NTDS evaluates search radar data on the display system, tracks targets, evaluates them, and then indicates hostile targets and assigns their engagement to the WDS. The WDS then evaluates target engageability, assigns priorities and transmits this data to the missile fire-control system, while retaining responsibility for weapon assignment, loading orders and firing. Having launched the missile, the system conducts in-flight monitoring and control, and finally carries out post-firing evaluation of the engagement. The WDS monitors data flow between the NTDS computer, the fire-control and the launching systems. Depending upon the tactical situation and computer recommendations, operators can also control both the fire-control and the launching systems and then fire missiles. The Mk 13 has a two-operator position weapon control panel group and features target scheduling. This allows the computer to provide operators with a recommended or automatically scheduled target

engagement order thus simplifying the fire-control and launching system assignment orders. In the Mk 13 Mod 2 system, used in the 'Oliver Hazard Perry' (FFG 7) class frigates, there are no launch system consoles. Both use a pair of Mk 152 Mod 7 computers which each support a Mk 72 signal data converter, both computers interfacing with a single Mk 95 input-output console.

Manufacturer/Contractor
Vitro Corporation, USA.

Mk 24 optical directors
There are two Mk 24 optical directors.

AN/SYS-2(V)2 data fusion system
AN/SYS-2(V)2 is fitted in FFG 61 and is being fitted in eleven others of the class. The role of the SYS-2(V)2 IADT (Integrated Automatic Detection and Tracking system) is to increase the number of air and surface targets which may be detected and tracked in all types of electronic environments. The system accepts contacts from each radar, seeks potential targets, correlates the data by comparing all the sensors' returns and then produces a single file of valid tracks, while avoiding duplication. The different radar characteristics provide an overlapping volume of coverage in a variety of clutter and ECM environments which may be monitored to obtain the best possible search coverage. The data is then fed to the ship's command and weapon control systems, and accepts inputs from fire-control radars.

Each system consists of two 16-bit Paramax AN/UYK-44 computers and two display consoles. In later systems 32-bit digital microprocessors are added to improve sensor data fusion. Supplementary processors are the Motorola 68020, the INMOS Transputer (801/5) and the Intel i860 RISC. The UYK-44 uses Ultra-16 Assembly language and Ada is planned for SYS-2. The transputer uses OCCAM software language. In most systems one computer is used to interface with the sensors and the inertial navigation system while the other supports the display consoles and interfaces with the combat direction system, and fire/weapon control systems.

In SYS-2 (V)2 one computer supports the AN/SPS-49 radar which acts as the long-range tracker while the second interfaces with the Mk 92 fire-control system and, through the preprocessor, with the AN/SPS-55 radar which acts as the medium-range tracker.

Manufacturer/Contractor
Norden Systems, Melville, New York, USA.

SONARS

Hughes AN/SQS-53B sonar
The prime sensor is the bow-mounted, low-frequency AN/SQS-53B (except for FFG 10, 24, 27, 31, 51, 52 and 54, which have AN/SQS-56). AN/SQS-53B is an active/passive sonar produced by Hughes Aircraft Company's Systems Group. The system has a cylindrical array 1.6 m (5.2 ft) high and 4.8 m (15.7 ft) in diameter with 576 transducers. The sonar has a power requirement of about 65 kW, a reported active transmitting frequency of about 3 kHz and a peak frequency of 192 kHz. SQS-53 operates in three active modes; surface duct, bottom bounce and convergence zone, and ranges are believed to be about 10 n miles (18.5 km) in surface duct mode and up to 34.5 n miles (64 km) in convergence zone mode. Passive detection range is reportedly greater than with earlier sets (such as SQS-26) with the ship capable of operating at higher speeds. SQS-53B has 37 cabinets of signal processing, transmitting and display equipment, the latter having digital display subsystems. SQS-53B has an AN/UYK-44 Military Reconfigurable Processor (MRP).

AN/SQR-19(V)
The AN/SQR-19(V) towed sonar array is a passive, long-range omnidirectional system for detecting and classifying submarine targets. Its OA-9056/SQR-19 towed array group consists of an array 244 m (800 ft) long and 82 mm (3.2) in diameter, which is towed on a 1 n mile (1.85 km) cable. The array can reach depths of up to 365 m (1,200 ft), but is so designed that it can achieve this without needing a 'fish' to depress it. The other two major subsystems are the Ship-based Electronic Subsystem (SES) and the OK-410/SQR-19 Handling and Stowage Group (H&SG). Early versions of AN/SQR-19 use the AN/UYK-20 Data Processing Set (DPS) but systems produced from FY87 onwards use the AN/UYK-44-based Signal Data Processing Unit (SDPU).

A few SQR-18A may still be fitted to ships assigned to the Navy Reserve Force.

AN/SQQ-28(V)9 SSPS
The AN/SQQ-28 Shipboard Sonar Processing System (SSPS) is the shipboard processor for the LAMPS III weapon system. It processes raw data from the sonobuoys laid by Sikorsky SH-60B Seahawk LAMPS IIIA SW helicopters which are relayed to the ship via the AN/SQR-4 duplex digital link and received by the AN/ARR-75 receiver. LAMPS I acoustic data, from sonobuoys laid by the Kaman SH-2F Seasprite, can also be received using the AN/SKR-4B(V) receiver. Modifications to the SKR-4 interface allow LAMPS I and LAMPS III interoperability, and shipboard sonobuoy receiver set or training acoustic inputs to the datalink port of the AN/SQQ-28 Input Signal Switching Unit (ISSU). When SQQ-28 is installed in ships with the AN/SQR-19, it shares the DPS or the SDPU. The AN/UYQ-25A(V)2 DPS and the associated SIMAS provide a computer-based capability for sonar in-situ performance prediction and mode selection to provide the most effective AN/SQQ-89 system performance in various environmental conditions.

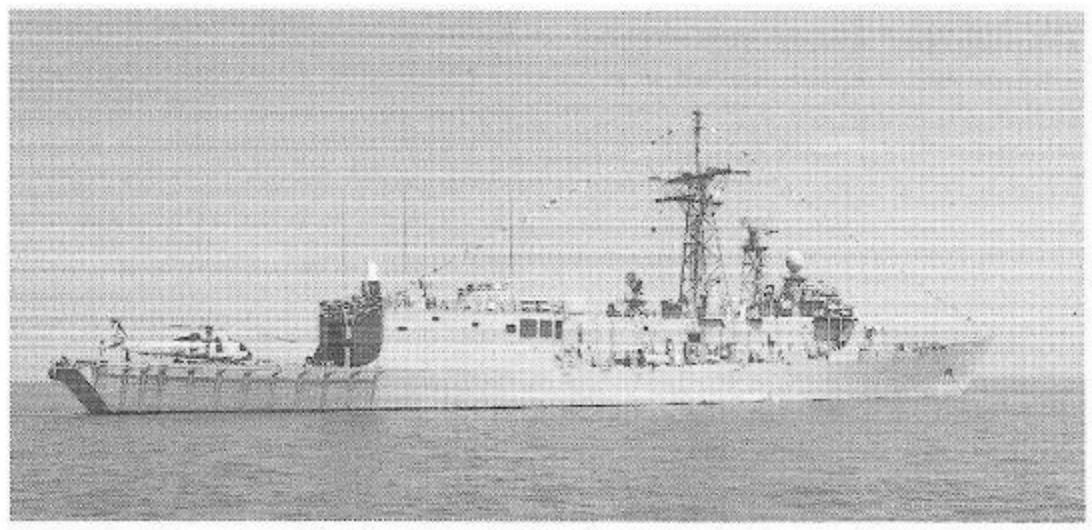
RADARS

	SPS-49(V)4/5* (Note 1)	SPS-55	STIR	Mk 92	
Company	Raytheon	Cardion	Lockheed	Unisys	Furumo
Role	Air search	Surface search	Fire control	Fire control	Navigation
Band	C/D (0.5-2 GHz)	I/J (8-20 GHz)	I/J	I/J	I
Beam	3.4 × 30° csc²	1.5 × 20°	12 × 1.2°	1.5 × 4.7°	
Peak power	360 kW	130 kW	5.5 kW	200 kW	
Gain	28.5 dB	31 dB	41.5 dB	33.5 dB	
Pulsewidth	125/2 µs	1/12 µs	0.27/1/6 µs	0.22/0.45 µs	
PRF	280/800/ 1,000 pps	750/2,250 pps	25,000/35,000 pps	3,600/1,800 pps	
Scan rate	6/12 rpm	16 rpm	—	60 rpm	
Range	250 n miles (457 km)		60 n miles (110 km)		

*SPS-49(V)5 is installed in FFG 61 as built and is being retrofitted in earlier ships

AN/SQQ-89(V)2 anti-submarine combat system
The AN/SQQ-89(V) surface ship anti-submarine warfare combat system detects, locates, tracks and engages submarine targets, and transmits and/or receives acoustic signals using a variety of sensors. Received signals are processed to provide target classification as well as performing TMA and controlling the setting of 'own ship' ASW weapons. In addition it provides multisensor track correlation, track management control and forwards track data to ship's Combat Direction System (CDS) or Command and Decision System (C&DS). The system is an integrated combat system consisting of sonar sensors which in other types of ship interface with the Mk 116 fire-control system to provide maximum operational effectiveness combined with minimum manpower requirements. Because there is no Mk 116 system in the 'Oliver Hazard Perry' class, however, the SQQ-89(V)2 system in these vessels has only two consoles and uses a Weapons Alternate Processor (WAP) in place of the Mk 116.

In the 'Perry' class, the sensors integrated in AN/SQQ-89(V)2 are the GE Electronic Systems Division AN/SQS-53B hull-mounted sonar, the GE Electronic Systems Division AN/SQR-19(V) Tactical Towed Array Sonar (TACTAS), the AN/SQQ-28 LAMPS I/III Sonar Signal Processing System (SSPS), all supported by the AN/UYQ-25 Data Processing System (DPS) and its associated Sonar In-situ Mode Assessment System (SIMAS) computer program.



From FFG 7 to FFG 35 the ships were designed to operate the LAMPS I system. These ships had a vertical transom (left) and operated the Kaman SH-2F helicopter. The LAMPS III system and the larger SH-60B helicopter required an extended flight deck with the transom angled out at 45° (right)
(Kaman (left); H & L van Ginderen Collection (right))

AVIATION

AVIATION FACILITIES

FFG 7 to FFG 35 were constructed to take the LAMPS I system, operating two Kaman SH-2 Seasprite helicopters, and thus required a smaller flight deck. When it was decided to deploy the LAMPS III system, however, a larger flight deck was required to enable the Indals helicopter landing system (RAST) to be installed. This was achieved by increasing the angle of the transom from virtually perpendicular to 45°, which increased the overall length of the ship by 2.4 m (8 ft). This extension was not, however, to enlarge the flight deck, but to provide alternative housing for the mooring facilities.

The original hangar had a single door, but this has been changed to twin doors, with an internal dividing bulkhead creating two hangars.

LAMPS III support facilities and RAST were tested in *McInerny* (FFG 8) and then fitted in all ships from FFG 36 onwards during construction and have been backfitted to all except FFG 9-14, 16-27, 30, 31 and 33-35. These latter ships can operate LAMPS III helicopters, but do not have the RAST landing facilities.

RAST

The Recovery Assistance Securing and Traversing (RAST) system enables helicopters to take off and land with the flight deck pitching up to 5° and rolling up to 28°.

An SH-60B lands aboard McInerney *(FFG 8) — note RAST tracks inset in the flight deck* (US Navy)

HELICOPTERS

Either two Kaman SH-2G Seasprite LAMPS I (NRF (short hull) ships) or two Sikorsky SH-60B Seahawk LAMPS III (long hull ships).

Sikorsky SH-60B Seahawk (LAMPS III)

Specifications

Dimensions
Main rotor diameter: 16.36 m (53.66 ft)
Tail rotor diameter: 3.35 m (11.00 ft)
Length overall (fuselage): 15.26 m (50.0 ft)
Height to top of rotor head: 3.79 m (12.43 ft)
Weights:
empty: 6,191 kg (13,648 lb)
mission gross weight: 9,182 kg (20,244 lb)
Performance:
dash speed (typical): 126 kts (234 km/h)
vertical rate of climb at S/L: 213 m (700 ft)/min
Power plant: 2 General Electric T700-GE-401C turboshafts rated at 1,417 kW (1,900 shp)
Accommodation: 3 (pilot and airborne tactical officer/back-up pilot in cockpit, sensor operator in specially equipped station in cabin)
Communications: Collins AN/ARC-159(V)2 UHF, Collins AN/ARC-174(V)2 HF, Hazeltine AN/APX-76A(V) and Bendix/King AN/APX-100(V)1 IFF transponders, TSEC/KG-45(E-1) communications security set, TSEC/KY-75 voice security set
Mission avionics: Sikorsky sonobuoy launcher, Edmac AN/ARR-75 and R-1651/ARA sonobuoy receiving sets (AN/ARR-84 receiver in Block 1 upgrade), Texas Instruments AN/ASQ-81(V)2 towed MAD, IBM AN/UYS-1(V)2 Proteus acoustic processor and CV-3252/A converter display, Control Data AN/AYK-14 (XN-1A) digital computer, Raytheon AN/ALQ-142 ESM, Sierra Research AN/ARQ-44 datalink and telemetry
Armament:
2 Mk 46 torpedoes;
2 AGM-119B Penguin 2 Mod 7 anti-shipping missiles (some helicopters only)
2 Honeywell 50 Advanced Lightweight Torpedoes; Hellfire missiles

SH-2F lands aboard an unmodified 'Perry' class frigate (Kaman)

Kaman SH-2G/LAMPS I Super Seasprite

Specifications

Main rotor diameter: 13.51 m (44.33 ft)
Tail rotor diameter: 2.46 m (8.15 ft)
Length overall (both rotors turning): 16.08 m (52.75 ft)
Fuselage length: 12.19 m (40.00 ft)
Height to top of rotor head: 4.58 m (15.00 ft)
Weights:
empty: 3,447 kg (7,600 lb)
max take-off: 6,124 kg (13,500 lb)
Max level speed at sea level: 138 kts (256 km/h)
Typical cruising speed: 120 kts (222 km/h)
Service ceiling: 7,285 m (23,900 ft)
Range with max standard fuel: 478 n miles (885 km)
Power plant: 2—1,285 kW (1,723 shp) General Electric T700-GE-401 turboshafts
Accommodation: Crew of 3 in ASW role (pilot, co-pilot/tactical co-ordinator, sensor operator)
Sensors: Canadian Marconi LN-66HP surveillance radar; AN/ALR-66(V)1 radar warning/ESM; Teledyne Systems AN/ASN-150 tactical management system; dual Collins AN/ARC-159(V) UHF radios; Texas Instruments AN/ASQ-81(V)2 MAD; Computing Devices AN/USY-503 acoustic processor; Flightline Electronics AN/ARR-84 sonobuoy receiver and AN/ARN-146 on-top position indicator. Tele-Dynamics AN/AKT-22(V)6 sonobuoy datalink; 15 DIFAR and DICASS sonobuoys. AN/ALE-39 chaff/flare dispensers; AN/ASQ-18B torpedo presetter
Weapons: 1/2 Mk 46 or Mk 50 torpedoes; 8 Mk 25 marine smoke markers. Provision for pintle-mounted 7.62 mm MG in both doorways

PROPULSION

Specifications
System: Gas turbine
Main machinery: 2 General Electric LM-2500 gas turbines; 30.59 MW (41,000 hp) sustained
Shafts: 1

Propeller: cp
Auxiliary propulsion units: 2 retractable props; 242 kW (325 hp) each
Ships services: 4—1,000 kW diesel generators

FURTHER INFORMATION

PROGRAMME

These were follow-on ships to the large number of frigates of the 'Garcia' and 'Knox' classes (formerly Destroyer Escorts DE) which were built for the US Navy in the 1960s and early 1970s. The lead ship, *Oliver Hazard Perry* (FFG 7), was authorised in FY73, laid down in 1975, launched in 1976 and commissioned in 1977.

The original US Navy plan was for approximately 75 ships, but this was later reduced to 50, although Congress subsequently added one further ship, *Ingraham* (FFG 61), which was commissioned in 1989.

It should be noted that US Navy hull numbers ran from FFG7 to FFG 61 (both inclusive), but excluded four numbers. This was because US hull numbers FFG 17, 18, 35 and 44 were provisionally allocated to the four ships built by the Todd yard in Seattle for the Royal Australian Navy.

The final ship in the class, *Ingraham* (FFG 61), was mandated by Congress against the navy's wishes and incorporated a variety of improved systems, many of which have since been retrofitted to earlier ships.

DESIGNATION

At the start of the programme these ships were designated 'patrol frigates' and *Perry* was initially allocated the pennant number 'PF 109'. This was, however, later changed to 'guided missile frigate (FFG)' and *Perry* was redesignated FFG 7 on 30 June 1975.

PROTECTION

These ships have considerable additional protection, with 19 mm Kevlar armour protection over vital spaces, steel armour (16 mm) over engine spaces and aluminium armour (19 mm) over magazines.

GROWTH MARGIN

The ships were designed with a growth margin of 39 tonnes, but this has proved to be a hopeless underestimate.

THE FUTURE

Under current plans 22 'Perry' class frigates will be retained in service, predominantly from the later production hulls. This will include FFG 36, 47, 48, 50-55, 57 and 59 which have had combat data and fire-control equipment retrofitted, and the last ship, *Ingraham* (FFG 61), but excluding the mine-damaged *Samuel B Roberts* (FFG 58).

RAM CIWS may be fitted in due course.

DISPOSALS

The first of this class transferred to the Naval Reserve Force on 31 January 1984, since when 15 more have transferred. Such ships have about 75 reservists (out of a total crew of 203) in their complement.

FFG 10 paid off in December 1994, followed by FFGs 16, 20, 21, 24, 26 in 1995/96, and with more to follow. This has made them available for sale or lease to foreign navies and it was originally proposed that they should go to: Bahrain — 1; Egypt — 2; Greece — 1; Oman — 1; Turkey — 3; and UAE — 2. Whether these transfers go ahead depends on the ships being made available and on the requirement being confirmed by the intended recipient. Bahrain and Greece have both declined the offer, while the UAE has opted for two ex-Dutch 'Kortenaer' class instead.

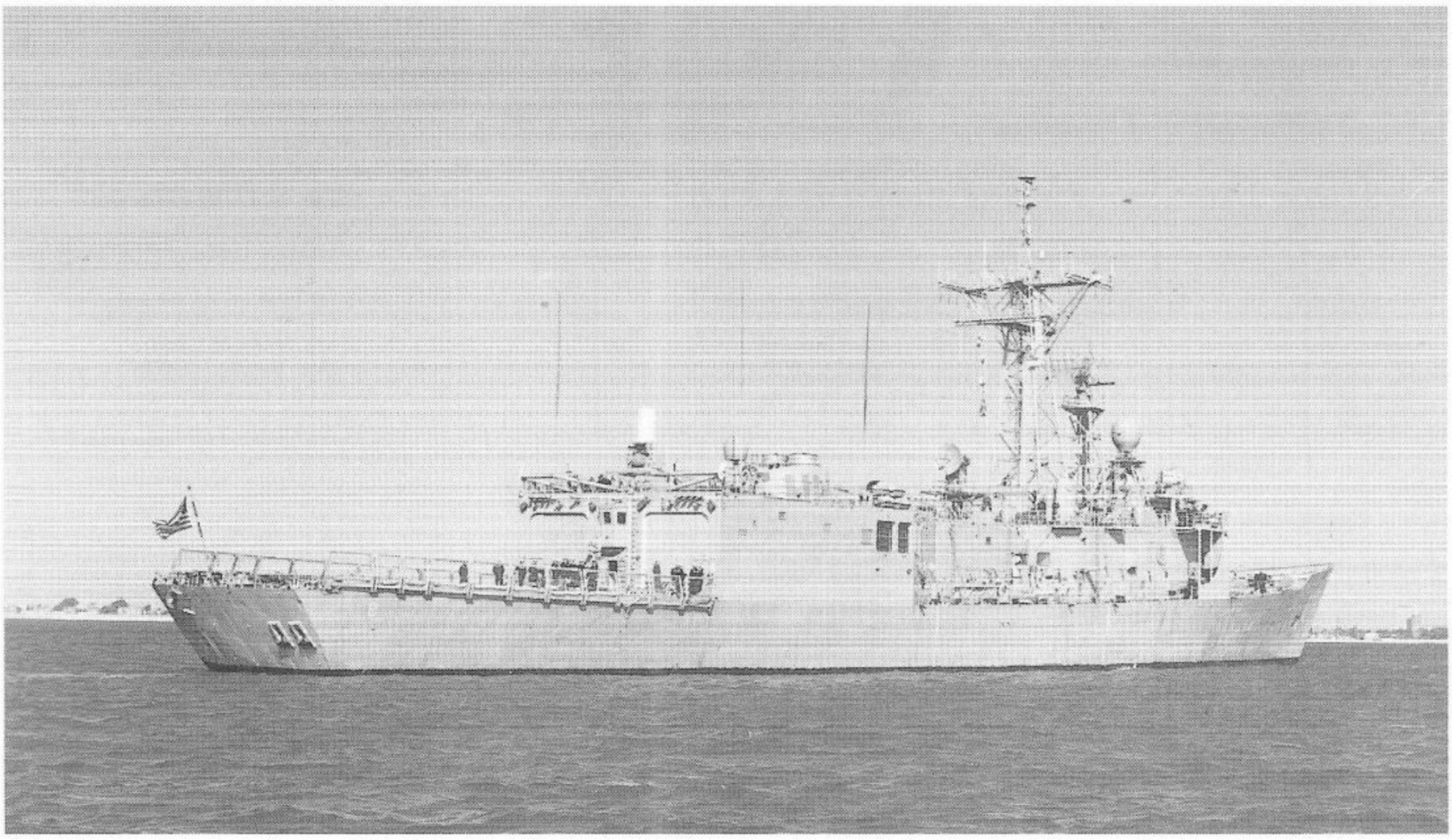
OPERATIONAL

Although built as ocean escorts, these ships have proved very valuable to the US Navy as general purpose warships; they have, for example, been deployed in the Gulf since the early 1980s and no less than 14 were present during the Gulf War.

Stark (FFG 31) was hit by two Exocet missiles in the Persian Gulf on 17 May 1987 and, although only one exploded, causing serious damage, a near-fatal list was caused by the lack of drainage facilities for the water pumped aboard rather than by direct enemy action. The ship was, however, saved and returned to operational status in August 1988. The incident gave rise to many improvements in firefighting, damage control doctrine, and the procedures and equipment needed to deal with residual missile propellant-induced fires.

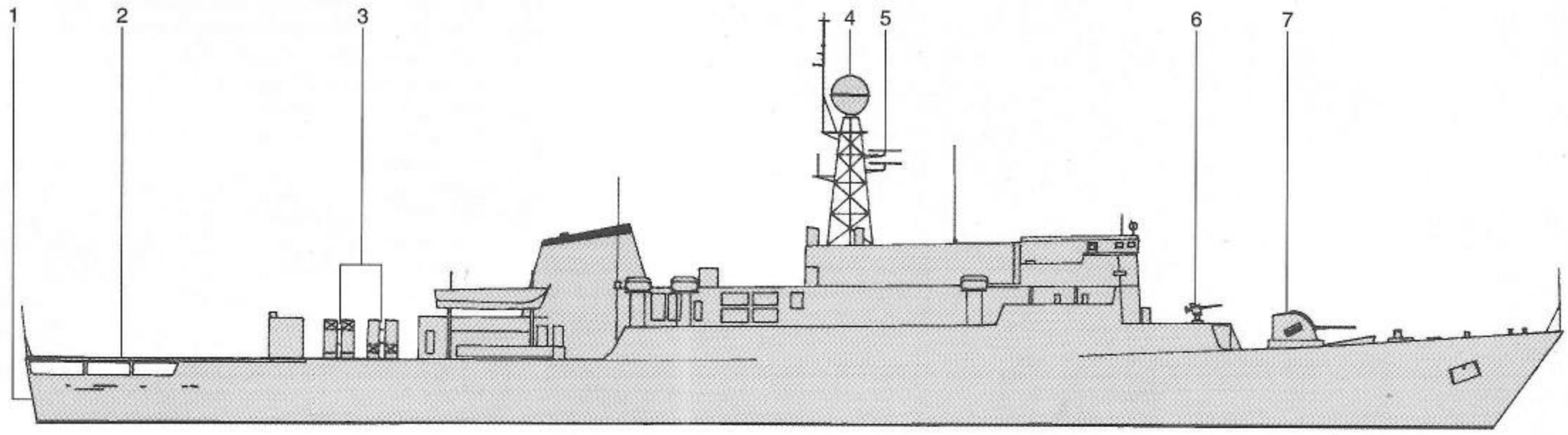
On 14 April 1988, *Samuel B Roberts* (FFG 58), was mined in the Gulf, but was able to reach Bahrain using the auxiliary propulsion motor. The ship was repaired at Bath Iron Works, Bath, Maine, USA and returned to the fleet in November 1989.

Vandegrift (FFG 48) was the trials ship for the Canadair CL-227 Sea Sentinel MAVUS II unmanned rotary-wing air vehicle in 1993/94 but this programme has not been pursued.



De Wert *(FFG 45)* (H M Steele)

KI HAJAR DEWANTARA



Ki Hajar Dewantara (Ian Sturton)
1 *Two 533 mm (21 in) torpedo tubes (under flight deck, pointing aft)* **2** *Flight deck* **3** *Aerospatiale MM 38 Exocet anti-ship missiles (four)* **4** *Signaal WM28 fire-control radar* **5** *Racal-Decca AC1229 surface search/navigation radar* **6** *Rheinmetall Rh-202 20 mm cannon* **7** *Bofors single 57 mm/70 gun*

GENERAL SPECIFICATIONS

Country of origin: Yugosavia (Croatia)
Operator: Indonesia

Class: KI HAJAR DEWANTARA

Built: 1
Active: 1

Displacement:
full load: 2,050 t

Dimensions
Length: 96.7 m (317.3 ft)
Beam: 11.2 m (36.5 ft)
Draught: 4.8 m (15.7 ft)

Speed: 26 kts (gas turbines); 20 kts (diesels)
Range: 4,000 n miles at 18 kts; 1,150 n miles at 25 kts

Complement: 76 (11 officers) plus 14 instructors and 100 cadets

SHIP

KI HAJAR DEWANTARA (364)

Builder	Split SY, Yugoslavia (Croatia)
Laid down	11 May 1979
Launched	11 Oct 1980
Commissioned	31 Oct 1981

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 38 medium-range anti-ship missile

There are four MM 38 Exocet launcher-containers mounted aft, facing across the ship, one pair pointing to starboard the other to port. Targets are acquired by the ship's search radar and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence. This involves turning on the thermal battery, releasing the mechanical safety locks, igniting the booster and, finally, breaking the umbilical cord; the total process takes some 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change of course during its flight.

The attack consists of three phases:

Cruise phase. The cruise phase starts as the missile clears the container and the missile, powered by the sustainer motor, flies towards the general location of the target at a height of about 100 m (328 ft) which is low enough to reduce the chance of detection but adequate for target acquisition. This phase can be as long as 22 km and ends when the seeker acquires the target. This seeker is a Dassault Electronique ADAC (Auto Directeur Anti-Clutter) active monopulse radar, working in the I-band (8-10 GHz), which has a typical range of 13 n miles (24 km) against FACs.

Approach phase. On detecting the target the missile descends to 9-15 m (30-50 ft) in the approach phase.

Terminal phase. During this final phase the missile descends to 8 m (26 ft) (2-5 m (6.5-16 ft) in a calm sea) for a sea-skimming run in to the target.

A salvo may be fired in 12-20 seconds.

Specifications

MM 38
Length: 5.21 m (17 ft)
Diameter: 35 cm (14 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,621 ft)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s
Booster: 100 kg SNPE Epervier boost motor, weight 100 kg, burn time of 2.4 s
Warhead: Luchaire 165 kg fragmentation warhead
Fuzes: Delayed impact fuze and autopilot-controlled proximity fuze

Manufacturer/Contractor

Aerospatiale Missiles.

TUBES

There are two 533 mm (21 in) torpedo tubes on the quarterdeck, pointing aft.

TORPEDOES

SUT anti-surface vessel/anti-submarine torpedo

SUT (Surface and Underwater Target) is a dual-purpose, electrically propelled, variable speed, wire-guided torpedo for engaging both surface and submarine targets. The wire guidance gives immunity to interference with a two-way datalink between vessel and torpedo, while the acoustic homing head has long acquisition ranges and a wide search sector for active and passive operation. On termination of wire guidance, SUT continues in operation, but now as a highly intelligent homing torpedo, with internal guidance programmes for target search, target loss and so on. The large payload with combined fuze systems ensures the optimum effect of explosive power. The SUT operates at great depths as well as in very shallow waters.

Specifications

Length: 6.15 m (20.17 ft)
Diameter: 533 mm (21 in)
Weight: 1,420 kg (3,130 lb)
Warhead: 260 kg (573 lb)
Speed: Selectable, max 35 kts
Range: >16 n miles (30 km)
Fuze: Magnetic proximity and impact

Manufacturer/Contractor

STN Atlas Elektronik, Bremen, Germany.

GUNS

Bofors SAK 57 L/70 Mk 1

The SAK 57 Mk 1 is a less sophisticated version of the more widely used Mk 2 and comprises a Bofors L/70 gun in a plastic turret. Two types of fixed 6.1 kg (20 lb) ammunition are available: one is a proximity-fuzed pre-fragmented shell for use against aerial targets; the other is a special surface target shell which penetrates the target and is detonated after a short delay.

Specifications

Calibre: 57 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,025 m/s (3,363 ft/s)
Traverse: 360° at 55°/s
Elevation: −10 to +75° at 40°/s
Crew: 5
Range: 9 n miles (17 km)
Rate of fire: 200 rds/min

Ki Hajar Dewantara *(364) was designed and built in (the then) Yugoslavia and fitted out in the Netherlands. There is a flight deck but no hangar, although the after deckhouse contains spares and safety equipment for the helicopter. Note the two 533 mm (21 in) torpedo tubes sited on the quarterdeck, which launch their torpedoes into the ship's wake* (92 Wing RAAF)

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Rheinmetall Rh-202 20 mm cannon

One of the lessons of Gulf deployments is the need for a light, short-range gun. Therefore, the Type 123 ships mount two Rheinmetall Rh-202 20 mm cannon, which were taken from decommissioned Klasse 520 landing craft. These are mounted in the bridge wings, abaft the target designation sights.

Specifications
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,250 m/s (3,297-4,101 ft/s)
Traverse: 360°
Elevation: −10 to +55°
Crew: 1-2
Range: 1 n mile (2,000 m)
Rate of fire: 800-1,000 rds/min

Manufacturer/Contractor
Rheinmetall, Germany.

DEPTH CHARGES

There is one projector/mortar.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Susie-1 radar intercept

Susie is a Thorn EMI ESM system covering the frequency range 2-18 GHz and Susie-1 is a version specifically designed for small warships. The system intercepts radar transmissions, analyses them and then displays relevant parameters including: bearing; frequency; pulse repetition frequency (PRF); pulsewidth; and signal strength.

Manufacturer/Contractor
Thorn EMI, UK.

DECOYS

There are two 128 mm twin-tubed flare launchers.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEM

SEWACO-RI action data automation/ Daisy data processing

SEWACO-RI (RI = Republik Indonesia) was specifically assembled for Indonesian use and is based on an expansion of the WM28 weapons control system.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

WEAPONS CONTROL

Signaal WM28/61

This ship is fitted with the Signaal WM28/61 fire-control system. Like other members of the WM20 family, WM28 radar has two antennas sharing a common, stabilised mounting and housed in a distinctive, egg-shaped radome — the famous 'Signaal egg' — which is located on top of the prominent, open-work mast. The stabilisation system permits operation at roll angles of ±30° and pitch angles of ±10°. The upper antenna, which is of the cassegrain type, is used for searching as well as for automatic tracking of surface targets for weapon control. The lower antenna is of the paraboloid segment type with horn feed and is used for tracking air targets and for controlling air defence weapons. The antennas are fed from a common I/J-band transmitter but during surveillance all the transmitter output is channelled to the search antenna.

Peak pulse power is 180 kW and output power is shared by waveguide switching. The search radar has a range of between 30 and 32 km against surface targets and 7,600 m (24,936 ft) against air targets, while the tracker has a range of about 29 km. With the larger search antenna the search radar is increased to about 46 km. The tracker is capable of monitoring the movement of aircraft with a 1 m² cross-section at velocities up to 900 m/s (2,953 ft/s) and similar size objects moving at or near the surface at maximum velocities of between 34 and 55 m/s (111 and 180 ft/s).

The computer, controls and displays are in a two- or three-man console which includes firing pedals. The consoles feature a small PPI display, an A-scope to present data on the tracking radar and shell splashes and a B-scope for presenting search radar video and the predicted hitting point. The PPI display has range scales of 10, 30 and 60 km. The console also has an alphanumeric display capable of presenting 16 lines, each of 32 characters.

WM28/61 (the suffix '61' denotes that it uses the SMR-MU computer) is a weapon control system for ships up to destroyer size to control light- or medium-calibre guns and an ASV missile using semi-active guidance. It can engage either an air or a surface target with the gun and a surface target with the missile system.

The radar can automatically track one air and one surface target simultaneously. For use with the missile the air target tracking antenna is slaved to the surface target tracking programme and linked with a CW transmitter in order to illuminate the target. It can control a second light- or medium-calibre gun for engaging an air and/or surface target.

The system can track automatically an air and/or two surface targets.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

Set	WM 28	AC 1229*
Company	Signaal	Racal-Decca
Role	Fire control (SSM/127 mm gun)	Navigation
Band	I/J	I/J
Beam	1.5 × 4/7° (search) 2.4° (track)	1.3 × 30°
Peak power	200 kW	25 kW
Gain	33.5 dB	30 dB
Pulsewidth	0.22/4.5 µs	0.05/0.25/1.0 µs
PRF	3,600/1,800 pps	1,300/650 pps
Scan rate	60 rpm	25 rpm
Range	25 n miles (46 km)	—

Notes
* AC = Anti-Collision

SONAR

Signaal PHS-32 hull-mounted search and attack sonar system

PHS-32 is a medium-range, high-performance search and attack sonar which includes signal processing facilities for fast Fourier transformation processing of all preformed beam receiving channels. All data are presented on a single TV-type display, while operation has been much simplified by the use of light pen control. The system can track up to four targets automatically. A circular transducer permits all-round coverage in various modes of transmission such as: Omni, TRDT, MCC (wide vertical beam), LISTEN (passive with time/bearing recorder presentation). An audio beam is also available.

Specifications

Frequencies: 3
Pulse lengths: 12.5, 25, 50, 100 ms and 400 ms long pulse (CW or FM)
Detection range: >10,000 yd
Vertical beamwidth: 12 or 20°
Bearing accuracy: 1° RMS
Range accuracy: ±0.5-2%
Notch filtering: Selectable rejection bandwidth
Own Doppler correction: On all 60 channels
Roll and pitch performance: Automatic co-ordination of transmitting pulse and vertical beamwidth in rough weather

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

AVIATION

AVIATION FACILITIES

Flight deck: 15.4 × 11.2 m (50 × 36 ft)
Hangar: There is no hangar, but a small deckhouse at the forward end of the flight deck would appear to offer maintenance facilities

HELICOPTERS

The helicopter normally carried is the Nurtanio-built version of the Eurocopter BO-105.

Specifications

Dimensions
main rotor diameter: 9.84 m (32.28 ft)
tail rotor diameter: 1.90 m (6.23 ft)
length including rotors: 11.86 m (38.91 ft)
height to top of main rotor head: 3.02 m (9.91 ft)
Weights
empty, basic: 1,301 kg (2,868 lb)
max take-off: 2,500 kg (5,511 lb)
Performance (at max T-O weight):
never-exceed speed (VNE) (sea level): 131 kts (242 km/h)
max cruising speed (sea level): 129 kts (240 km/h)
best range speed (sea level): 110 kts (204 km/h)
max rate of climb: 444 m (1,457 ft)/min
range (sea level): 300 n miles (555 km)
endurance (standard fuel/max payload): 3 h 24 min
Power plant: 2–313 kW (420 shp) Allison 250-C20B turboshafts, each with a max continuous rating of 298 kW (400 shp)
Accommodation: 5 (pilot, co-pilot/passenger, three passengers)

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 Rolls-Royce Olympus TM3B gas turbine; 18.3 MW (24,525 hp) sustained; 2 MTU 16V 956 TB92 diesels, 8.14 MW (11070 hp(m)) sustained
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

This ship was built as a training ship and can carry 14 instructors and 100 cadets. It does, however, have a potential combat role in a local conflict.

The ship was ordered on 14 March 1978 from Split shipyard in the former Yugoslavia, where the hull was built and engines fitted. The armament and electronics were subsequently fitted in the Netherlands and Indonesia.

The design is closely related to that of the Iraqi ship *Ibn Majid,* which was built at the same yard. There were reports in the early 1980s that a second unit had been ordered in 1983, but no such ship has been built.

DESIGN

There is a general purpose classroom together with specialised training rooms for navigation and radio training, and an additional wheelhouse.

Armament includes four MM 38 Exocet, one 57 mm Bofors gun, two 20 mm cannon, two 533 mm torpedo tubes and a helicopter, which give the ship a useful combat capability.

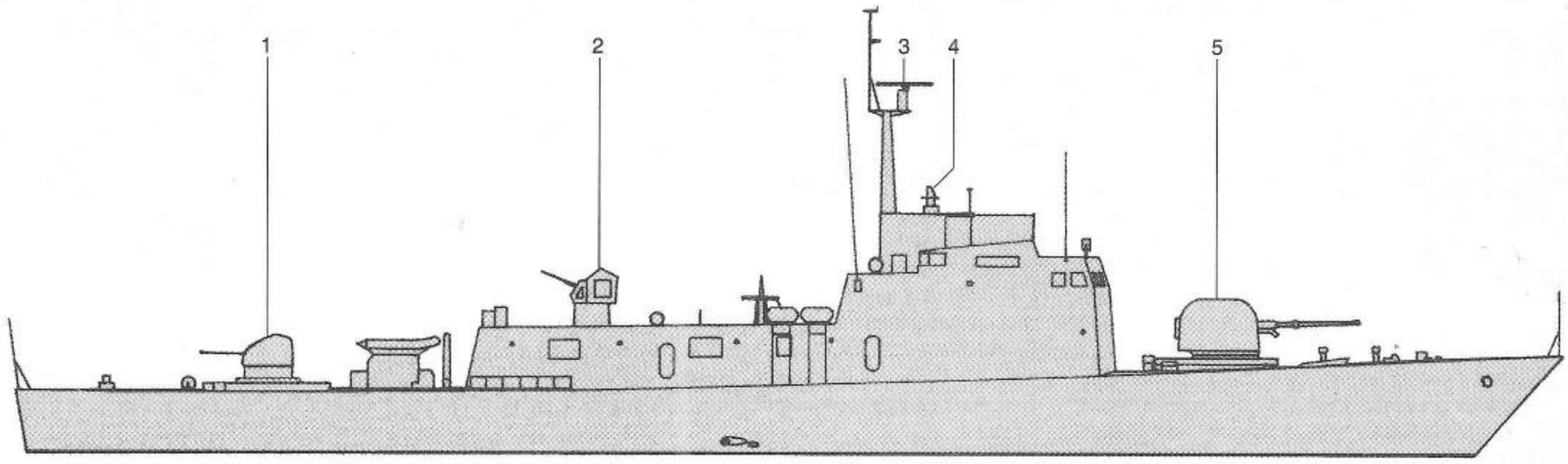
DEPLOYMENT

Aside from its primary use as a training ship, *Hajar Dewantara* is also used in peacetime as a troop transport, a valuable role in the Indonesian archipelago. War roles include convoy escort, anti-submarine warfare and troop transport.

Ki Hajar Dewantara *(364). The shipyard at Split in Croatia, which built this ship has achieved a number of export sales over the past 20 years* (Vic Jeffrey RAN)

CORVETTES

DJEBEL CHINOISE



Djebel Chinoise (Ian Sturton)
1 *OTOBREDA twin 40 mm/70 Compact automatic guns (FFBNW)* **2** *ZV-23-2 twin 23 mm cannon* **3** *Racal-Decca Type 1226 navigation radar* **4** *Electro-optic director for 76 mm gun (FFBNW)* **5** *OTOBREDA 76 mm (3 in)/62 Compact automatic gun (FFBNW) (FFBNW = Fitted For But Not With)*

GENERAL SPECIFICATIONS

Operator: Algeria
Type: Project 802

Class: DJEBEL CHINOISE

Built: 2
Active: 2
Building: 1

Displacement:
standard: 496 t
full load: 540 t

Dimensions
Length: 58.4 m (191.6 ft)
Beam: 8.5 m (27.9 ft)
Draught: 2.6 m (8.5 ft)

Speed: 31 kts

Complement: 52 (6 officers)

SHIPS

DJEBEL CHINOISE (351)
Builder ECRN, Mers-el-Kebir, Algeria
Launched 3 Feb 1985
Commissioned 1988

EL CHIHAB (352)
Builder ECRN, Mers-el-Kebir, Algeria
Launched Feb 1990
Commissioned 1995

— (353)
Builder ECRN, Mers-el-Kebir, Algeria
Launched 1997
Commissioned 1999

WEAPONS SYSTEMS

GUNS

OTOBREDA 76 mm (3 in)/62 Compact (fitted for but not with)

It is intended to mount an OTOBREDA 76 mm/62 Compact gun on the foredeck. The fittings for both the gun and an optronic director are already built in, but the guns are not yet installed.

Specifications
Elevation: −15 to +85° at 45°/s
Traverse: 360° at 70°/s
Weight (unloaded): 7.5 t
Muzzle velocity: 925 m/s (3,034 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.6 n miles (16 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm/70

It is also intended to mount a single twin OTOBREDA Fast Forty mounting on the quarterdeck, but this too, has yet to be installed.

The Fast Forty is designed for use against manned aircraft and small ships but possesses an anti-missile capability and is marketed as a Close In Weapon System (CIWS).

Specifications
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,025 m/s (3,362 ft/s) (PFHE), 1,350 m/s (4,429 ft/s) (APFSDS)
Traverse: Unlimited at 90°/s
Elevation: −13 to +85° at 60°/s (Twin)
Range: 6.75 n miles (12.5 km) surface/surface, 8,700 m (AA) (28,500 ft)
Rate of fire: 900 rds/min
Ammunition: 2.4 kg (5.3 lb) (PFHE), 2.5 kg (5.5 lb) (APFSDS)
Power requirements: 400 V, 60 Hz, three phase; 115 V, 400 Hz, one phase
Power consumption: 13 kW (peak)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

23 mm ZU-23-2 (2 twin)

There are two twin ZU-23-2 mounts side-by-side on the after superstructure.
Note: These are the only weapons currently installed.

Specifications
Calibre: 23 mm
Length of barrel: 87 calibres
Traverse: 360°
Elevation: −10 to +90°
Rate of fire: 200 rds/min/barrel
Range:
anti-surface: 1.1 n mile (2 km)
anti-air: 1,500 m (4,920 ft)

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Electro-optic director

There is space for an electro-optic director for the 76 mm gun on the bridge roof, but this is not currently fitted.

RADARS

Racal-Decca 1226

I-band surface search radar.

PROPULSION

Specifications
System: Diesel
Main machinery: 3 MTU 20V538 TB92, 9.4 MW (12,800 hp)
Shafts: 3

FURTHER INFORMATION

PROGRAMME

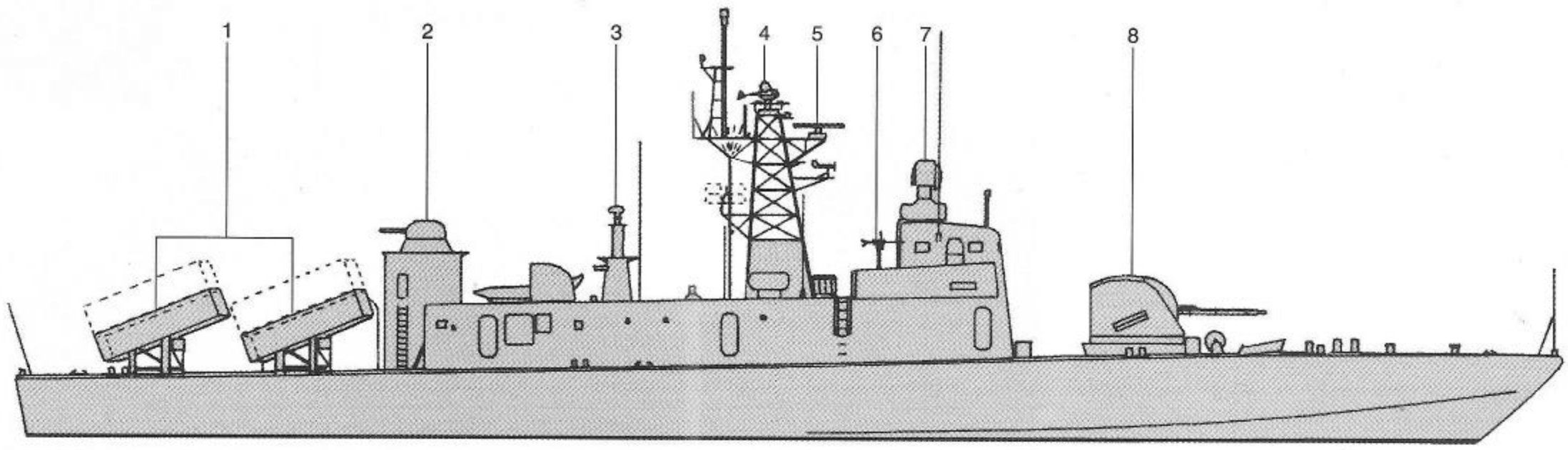
Project 802 is a class of corvette being built with assistance and advice from Bulgarian experts. The first warships ever to be constructed in Algeria, the programme has been affected by a combination of shipbuilding inexperience and shortage of funds. The three ships were ordered in July 1983 and the first of class was launched in 1985 and commissioned in 1988. The second was launched in 1990, but fitting-out work was suspended in 1992 due to shipyard debt problems, although the ship has subsequently been completed. The third of class is currently being held up by shipyard funding problems. The main armament was due to be fitted to the first two ships in 1996.

DESIGN

There are suggestions that the design may have been prepared by Bulgarian shipyards.

El Chihab *(352), the second of these Algerian-built ships. The armament is being slowly completed: the stern-mounted OTOBREDA 40 mm has recently been installed, but the planned 76 mm gun has yet to be acquired* (Diego Quevedo)

KRALJ (TYPE 400)



Kralj (Ian Sturton)
1 *CelsiusTech RBS 15 anti-ship missiles (four/eight)* **2** *AK-630 six-barrel 30 mm CIWS* **3** *CelsiusTech 9LV 249 Mk 2 director* **4** *Racal BT 502 surface search radar* **5** *Racal 1290A navigation radar* **6** *Oerlikon 20 mm or 12.7 mm machine guns* **7** *CelsiusTech 9LV 249 Mk 2 director* **8** *Bofors single 57 mm SAK 57*

GENERAL SPECIFICATIONS

Operator: Croatia
Type: Type 400

Class: KRALJ

Built: 1
Active: 1
Building: 1
Proposed: 2

Displacement:
full load: 450 t

Dimensions
Length: 53.6 m (175.9 ft)
Beam: 8.5 m (27.9 ft)
Draught: 2.3 m (7.5 ft)

Speed: 36 kts
Range: 1,500 n miles at 20 kts

Complement: 33 (5 officers)

SHIPS

KRALJ PETAR KRESIMIR IV (11)
Builder Kraljevica Shipyard, Croatia
Launched 21 Mar 1992
Commissioned 1992

— (12)
Builder Kraljevica Shipyard, Croatia
Launched —
Commissioned —

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Saab RBS-15M

The 'Kralj' class carries either four or eight Saab RBS-15M anti-ship missiles, but where eight are mounted, the mine rails must be removed. The RBS-15M missile system features inertial guidance and active radar homing to 37.8 n miles (70 km) at Mach 0.8. In the missile's nose is the CelsiusTech 9GR400 monopulse J-band (12-18 GHz) seeker. The broad band, frequency-agile radar with its digital processing is claimed to provide a high-Electronic Counter-Counter-Measures (ECCM) performance. The seeker has two modes which may be selected by the operator; active or active-passive lock on.

The ship system is operated by one man and consists of control and display panels, a computer, launcher switching units and power supply.

The system receives data from ship sensors, ship fire-control system or from external sensors on land, sea or air. The fire-control panel and the computer are in the ship's combat information centre.

There are three modes of operation; test, simulation and combat. The combat mode has preparation and firing submodes with the former offering automatic and/or manual selection of target data, missile readiness, tactical parameters and salvo numbers. The tactical parameters' data include seeker search pattern, target selection logic and trajectory. There is a separate selection of the distance the missile will travel in the high-level cruise phase. Using this and other data the system calculates missile heading, seeker parameters, tactical boundaries and the time to the point when the missile will enter the low-level cruise phase.

The firing sub-mode is initiated manually but the selected missiles are automatically activated and their container doors are automatically opened. The system compensates for ship motion and ignites the boost motors which burn for approximately three seconds before being jettisoned. As the missile reaches its maximum altitude the turbojet is activated and the missile turns towards the target, the maximum offset being about 90°. It then enters a predetermined high-level cruise phase, which allows it to overfly islands, then descends to the low-level cruise phase.

At an appropriate distance from the target the seeker is activated and the predetermined search pattern is adopted. Once the seeker has locked on to the target the missile can then enter its terminal sea-skimming phase.

Specifications

Length: 4.33 m (14.2 ft)
Diameter: 50 cm (19.7 in)
Wing span: 1.4 m (4.6 ft) (unfolded)
Weight (without boosters): 626 kg (1,380 lb)
Speed: In excess of Mach 0.8
Range: In excess of 38 n miles (70 km)
Warhead: 200 kg (441 lb) HE (blast fragmentation)

Manufacturer/Contractor

Saab Dynamics AB, Sweden.

GUNS

Bofors SAK 57 L/70 Mk 1

There is a single Bofors SAK 57 L/70 Mk 1 in 'A' position. This is intended to engage air and surface targets and to provide gunfire in support of troops ashore. It is housed inside a GRP shield.

Specifications

Calibre: 57 mm
Length of barrel: 70 calibres
Traverse: 360° at 55°/s
Elevation: −10 to +77° at 40°/s
Crew: 3
Range: 9 n miles (17 km)
Rate of fire: 220 rds/min
Projectile weight: 2.4 kg (5.3 lb)

Manufacturer/Contractor

Bofors Ordnance, Sweden.

AK-630 30 mm CIWS

One AK-630 30 mm six-barrel CIWS is mounted on a small tower at the aft end of the superstructure.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Muzzle velocity: 890 m/s (2,920 ft/s)
Traverse: 360° (depending on location of turret) at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (4,400 yd
electro-optic fire control: 5,000 m (5,470 yd)
Rate of fire: 4,000-5,000 rds/min
Ammunition:
round: 1,224 kg (2.7 lb)
projectile weight: `UOF-84 384 g (13.68 oz); UOR-84; 388 g (13.69 oz)

Oerlikon 20 mm or 2-12.7 mm MGs

These ships are reported to mount either two Oerlikon 20 mm guns or two M2HB 12.7 mm (0.50 in) machine guns (although there seems no reason why they should not mount both types of weapon).

Specifications

	Oerlikon 20 mm	M2HB
Calibre	20 mm	12.7 mm
Length of barrel	70 calibres	—
Muzzle velocity	835 m/s (2,739 ft/s)	883 m/s (2,900 ft/s)
Range		
anti-surface	1,500 m (1,640 yd)	6,700 m (7,400 yd)
anti-air	1,150 m (3,800 ft)	1,380 m (4,500 ft)
Rate of fire	450 rds/min	450-550 rds/min
Elevation	−15 to + 55°	depends on mount

MINES

AIM-70 mine

Up to four AIM-70 (Acoustic-Induction Mine) can be carried. This bottom mine is effective against warships of up to 5,000 tonne displacement and merchant ships up to 20,000 tonnes and contains 700 kg (1,543 lb) of explosive.

SAG-1 mine

Alternatively, up to six SAG-1 mines can be carried. This is believed to be a Yugoslav-produced contact mine, which can be laid at depths of up to 106 m (350 ft).

Kralj Petar Kresimir IV *(RT 11)* (L Poggiali)

ELECTRONIC WARFARE SYSTEMS

DECOYS

ML Aviation Barricade countermeasures system

Barricade launchers are mounted in these ships to provide them with the means of deploying chaff and infra-red (IR) decoys to counter missile attacks, using a layered defence against the various types of anti-ship missile. The system uses a 102 mm rocket and a launcher with four sets of triple-cell launchers. The ammunition lockers each contain 24 rockets. There are four decoy modes:

- confusion, in which long-range (Stockade) rockets are fired to confuse enemy search radar and make target selection difficult
- distraction, in which medium-range chaff and/or infra-red rockets are fired in a pattern of six around the ship to present alternative targets to missiles during their search phase, affording defence against multiple missiles coming from different directions
- dump is used where a missile has locked on to the ship. The ship uses a jammer to remove the missile's range gate and then fires a single rocket to produce a chaff cloud on which the gate may be 'dumped', thus allowing the jammer to be redeployed.
- centroid, is a close-range, final defence mode, used against single missiles. If the incoming missile is locked on to the ship, a pattern of short-range chaff and/or IR rockets is fired to create a large alternative target close to the ship, which manoeuvres away, leaving the missile to home on to the decoy.

Manufacturer/Contractor

ML Wallop Defence Systems, Andover, Hampshire, UK.

COMMAND AND CONTROL SYSTEMS

CelsiusTech 9LV 249 Mk2

The basic 9LV 200 system is an air defence (LV = *Luftvarn* (anti-aircraft)) fire-control system for small warships controlling dual-purpose guns from 40 mm to 120 mm calibre, but has been extended to the surface engagement role using anti-ship missiles or wire-guided torpedoes. The system can direct one or more guns against one or more targets simultaneously. The 9LV 200 family has a mainframe architecture, using the Philips P800 series of minicomputers. A typical 9LV 200 installation features a tactical display, two gun control consoles (with primary air defence and surface engagement roles respectively), two optical target designators and a wind sensor.

Manufacturer/Contractor

CelsiusTech, Sweden.

RADARS

Racal BT-502

The BT-502 is an E/F-band surface search radar.

Racal 1290A

The 1290A is an I-band navigation radar.

SONARS

RIZ PP10M

This is either a Russian or Yugoslav hull-mounted, active search, high-frequency sonar.

PROPULSION

Specifications

System: Diesel

Main machinery: 3 M504B-2 diesels, 9.2 MW (12,500 hp)

Shafts: 3

FURTHER INFORMATION

PROGRAMME

The building of this class (formerly called the 'Kobra' class) was officially announced as 'suspended' in 1989 but was restarted in 1991 and the first of class was commissioned in 1992. Progress on the second of class is equally slow. Projected numbers are uncertain after the first two. Designated as a *Raketna Topovnajaca* (Missile Gunboat).

DESIGN

This design has been derived from that of the 'Koncar' class fast attack craft, six of which were built at the same yard in the 1970s. The 'Koncar' class was designed by the Naval Shipping Institute at Zagreb and was based on the Swedish 'Spica' design. The Kralj design has a stretched hull (it is actually 8.6 m (28.2 ft) longer) with a greater spacing between the ribs. There is also a new superstructure. The principle weapons are the anti-ship Saab RBS-15 missiles, which were originally acquired for use by Yugoslav coastal defence batteries.

The original 'Koncar' class carried two SS-N-2B Styx missiles on the stern and the Kralj, as currently configured, carries four Saab RBS-15 launchers, plus two mine rails. It is intended, however, to mount eight missiles, in which case, the mine rails will be removed.

OPERATIONAL

Kralj Petar Kresimir IV was reported to be damaged as a result of a missile explosion during ammunition loading in July 1993. This had, however, been repaired by October 1994 when the ship carried out a live SSM firing. It is of interest that the missile that blew up was reported to be an SA-N-5, a type not normally listed as part of the ship's weapons fit.

Kralj Petar Kresimir IV is normally based at Sibenik.

STANDARD FLEX 300

OVERVIEW

The Royal Danish Navy's (RDanN) Standard Flex 300 represents a unique response to modern naval requirements. The situation in which the RDanN found itself in 1982 was that 22 old ships would have to be replaced at the end of the decade: eight US 'Bluebird' class coastal minesweepers, six 'Soloven' class light torpedo boats and eight 'Daphne' class patrol boats. One-for-one replacement would have been prohibitively expensive and so a novel concept was evolved in which a basic ship platform would be designed, with exchangeable weapon and electronic modules to enable it to be configured to meet a variety of missions. The outcome was a set of principles:

- A common basic ship platform.
- Closely defined roles to enable the containers to be designed.
- A series of containerised modules, requiring the shortest possible role-changing time.
- The ship command team to be assembled in one room.
- A distributed command and control system (a prerequisite for the quick exhange of modules).
- An operator's standard workstation.
- Reduced crew.
- Reduced onboard maintenance.
- Reduced life-cycle costs.

The standard console of the Standard Flex C³I system. The number of positions varies between three and six depending on the role. The system is based on an Ethernet (IEEE 802.3) duplicated databus, with intelligent modes serving as subsystem gateways. All software is written in Ada and there are now some 1.5 million source lines of codes (RDanN)

Ship platform

The ship platform has a full load displacement of 450 tonnes and is constructed using the Glass Fibre-Reinforced Plastic Sandwich (GRP-sandwich) method, in which PVC cellular core plates are laminated on both sides with several layers of glass fibre mats wetted with polyester resin. In combination with decks and bulkheads, this produces a very rigid shell, with good thermal insulation, and which is 20 per cent lighter than a traditional steel ship of the same size.

The platform includes all the services common to all roles, such as propulsion, machinery control, surveillance radar and gunfire-control system. There are also four container positions for the special-role modules: one on the foredeck and three aft.

Containers

The containers, which are constructed of Non-Magnetic Stainless Steel, are 3.5 × 3.0 × 2.5 m (11.5 × 9.8 × 8.2 ft) in size and have two sets of standard interfaces for the supply of power, video, LAN, intercom, fire warning, Halon supply, degaussing, and fresh- and seawater supplies. There are two types of container. The gun is fitted to an open-sided container, while most other modules are fitted into a closed container. There is also a simple deck plate to cover the hole if no container is fitted. The containers all have standard lifting attachments and have a precision-machined flange to ensure accurate alignment when bolted to the corresponding deck flange.

Additional items

In addition to the containers, there are a number of other items which are part of the overall system:

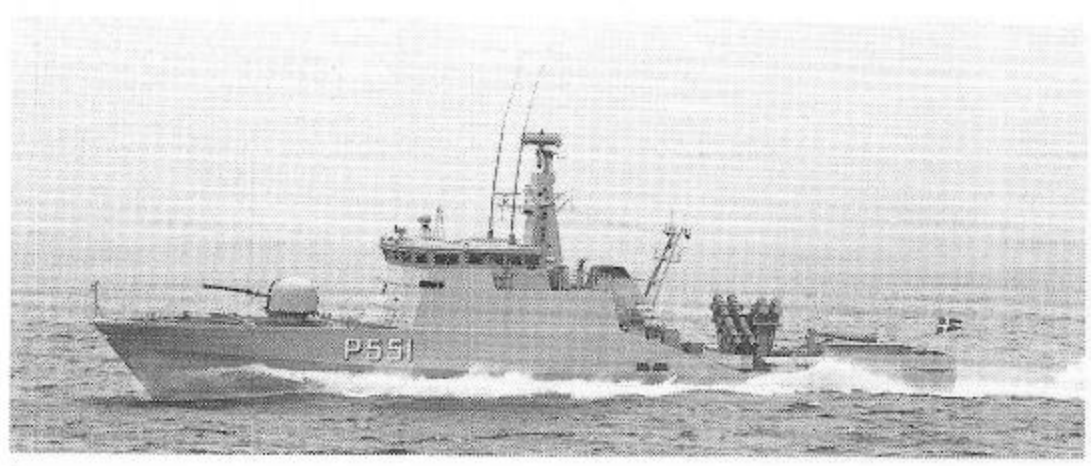
- Mine rails for use in the minelaying role.
- Surface Auxiliary Vessel (SAV) for use in the MCMV role.
- Mine destruction vehicle, also for use in the MCMV role.
- Rigid inflatable boat (RIB).

Role changing

It takes less than 12 hours to change roles, using a dockside mobile or stationary crane. This time includes: exchanging the necessary containers; off-loading unwanted supplies, ammunition and missiles

A

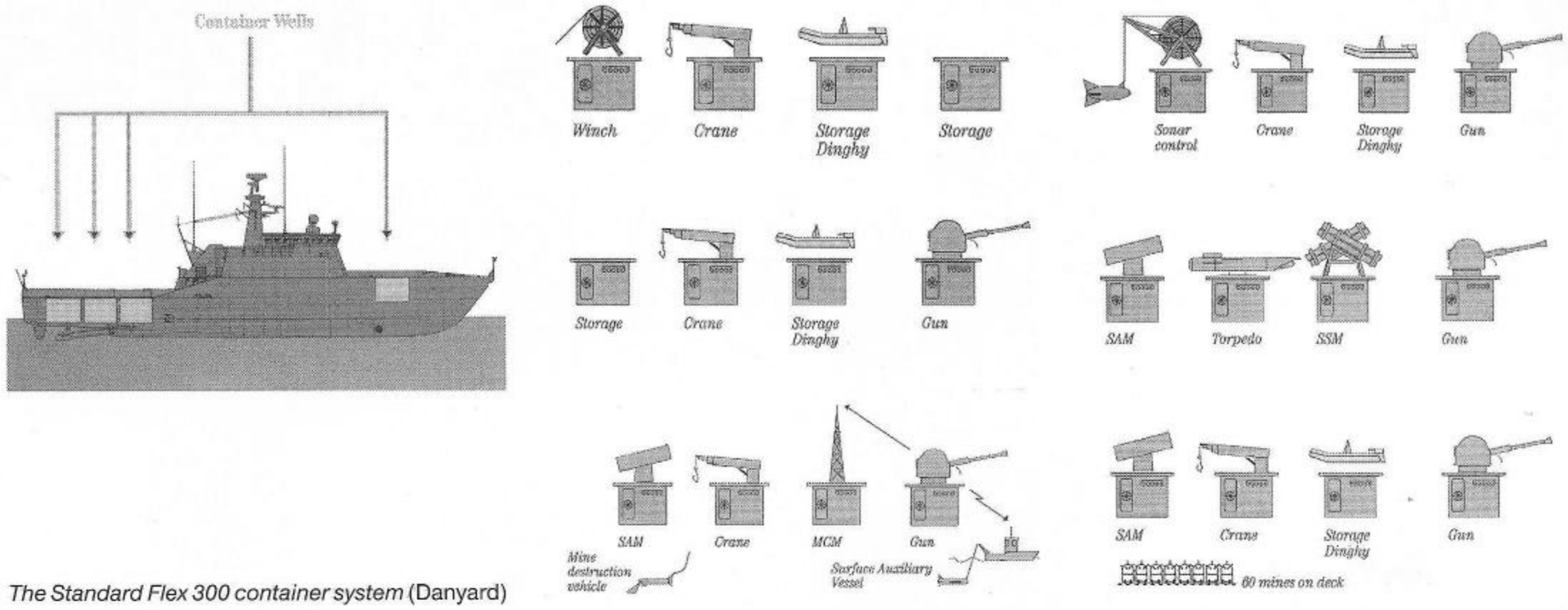
B



C

D

The variety of roles which can be fulfilled by the STANFLEX 300 system: **A** Makrelen *(P 544), fitted as a hydrographic survey vessel with 76 mm gun, crane module and an ISO-containerised survey/communications unit* **B** Flyvefisken *(P 550) as a patrol ship with a gun, crane module and RIB* **C** Hajen *(P 551) in the surface warfare role, with 76 mm gun, a full outfit of eight Harpoon anti-ship missiles and a crane. The intended Sea Sparrow SAM modules have yet to be procured* **D** Støren *(P 555) in the ASW role with gun, crane and VDS* (All pictures RDanN via Hans Harboe-Hansen)



The Standard Flex 300 container system (Danyard)

and restocking with those necessary for the new role; inputting the necessary new system software; and pre-sailing checks.

Roles

The current ships and containers are designed to fulfil seven major roles:

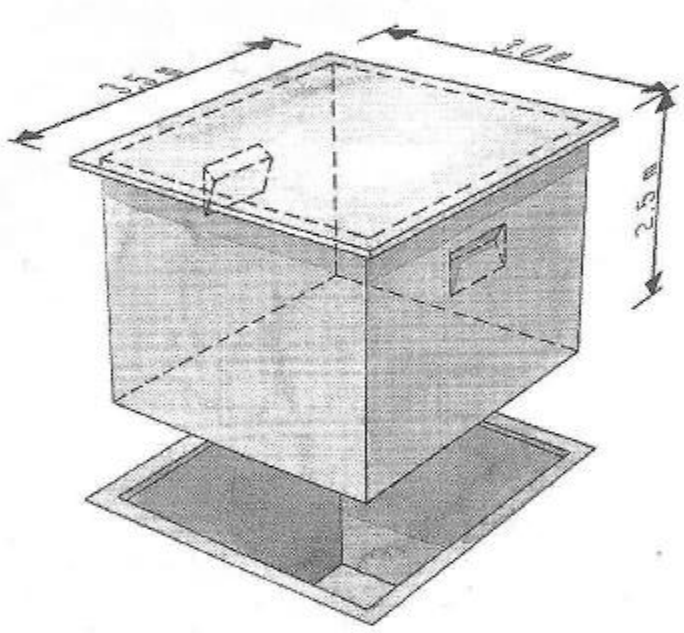
- Anti-surface warfare.
- Minelaying.
- Mine countermeasures.
- Surveillance (for example, EEZ patrols).
- Mine countermeasures (MCM).
- Anti-submarine warfare.
- Anti-pollution.

Coverage

The combat unit and ASW unit are described below, while the MCMV and minelaying versions are described in the relevant sections elsewhere in this volume.

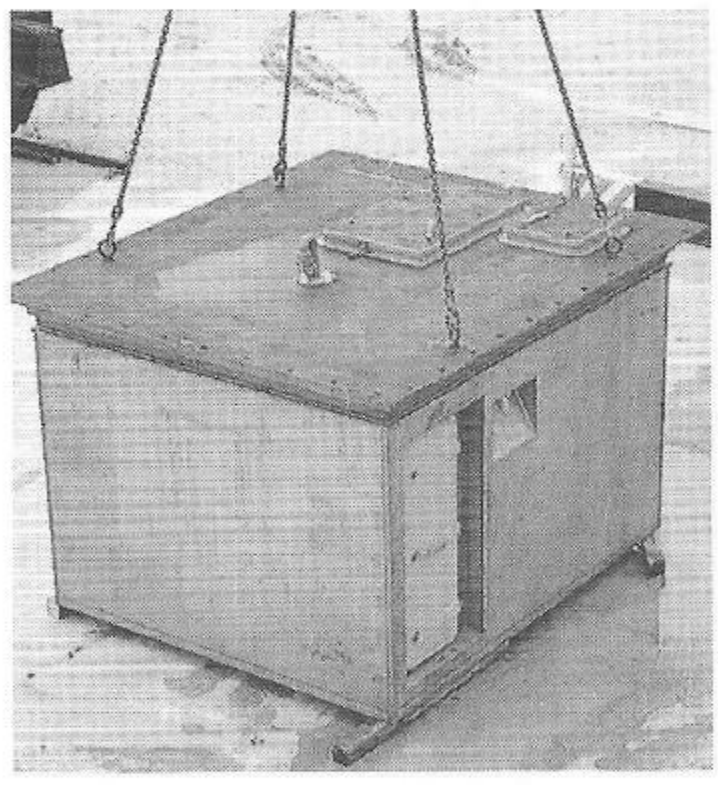
Current position

With the commissioning of the fourteenth ship in May 1996, platform procurement came to an end but module procurement continues. DKr276 million (US$47 million) have recently been released for MCM systems numbers four and five, while other equipments such as Vertical Launch Sea Sparrow Harpoon and ASW systems remain in the plan.



A

B

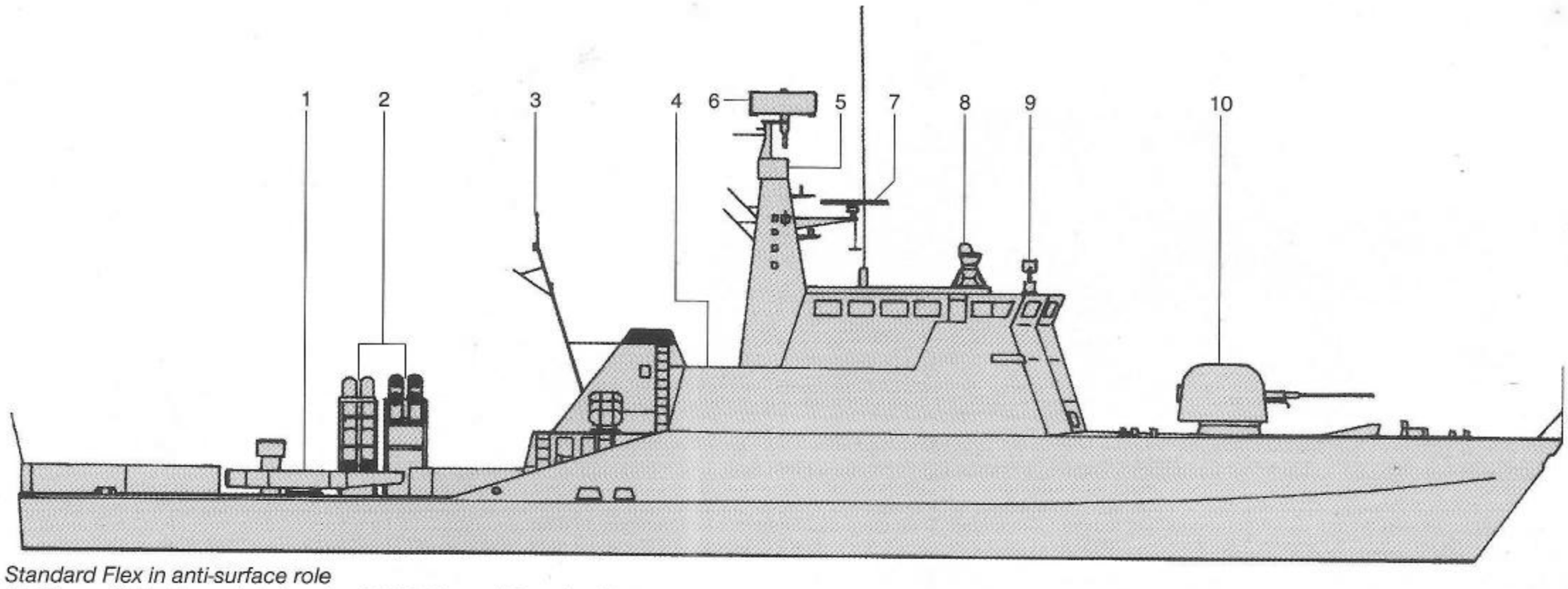


C

D

Containers **A** *have standard measurements and are either open-sided* **B** *or closed* **C** *. There is also a simple deckplate if no containers are being used. Containers are changed using mobile cranes* **D** *and static cranes; it takes under an hour to change each container and the entire platform can be reroled and tested in less than 12 hours* (Danyard)

FLYVEFISKEN (STANFLEX 300)



Standard Flex in anti-surface role
1 *533 mm (21 in) torpedo tubes (two)* **2** *McDonnell Douglas Harpoon anti-ship missiles (eight)* **3** *Radio antennas* **4** *Thorn EMI Sea Gnat decoy launcher* **5** *Racal Sabre ESM* **6** *AEG-Telefunken TRS-3D air/surface search* **7** *Terma Pilot navigation radar* **8** *Electro-optic fire director* **9** *Searchlight* **10** *OTOBREDA 76 mm (3 in)/62 Super Rapid automatic gun*

GENERAL SPECIFICATIONS

Operator: Denmark
Type: Stanflex 300

Class: FLYVEFISKEN

Built: 14
Active: 14
Building: 0

Displacement:
light: 320 t
full load: 450 t

Dimensions
Length: 54 m (177.2 ft)
Beam: 9 m (29.5 ft)
Draught: 2.5 m (8.2 ft)

Speed: 30 kts (20 on diesels, 10 on hydraulic propulsion)
Range: 2,400 n miles at 18 kts

Complement: 19 to 29, depending on role (4 officers)

SHIPS

FLYVEFISKEN (P 550)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 19 Dec 1989

HAJEN (P 551)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 19 Jul 1990

HAVKATTEN (P 552)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 1 Nov 1990

LAXEN (P 553)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 22 Mar 1991

MAKRELEN (P 554)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 1 Oct 1991

STOREN (P 555)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 24 Apr 1992

SVAERDFISKEN (P 556)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 1 Feb 1993

GLENTEN (P 557)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 29 Apr 1993

GRIBBEN (P 558)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 1 July 1993

LOMMEN (P 559)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 21 Jan 1994

RAVNEN (P 560)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 17 Oct 1994

SKADEN (P 561)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 10 Apr 1995

VIBEN (P 562)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 15 Jan 1996

SOLOVEN (P 563)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 2 Apr 1996

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas Harpoon

A total of eight Harpoon active radar homing anti-ship missiles is fitted on the 'Flyvefisken' class when in attack mode. Internally, the Harpoon is divided into guidance, warhead, propulsion and control sections and an integral booster. The guidance compartment has the Texas Instruments PR-53/DSQ-28 J-band active radar seeker with flat, phased-array antenna which may be rotated 90°. Behind it is the mid-course guidance unit which includes a Lear Siegler three-axis attitude reference platform and an IBM 4PiSP-OA 16-bit digital computer which acts as the autopilot. The Honeywell or Kollsman AN/APN-194 radar altimeter has a transmitter antenna in this compartment and a receiver antenna in the warhead compartment. The Block 1B system, introduced in 1982, featured improved ECCM performance while in the Block 1C, introduced in 1985, there were a number of improvements to the range, fuze and seeker. The sea-skimming performance was improved, the missile was capable of an indirect approach to the target by means of way points and the seeker had enhanced ECCM performance.

The Mk 141 launcher, fitted to the 'Flyvefisken' class, features shock resistant and thick wall assemblies which are usually used in larger vessels. Each has a support structure while the front ends of the launcher tubes are held by a clamp frame assembly. The central and rear ends are held by stacking frames with the thick wall assemblies providing armour protection for the missiles against fragments.

After the missile is launched and the booster carries it to an altitude of 430 m (1,410 ft), the turbojet is activated and the booster is jettisoned. The missile may be launched to engage targets at 180° to the platform's course.

In the Block 1A and Block 1B the missile then descends to its cruising altitude and, at a point preset by the launch platform, activates its seeker to acquire and designate the target. The Harpoon can fly one of

Glenten *(P 557) in the anti-surface role. Note that only four Harpoons are fitted and the Sea Sparrow module is not fitted at all* (Sovuernets Materielkommands via Hans Harboe-Hansen)

three fixed patterns (large, medium and small) or one variable search pattern. In the terminal phase the Block 1A missiles would then climb suddenly at a distance of about 0.9 n miles (1.8 km) from the target to make a 30° dive attack upon the target. The seeker is believed to optimise the horizontal radar cross-section but is adjustable. In both systems this terminal phase is an option and sea-skimming is the other option. The Block 1C has a similar performance to the Block 1B but has a number of additional options. It can fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses and it can approach the target indirectly by means of a preselected waypoint (the missile being capable of three waypoint course changes with turns greater than 15°). Approaching the target, it can use selectable seeker search expansion patterns and for the terminal phase it has the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
(Block 1A-C)
Length:
with booster: 4.63 m (15.2 ft)
without booster: 3.84 m (12.6 ft)
Diameter: 34 cm (13.3 in)
Wing span: 83 cm (32.6 in)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 50 n miles (92 km) (1A/B); 67 n miles (124 km) (1C)
Warhead: 221.6 kg (488.5 lb)
Guidance: Inertial and active radar

Manufacturer/Contractor
McDonnell Douglas, USA.

SURFACE-TO-AIR MISSILES (SAM)

Mk 48 Mod 3 launcher for Sea Sparrow
The Mk 48 system is designed to provide hemispheric coverage, a higher rate of sustained fire power and increased reliability in a flexible, modular system which requires lower manning levels. However, there is no provision for underway replenishment.

The system consists of a number of Mk 164 vertical launcher groups with launcher canisters, a Mk 220 missile launch controller and a Mk 63 Shipboard Mounting Interface-Electrical (SMI-E). The system prime contractor is Raytheon with the SMI-E provided by Denmark's NEA-Lindberg. The Shipboard Mounting Interface-Mechanical (SMI-M) is provided by Canada's EBCO, the Mk 20 canister by Belgium's Bronswerk and the Mk 220 missile launch controller by the Netherland's MBLE.

The Mk 164 launcher group consists of pairs of aluminium honeycomb launcher canisters, each 3.97 m (13 ft) long, attached to an aluminium framework. Each container has its own efflux system. The Mod 3 system consists of an in-decks module of six canisters with the six efflux pipes in a line between them.

There is one Mk 220 launch-controller for every 16 missiles. This deck-mounted system weighs 374 kg (824.5 lb) and is 61 × 101.6 × 132 cm (2 × 3.3 × 4.3 ft) (width × depth × height). There is one bulkhead-mounted Mk 62 SMI-E for every four missiles. It weighs 109 kg (240 lb) and is 68.5 × 45.72 × 91.44 cm (2.2 × 1.5 × 3 ft) (width × depth × height).

Specifications
Mod 3 launcher
Length: 4.95 m (16.2 ft)
Width: 3.76 m (12.3 ft)
Depth: 2.84 m (9.3 ft)
Weight:
above deck: 7.956 t
below deck: 340 kg (749.5 lb)

Manufacturer/Contractor
Raytheon Company, Equipment Division, US (prime).

Sea Sparrow missile
The following description is of the latest production version of the missile, RIM-7P, which is typical of all production Sea Sparrows. The missile has a slim cylindrical body with pointed nose, and clipped delta planform wings midway along the body in a cruciform configuration. The wings, made by Titech Inc, have hinge fairings halfway along their length to allow them to fold. Four smaller clipped delta planform fins are at the end of the body.

In the front of the body is the guidance and control section which includes a Raytheon inverse monopulse semi-active radar seeker with a digital computer. Elements of the seeker are made by Trak, Microsonics and M/A Com while the computer is reprogrammable to enable the missile to operate in changing ECM conditions. The computer provides the missile with both a proportional navigation capability as well as a substantial improvement in seeker performance allowing sea-skimming targets to be detected in conditions of heavy clutter.

Behind the control and guidance section is the warhead which ends at the wing's leading edge. The 38.6 kg (85 lb) WAU-17/B blast fragmentation warhead is manufactured by the Naval Weapons Center, Crane, and uses a dual-purpose proximity impact fuze. Behind the warhead is the hydraulic actuation system with Eagle Picher battery and Moog valves. In the rear of the missile is the Hercules/Aerojet Mk 58 Mod 4 solid propellant booster-sustainer with remote safety and arming.

For vertical launch applications a Jet Vane Control (JVC) unit weighing 15.8 kg (34.8 lb) is attached to the rear of the missile. The JVC consists of a strapdown inertial reference system, a digital microprocessor with supporting analogue package and an autonomous actuation system. The system operates four jet vanes and it is powered by a thermal battery.

The RIM-7M incorporated the solid-state onboard computer with larger rocket motor and the 39 kg (89 lb) warhead. Two versions exist; RIM-7M (F1-build) and RIM-7M (H-build), these differ only in the software used in their hardware processors.

The RIM-7P, which succeeded the RIM-7M on the production lines in 1991, has a Missile-Borne Computer (MBC) to control overall missile performance and to link the major missile subsystems. It features Electrically Erasable Programmable Read Only Memory (EEPROM) chips to assist easy reprogramming as well as advanced guidance algorithms and double the processing speed. The missile has an improved low-altitude guidance mode and enhanced sub-clutter performance against very low-altitude targets. Other features include a 38.6 kg (85 lb) warhead with new fuze for low-altitude use, a command uplink, sample data homing and multiple target designation. On the 'Flyvefisken' class it is used with the 9LV Mk 3 command and weapon control system.

Specifications
Length: 3.66 m (12 ft)
Diameter: 20.3 cm (8 in)
Wing span: 1.02 m (3.3 ft)
Weight: 231.5 kg (510 lb)
Speed: Mach 1
Range: 8 n miles (14.8 km)
Guidance: Semi-active radar

TUBES

21 in (533 mm) tubes for Type 617 torpedoes
2 tubes for Bofors Underwater Systems Type 617 heavyweight wire-guided torpedoes fitted in attack mode. The Type 617 is based on the Tp61 and retains the same thermal propulsion system with hydrogen peroxide/acohol/water as the propellants.

Specifications
Length: 6.98 m (22.9 ft)
Diameter: 533 mm (1.7 ft)
Weight: 1,860 kg (4,100 lb)
Warhead: 250 kg (551 lb)
Speed: 25 kts
Range: 20,000 m (65,617 ft)
Propulsion: High Test Peroxide (HTP)

Manufacturer/Contractor
Bofors Underwater Systems, Sweden.

GUNS

OTOBREDA 3 in (76 mm)/62 Super Rapid
Single dual-purpose main gun usually fitted forward.

The 62 calibre barrel is of two-part construction consisting of the tube and a liner with rifling consisting of one turn in 30 calibres. It is 4.7 m (15.4 ft) long and weighs 765 kg (1686.5 lb) of which the liner is 324 kg (714.3 lb). The whole gun is 5.28 m (17.3 ft) long and features a vertically sliding breech, a small multihole muzzle brake, a fume extractor and an automatic salt water spray cooling system based upon a 7 kg/cm² spray with 2-4 kg/cm² fresh water flushing. The MMI mounting is protected by a watertight, splinter-proof shaped shield with the gun's director on the left-hand side at the front. Ammunition is fed from a magazine containing 15 rounds, each of which is moved by a feeding system which can be from 2.5 to 11 m (8.2 to 36 ft) long to the loading tray where it is automatically rammed into the breech. The mounting is normally under local electrical and hydraulic control but may be controlled remotely if required. The mounting weighs 12 tonnes. The 76/62 Compact can fire 80 rounds without reloading and the rate of fire is adjustable from 10 to 85 rds/min.

The Super Rapid mounting is similar in design, dimensions and weight to the Compact. It features upgraded hydraulic motors for the feed and hoist systems, rocker arms made from titanium, a redesigned feeder device and loading tray which move shorter distances for faster action. There is also a new digital console with plasma display for gun control.

Specifications
Elevation: −15 to +85° at 35°/s
Training speed: 60°/s
Weight (unloaded): 8 t
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 120 rds/min
Range: 8.5 n miles/15.75 km

Manufacturer/Contractor
OTOBREDA, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Sabre ESM System

SABRE is a modular, high-performance naval radar intercept (ESM) system covering the 0.5 to 18 GHz frequency range. It is configured to address a wide range of surface ship electronic warfare requirements, including threat warning, surveillance, identification, intelligence gathering and targeting. It uses the Racal Sadie processor and advanced antenna techniques to achieve a high specification and operational flexibility. The system is fully modular in design with options available to extend its performance to satisfy future operational requirements. The system has a bearing accuracy of 2°, which is one of the reasons for its selection by the Royal Danish Navy, which required a great degree of precision in the cluttered waters in which these ships operate. The system is fully integrated with the ship's AIO and ECM systems, interfacing with the ship's multifunction consoles through standard bus interfaces.

An advanced ESM processor design using the latest VLSI integrated circuit technology provides fast signal processing and identification in high-density signal environments. The processor tracks 200 radars automatically and provides a continuous update on status to the ESN operator and the command team. Scan analysis is measured on all intercepted transmitters. The ESM library holds 3,000 radar emitter modes and is loaded from a disk unit. An auxiliary library of 250 emitter modes is provided to hold operator-loaded data. The operator's console features twin high-resolution colour displays, a normal keyboard, special function keys and a rollerball. The displays present both graphical information, in either polar or cartesian format, and tabular information of the emitter parameters. Full digital data recording onto magnetic disk is available.

Specifications

Frequency range: 0.5-18 GHz (option to 40 GHz)
Accuracy: 2° RMS
Sensitivity: −60 dBmi
Dynamic range: 60 dB
Pulse density capability: 500,000 pps
Radar store capability: 3,000 modes
Processing time: <1 s

Manufacturer/Contractor

Racal Radar Defence Systems Ltd, Chessington, UK.

Ravnen *(P 560) in the surveillance role. Note the RIB on the afterdeck and at the masthead the TRS-3D radar and, below it, the Racal Sabre ESM array* (Jane's/H M Steele)

ELECTRONIC COUNTERMEASURES (ECM)

Racal-Decca Cygnus ECM system

Cygnus is an I/J-band jammer, which uses both responsive noise and deception jamming to provide an effective jamming capability against all types of radar including early warning, target acquisition and missile guidance. Cygnus has a narrow beamwidth giving very high effective radiated power (300 kW) and is kept on target by built-in, interferometer-type, passive tracking system in both azimuth and elevation. The tracking system is also used to relay accurate position data to systems of other ships. RF received by the tracking antennas is also used as the basis of transmitted RF and modulation, and power management is under the control of a processor which also controls the tracking procedure. Types of modulation sequence available include range gate pull off and false target generation.

Manufacturer/Contractor

Racal Radar Defence Systems Ltd, Chessington, UK.

DECOYS

Sea Gnat DL-6T

Two 6-barrelled launchers for chaff and InfraRed (IR) flares.

The Sea Gnat system uses a new control unit, new launcher with 130 mm tubes and new munitions.

The control unit provides for the launching of the most effective combination of rounds for distraction and centroid/seduction giving the type, speed and direction of the threat, the ship's speed and heading as well as wind direction and speed.

The munitions involved are the Mk 214 RF seduction and Mk 216 RF distraction rounds, which are provided by Chemring Ltd. A Mk 218 IR seduction round was expected to enter service in 1995.

Manufacturers/Contractors

Thorn EMI, UK.
AB Precision, UK.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

CelsiusTech 9LV Mk 3

The 9LV 200 Mk 3/9SCS Mk 3 or 9LV Mk 3 command systems are based upon Bassystem 2000 (or BS 2000 with FS2000 as the naval version) with hardware and software modules used to create flexibility with real-time processing in both the short and long term. The systems have a distributed architecture and are based upon a 32-bit computer using Motorola 68020 and 68040 microprocessors and Ada-language software, workstations and Ethernet IEEE 802.3 standard local area networks. Memory consists of 4 MByte RAM and 256 k of Erasable Programmable Read Only Memory (EPROM). The hardware is used to create nodes which may be workstations, processing or interface nodes with a network interface, one or more processing units, power supply, local PROM, and appropriate interfaces. Memory management is by means of the Motorola 68851 while the floating-point processor is the Motorola 68881. All the software programs run independently but communicate through an Inter-Program Communication 2000 (IPC2000) mechanism. The software is in Ada and the basic system has about 500,000 lines of code but this is usually more than doubled to meet added requirements.

Each system consists of a dual-redundant local area network which interfaces with all sensors, weapon systems and workstations. The system is supported by two processor units (one redundant) which provide command, communications and control as well as a database. The systems are capable of acting as a data handling system compiling the tactical situation,

conducting threat evaluation and target designation as well as providing navigation and offboard sensor data (the latter via a datalink) while recording and providing a simulation capability. The fire-control radar is Celsius-Tech's Sea Viking director, which acts as a stand-alone system with servo-controlled pedestal, tracking and ballistic computer. This can control not only guns but also surface-to-air missiles. It can control different weapons in sequence and has an automated air defence function for use against multiple targets. It takes sensor data, evaluates the threat and automatically deploys the most effective hard or soft kill countermeasure to neutralise each target.

The Sea Viking tracker can weigh up to 700 kg (1,543 lb). The prime sensor is a tracking Ku/J-band radar with stabilised cassegrain monopulse antenna and travelling-wave tube transmitter which operates in the 15.9-17.1 GHz frequency range and permits the combination of pulse Doppler-MTI operation with batch-to-batch frequency agility. Pulse-to-pulse frequency agility is retained for use when return suppression is not required. The radar may be supplemented by a range of electro-optical sensors including a Si-Vidicon CCIR-compatible TV camera with 300 mm lens and 42 × 31 mrad field of view, an 8-12 µ infra-red camera using Cadmium Mercury Telluride detectors with closed-cycle Sterling cooling and fields of view of 52 × 35 mrad and 157 × 105 mrad. There may also be a 1.06 µ Nd:YAG laser rangefinder with a peak power of 4MW and a PRF of 10 Hz.

Also available is an independent G/H or C-band and I/J or X-band search radar with parabolic, horn-fed stabilised 2.4 × 1.0 m antenna. This also has a travelling-wave tube transmitter and operates in the 5.4-5.9 GHz and 8.5-9.6 GHz frequencies. An optional I/J-band magnetron transmitter is also available.

The Mk 3 system retains the horizontal tactical situation compilation display used in the Mk 1 systems although with improved electronics and its own secondary database. On the 'Flyvefisken' class, the prime HCI consists of Terma Standard Consoles (SCL), which use Motorola 68020 and 68040 microprocessors on a VME bus. The Type I was designed for the SF 300 C3 system and is a one-man console with two 53.34 cm (21 in) 1,024 × 1,224 pixel raster scan displays which can present radar, tactical situation, graphics and electro-optic data as well as providing space of 80 columns and 18 lines for alphanumeric data. There may also be provision for internal and external communications facilities (including a telephone). The HCI consists of an LED, a 78-key function panel and two rollerballs. They are low, wide displays designed initially for the Standard Flex ships.

Specifications
(Terma SCL Type 1)
Length: 1.23 m (4 ft)
Width: 1.20 m (3.9 ft)
Height: 1.20 m (3.9 ft)
Weight: 320 kg (705 lb)
Power requirements: 115 V, 60-400 Hz, three phase (2 kVA)
Back-up: 24 V DC (30 VA).

Manufacturer/Contractor
CelsiusTech, Sweden.

RADARS

AEG-Telefunken TRS-3D/16
Initial units were fitted with the Plessey AWS-6, but later units have the AEG-Telefunken TRS-3D/16, which is also being backfitted into the earlier ships. TRS-3D/16 has a large rectangular antenna angled at about 35°. It is a frequency agile set operating in the C-band.

Terma Scanter
I-band surface search radar.

Furuno
I-band navigation radar.

SONARS

CelsiusTech CTS-36
A hull-mounted, high-frequency active search sonar.

Thomson Sintra TSM 2640 Salmon
Variable Depth Sonar (VDS) medium frequency for ASW. The Salmon is a compact sonar designed for shallow water ASW. The basic version consists of an acoustic array of 24 staves housed in a streamlined fish. Embedded facilities include passive listening, sound ray tracer, integrated onboard simulator, and acoustic propagation prediction.

Specifications
Acoustic array: 24 identical staves of 7 transducers
Weight: 260 kg (573 lb)
Frequency: 19 kHz approximately.
Transmitter: Omnidirectional transmission in CW and FM modes
Receiver: 36 preformed beams; advanced processing coherent in FM with pulse compression and spectrum analysis (FFT) in CW

Manufacturer/Contractor
Thomson Sintra ASM, France.

PROPULSION

Specifications
System: Combined diesel and gas turbine (CODAG)
Main machinery: 1 GE LM500 gas turbine on centre shaft; 2 MTU 16V 396 TB94 diesels on outer shafts; plus auxiliary propulsion by hydraulic motors on outer gearboxes (hydraulic pumps driven by 1 GM 12V-71 diesel)
Power output: 5,450 hp (4.1 MW) from gas turbine; 5,800 (4.26 MW) from diesel engines; 500 hp (375 kW) from diesel for hydraulic pumps.
Shafts: 3

FURTHER INFORMATION

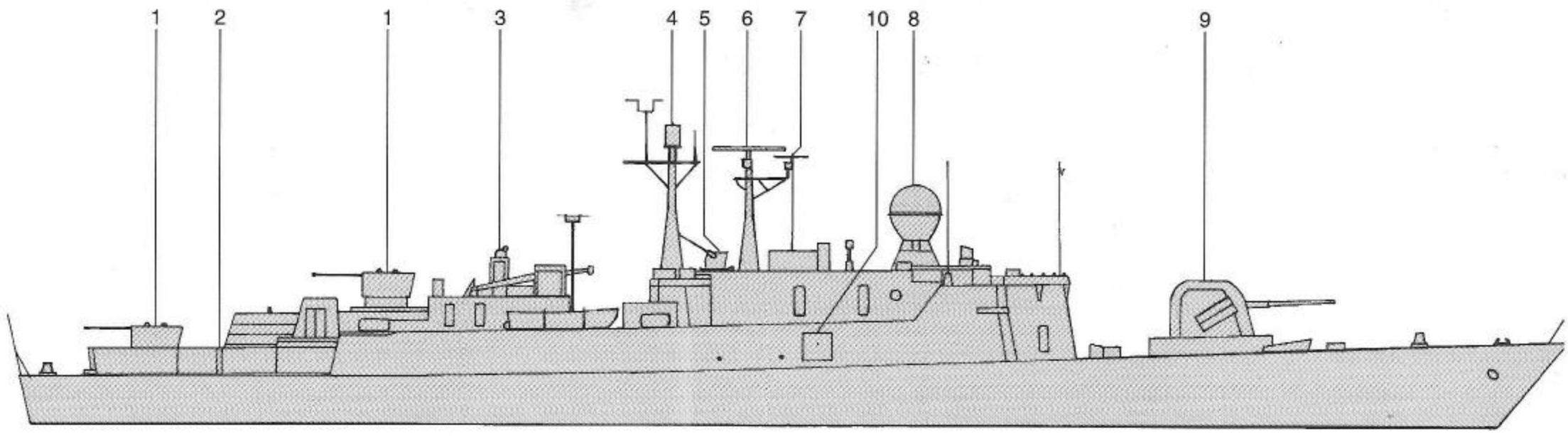
PROGRAMME

Standard Flex 300 has replaced 'Daphne' class (seaward defence craft) and 'Soloven' class (fast attack craft torpedo) and will replace 'Sund' (MCM) class. The first batch of seven with an option on a further nine was contracted with Danyard on 27 July 1985 with the second. This total of 14 is two less than the 16 originally planned.

OPERATIONAL

All vessels can be fitted out as patrol craft; the planned number of outfits for the other roles are: attack role 10; MCMV six; minelayer eight. In general, outfits can be changed within a few hours. Outfits for non-military tasks such as pollution control and hydrographic survey have also been developed.

TURUNMAA



Turunmaa (Ian Sturton)
1 *Bofors twin SAK 40/70-350 automatic guns* **2** *Exhaust trunks* **3** *CelsiusTech EOS-400 optical director* **4** *ARGOSystems EMS radar intercept* **5** *Russian twin 23 mm/87 (two)* **6** *Terma 20T 48 super surface search radar* **7** *Raytheon ARPA navigation radar* **8** *Signaal WM22 fire control* **9** *Bofors single TAK 120 mm (4.7 in)/46 gun* **10** *RBU-1200 ASW rocket launcher (behind door)*

GENERAL SPECIFICATIONS

Operator: Finland

Class: TURUNMAA

Built: 2
Active: 2

Displacement:
standard: 660 t
full load: 770 t

Dimensions
Length: 74.1 m (243.1 ft)
Beam: 7.8 m (25.6 ft)
Draught: 2.4 m (7.9 ft)

Speed: 35 kts (17 kts diesel) (12 kts gas turbine alone (see Further Information))
Range: 2,500 n miles at 14 kts

Complement: 70

SHIPS

TURUNMAA (03)

Builder	Wärtsilä, Helsinki, Finland
Laid down	Mar 1967
Launched	11 Jul 1967
Commissioned	29 Aug 1968

KARJALA (04)

Builder	Wärtsilä, Helsinki, Finland
Laid down	Mar 1967
Launched	16 Aug 1967
Commissioned	21 Oct 1968

WEAPONS SYSTEMS

GUNS

Bofors TAK 120 mm (4.7 in)/46

There is a single Bofors 120 mm (4.7 in) gun in 'A' position on the foredeck, which is capable of firing 80 rds/min to a range of 10 n miles (18.5 km). The turret is also fitted with 103 mm (4 in) rails for illuminants. The water-cooled TAK 120 L/46 has two feed tables each holding six rounds, located on the sides of the automatic loader and beneath the ammunition compartments; they can be fed from either magazine, permitting the loading of two different kinds of ammunition. The gun is normally served by two loaders and an operator; during manual operation the operator acts as the layer in training, while an additional man is responsible for elevation.

Specifications
Calibre: 120 mm
Length of barrel: 46 calibres
Muzzle velocity: 800 m/s (2,625 ft/s)
Traverse: 360° at 40°/s
Elevation: −10 to +80° at 32°/s
Mounting weight: 28.8 t
Crew: 3-4
Range: 10 n miles (18.5 km)
Rate of fire: 80 rds/min/barrel

Manufacturer/Contractor
Bofors, Sweden.

Bofors SAK 40L/70-350

Two single Bofors 40 mm anti-air guns are mounted. The SAK 40L/70-350 mounting is equipped with electrohydraulic laying machinery and is remotely controlled from a central fire-control system or an optical director. It features gyrostabilised local control with hand-cranks for emergency use. Junction boxes for power, remote control and communications are built into the mounting.

Specifications
Mounting
Weight (unloaded): 2.89 t
Traverse: Nominal 360°
Elevation: −9° to +85°
Training speed: 85°/s
Elevation speed: 45°/s
Crew: 4
Power requirements: 440 V, 3 phase, 60 Hz

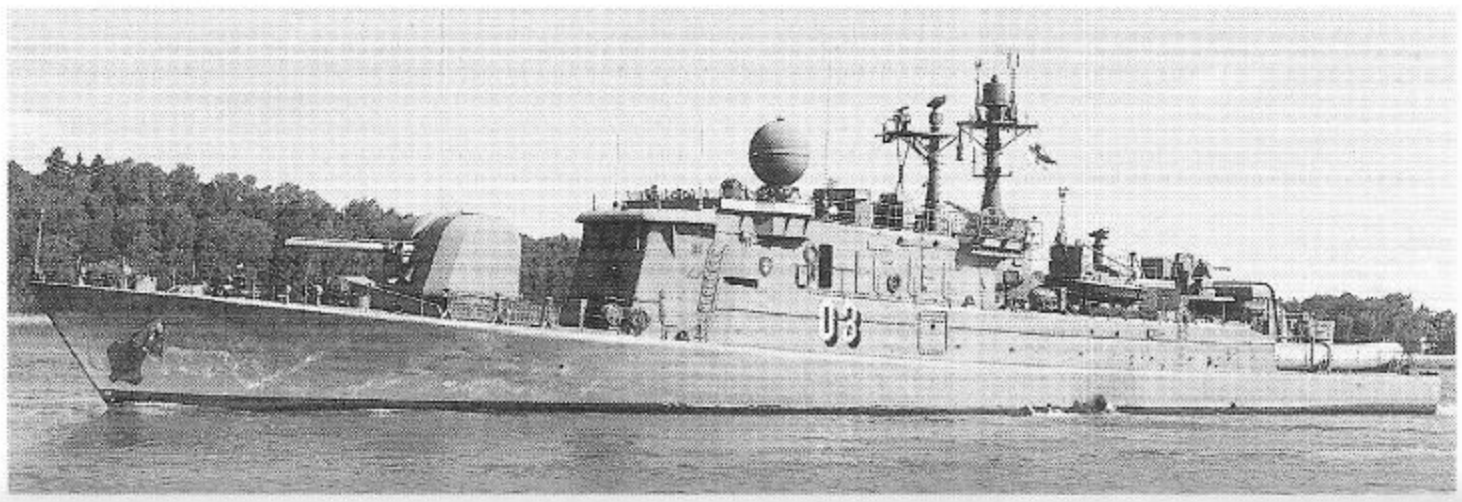
Specifications
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000-1,025 m/s (3,280-3,362 ft/s)
Range:
anti-surface: 6.75 n miles (12.5 km)
anti-air (nominal): 6,900 m (22,600 ft)
Rate of fire: 300 rds/min (practical)
Ammunition: 2.21 kg (4.87 lb)

Manufacturer/Contractor
Bofors, Sweden.

Russian 23 mm/87 (2 twin)

There are two twin ZU-23-Sako mountings in the 'Turunmaa' class consisting of two guns installed one above the other in separate cradles and on their sides so that it is fed from the side. The guns have air-cooled barrels of monobloc construction with flash suppressors at one end and an exposed spring recuperator wrapped around the barrel near the breech. The mounting, which is 1.2 m (4 ft) high, 1.6 m (5.2 ft) long (excluding the barrel) and 1.5 m (4.9 ft) wide, may be either hydraulically or manually operated. With ammunition the mounting weighs 1.735 tonnes and it has two on-mount operators and five loader-carriers.

Specifications
Calibre: 23 mm
Length of barrel: 87 calibres
Traverse: 360° at 80°/s
Elevation: −15 to +80° at 50°/s
Rates of fire: 200 rds/min/barrel
Projectile: 0.19 kg (0.4 lb)
Range:
anti-surface: 1.1 n miles (2 km)
anti-air: 1,500 m (4,920 ft)



Turunmaa *(03). The square door some 2 m (7 ft) aft of the pennant number houses the RBU-1200 ASW rocket launcher* (Pär-Henrik Sjöström)

ANTI-SUBMARINE MORTARS

RBU 1200

Two Russian RBU 1200 launchers are in fixed mountings inside the main deck superstructure (they are immediately abaft the pennant number). RBU 1200 is believed to have a range not exceeding 1,200 m (3,936 ft).

Specifications
Length: 1.4 m (4.59 ft)
Range: 1,200 m (3,936 ft)
Warhead: 34 kg (75 lb)

DEPTH CHARGES

There are two depth-charge racks.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

ARGOSystems

There is an ARGOSystems radar intercept equipment.

DECOYS

ML Aviation Barricade countermeasures system

Superbarricade launchers are being fitted in these ships. Superbarricade is an improved version of the widely used Barricade system and provides ships with means of deploying chaff and infra-red (IR) decoys to counter missile attacks, using a layered defence against the various types of anti-ship missile. The system uses a 102 mm rocket and a redesigned launcher with four sets of triple-cell launchers. The system has a similar control unit to Barricade Mk III and the same tactical computer. The ammunition lockers each contain 24 rockets. There are four decoy modes:

- confusion, in which long-range (Stockade) rockets are fired to confuse enemy search radar and make target selection difficult
- distraction, in which medium-range chaff and/or infra-red rockets are fired in a pattern of six around the ship to present alternative targets to missiles during their search phase, affording defence against multiple missiles coming from different directions
- dump is used where a missile has locked on to the ship. The ship uses a jammer to remove the missile's range gate and then fires a single rocket to produce a chaff cloud on which the gate may be 'dumped' thus allowing the jammer to be redeployed.
- centroid, is a close-range, final defence mode, used against single missiles. If the incoming missile is locked on to the ship, a pattern of short-range chaff and/or IR rockets is fired to create a large alternative target close to the ship, which manoeuvres away, leaving the missile to home on to the decoy.

Manufacturer/Contractor
ML Wallop Defence Systems, Andover, Hampshire, UK.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Signaal WM22

These ships are fitted with the Signaal WM22 fire-control system, which has two antennas sharing a common, stabilised mounting and housed in a distinctive, egg-shaped radome — the well-known 'Signaal egg' — which is located on the bridge roof. The stabilisation system permits operation at roll angles of ±30° and pitch angles of ±10°. The upper antenna, which is of the cassegrain type, is used for searching as well as for automatic tracking of surface targets for weapon control. The lower antenna is of the paraboloid segment type with horn feed and is used for tracking air targets and for controlling air defence weapons. The antennas are fed from a common I/J-band transmitter but during surveillance all the transmitter output is channelled to the search antenna.

Peak pulse power is 180 kW and output power is shared by waveguide switching. The search radar has a range of between 30 and 32 km (16.2 and 17.3 n miles) against surface targets and 7,600 m (25,000 ft) against air targets, while the tracker has a range of about 15.6 n miles (29 km). With the larger search antenna the search radar is increased to about 25 n miles (46 km). The tracker is capable of monitoring the movement of aircraft with a 1 m² cross-section at velocities up to 900 m/s (2,952 ft/s) and similar size objects moving at or near the surface at maximum velocities of between 34 and 55 m/s (111.5 and 180 ft/s).

The radar can automatically track one air and one surface target simultaneously. For use with the missile, the air target tracking antenna is slaved to the surface target tracking programme and linked with a CW transmitter in order to illuminate the target. It can control a second light- or medium-calibre gun for engaging an air and/or surface target.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

CelsiusTech EOS-400

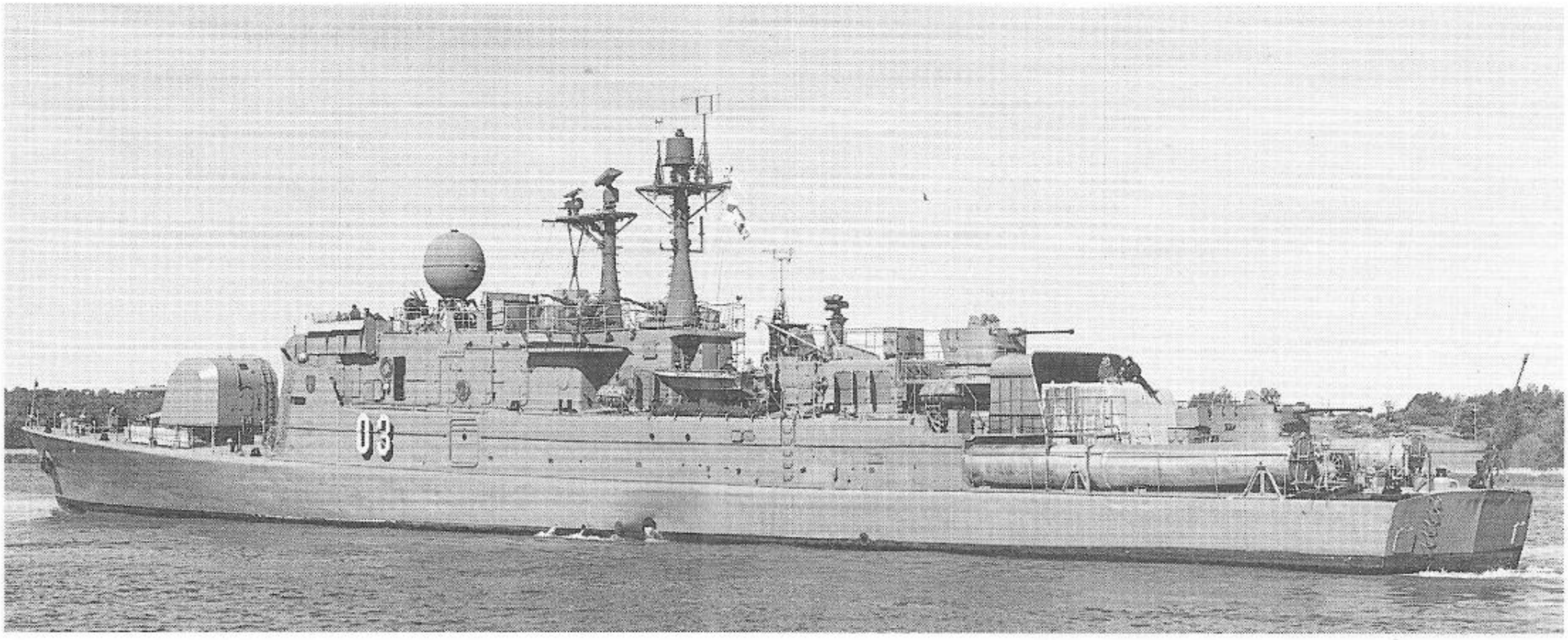
EOS-400 is a TV tracker and laser rangefinder fire director system. Accurate target position is obtained using the Saab television tracker for automatic tracking in conjunction with a laser rangefinder, both units being mounted on a common training and elevating stabilised platform. Below deck, the control/display unit is located in the operations room. The control/display unit contains a TV monitor and a joystick for sensor platform operation, a mode selector, and target data displays. The video output is connected to the platform and the video input to the control/display unit.

The system is capable of tracking one target among several in close formation, tracking when radar tracking is not possible, and either surface or air targets may be tracked. Inputs from other systems include those from the ship's surveillance radar and reference data from the ship's compass. The system calculates ballistics for several guns and gives gun-laying data.

Specifications
Tracking parameters
Training: Unlimited
Elevation: −30° to +85°

Platform
Angular speeds, azimuth and elevation: 150°/s
Angular accelerations: Azimuth 2 rad/s²; elevation 3 rad/s²
Angular transducers: Multispeed synchros
Stabilisation: Rate gyros in 2 axes
Tracking: Digital correlation
Contrast selection: Automatic black/white
Lock on area: Whole field

Daylight camera
Scanning standard: 625 lines
Camera tube: Si-vidicon
Night camera: IR camera optional



Turunmaa *(03). Sensors include the Signaal 'egg' on the bridge roof and on the foremast the Raytheon ARPA navigation radar and Terma 20T 48 surface search radar. At the main masthead are a cylindrical dome housing the ARGOSystems EW antennas, with, behind it, a small log periodic array (with a similar array atop a pole at the forward end of the after deckhouse.) Note also the large, silver exhausts for the gas turbine which can be used to propel the ship on jet propulsion alone.* (Pär-Henrik Sjöström)

Laser rangefinder
Wavelength: 1.06 µm
Repetition rate: 10 Hz
Beamwidth: 1.5 mrad

Director with basic sensors
Height: 1.5 m (4.9 ft)
Width: 1 m (3.28 ft)
Length: 0.8 m (2.6 ft)
Weight: 220 kg (485 lb)

Console
Height: 0.9 m (2.9 ft)
Width: 0.6 m (1.9 ft)
Length: 0.8 m (2.6 ft)
Weight: 75 kg (165 lb)

Optional thermal imager
Cooling: Joule-Thompson minicooler
Field of view: 52 × 35 mrad

Manufacturer/Contractor
CelsiusTech, Sweden.

RADARS

Terma 20T 48 Super
E/F-band surface search radar.

Signaal WM22
I/J-band fire-control radar.

Raytheon ARPA
I-band navigation radar.

SONARS

Simrad hull-mounted sonar
There is a high-frequency active search and attack sonar, which is optimised for operations in archipelagic waters.

PROPULSION

Specifications
System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 Rolls-Royce Olympus TM1A gas turbine, 11.2 MW (15,000 hp); 3 MTU MB diesels 2.2 MW (3,000 hp)
Shafts: 3

FURTHER INFORMATION

PROGRAMME

These ships were ordered on 18 February 1965 and commissioned in 1968.

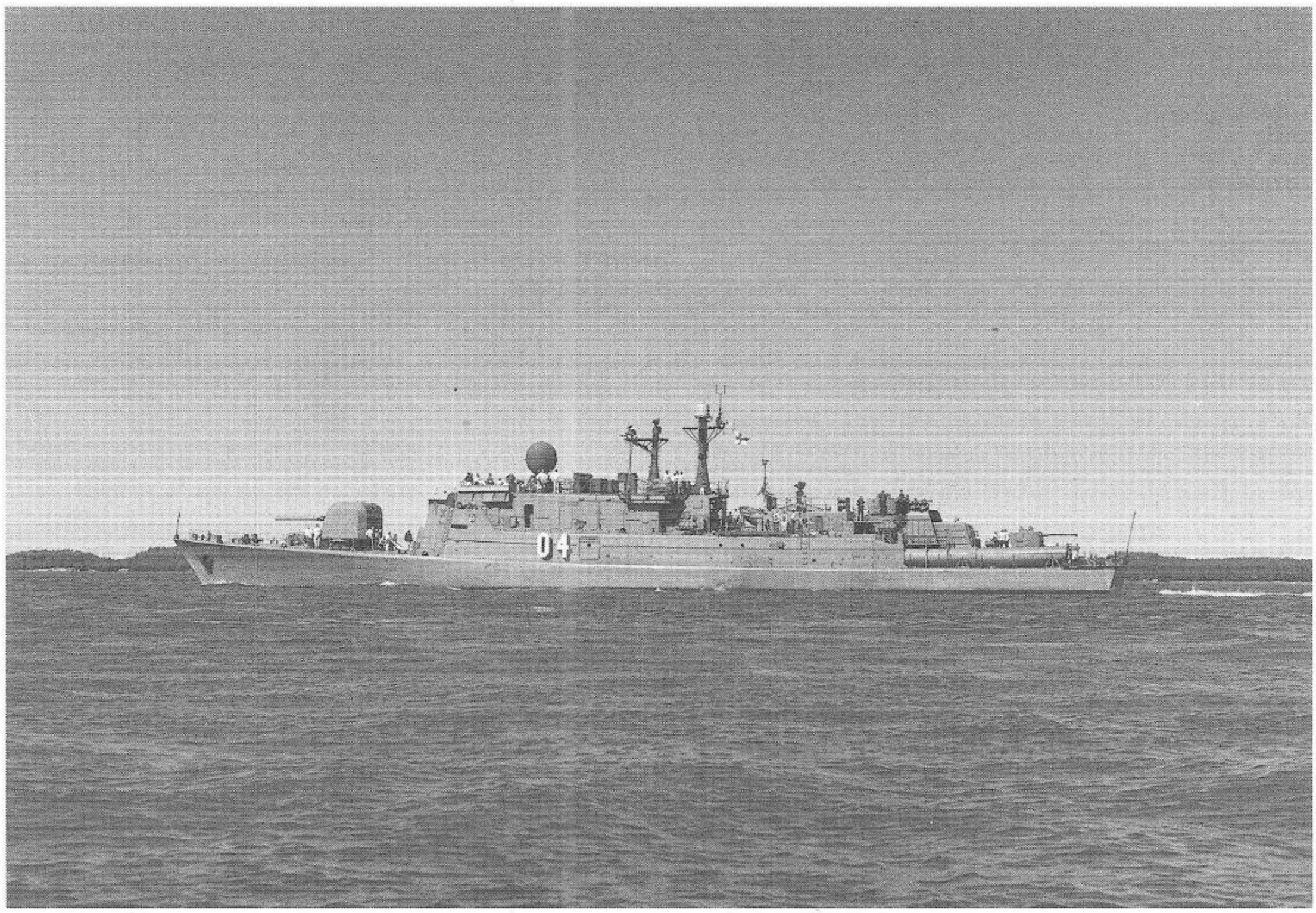
DESIGN

These flush-decked ships were designed and built in Finland. They are fitted with Vosper-Thornycroft roll-damping equipment.

One of the unusual features of these ships is that the large, tubular gas-turbine exhaust trunks are led over the quarterdeck, discharging over the stern, with their plumes coalescing some 15 m (49 ft) abaft the stern. This arrangement enables the ships to be driven at up to 12 knots without the use of propellers.

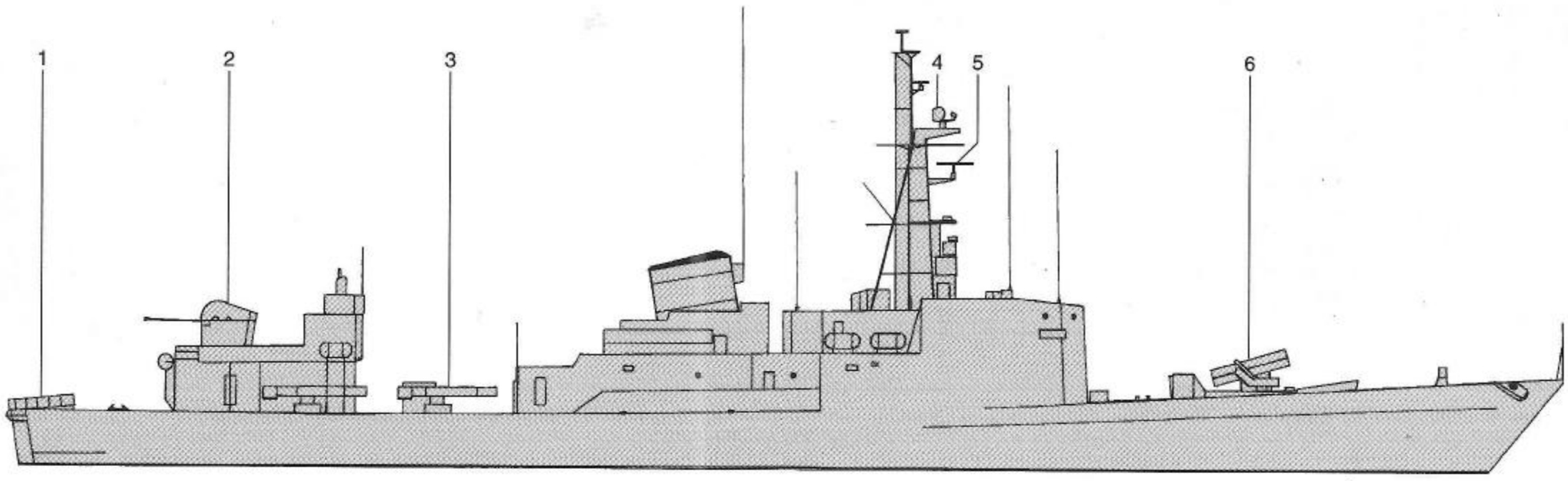
MODERNISATION

Both were completely refitted at the Wärtsilä Shipyard, Turku in 1986, when they were fitted with new equipment, including radars, EW equipment and sonar.



Karjala *(04), one of two corvettes built for the Finnish Navy in 1967-68* (Pär-Henrik Sjöström)

NIKI (THETIS)



Niki (Ian Sturton)

1 *Depth charges* **2** *OTOBREDA 40 mm/70 twin mounting* **3** *533 mm (21 in) torpedo tubes (liners enable 324 mm torpedoes to be launched) (four)* **4** *Thomson-CSF TRS 3001 surface search radar* **5** *Kelvin Hughes 14/9 navigation radar* **6** *Bofors four-tube 375 mm ASW rocket launcher*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Greece
Type: Thetis (Type 420)

Class: NIKI

Acquired: 5
Active: 5

Displacement:
standard: 575 t
full load: 732 t

Dimensions
Length: 70 m (229.6 ft)
Beam: 8.2 m (26.9 ft)
Draught: 2.7 m (8.6 ft)

Speed: 19.5 kts
Range: 2,760 n miles at 15 kts

Complement: 64 (4 officers)

SHIPS

NIKI (P 62)
Builder Rolandwerft, Bremen, Germany
Commissioned (FGN) 1 Jul 1961 (*Thetis* (P 6052))
Recommissioned (Hellenic Navy) 6 Sep 1991

DOXA (P 63)
Builder Rolandwerft, Bremen, Germany
Commissioned (FGN) 12 May 1962 (*Najade* (P 6054))
Recommissioned (Hellenic Navy) 6 Sep 1991

ELEFTHERIA (P 64)
Builder Rolandwerft, Bremen, Germany
Commissioned (FGN) 10 Nov 1962 (*Triton* (P 6055))
Recommissioned (Hellenic Navy) 7 Sep 1992

CARTERIA (P 65)
Builder Rolandwerft, Bremen, Germany
Commissioned (FGN) 16 Dec 1961 (*Hermes* (P 6053))
Recommissioned (Hellenic Navy) 7 Sep 1992

AGON (P 66)
Builder Rolandwerft, Bremen, Germany
Commissioned (FGN) 15 Aug 1963 (*Theseus* (P 6056))
Recommissioned (Hellenic Navy) 8 Nov 1993

WEAPONS SYSTEMS

TUBES

The ships still mount the original four single 533 mm (21 in) torpedo tubes, but these use liners to enable them to launch standard Mk 46 324 mm torpedoes. There are no reloads.

TORPEDOES

Alliant Techsystems Mk 46 Mod 1/5 324 mm torpedoes

Specifications
Length: 2.59 m (8.50 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507.0 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)

GUNS

OTOBREDA 40 mm L/70 twin mounting

The ships can carry either one or two twin 40 mm mounts. The after mount is permanent, but the foredeck mounting can be used for either a second 40 mm/L 70 gun or a Bofors 375 mm anti-submarine rocket launcher.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 600 rds/min/mount
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 6 km (3.25 n miles)
anti-air: 4,000 m (13,120 ft)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Ready rounds: 736
Crew: 2

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy

M2HB 12.7 mm (0.50 in) machine guns

Two M2HB 12.7 mm machine guns are carried and can be mounted on flexible mounts.

Specifications
Calibre: 12.7 mm (0.50 in)
Rate of fire: 450-550 rds/min
Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
anti-surface: 6,700 m (7,300 yd)
anti-air: 1,380 m (4,500 ft)

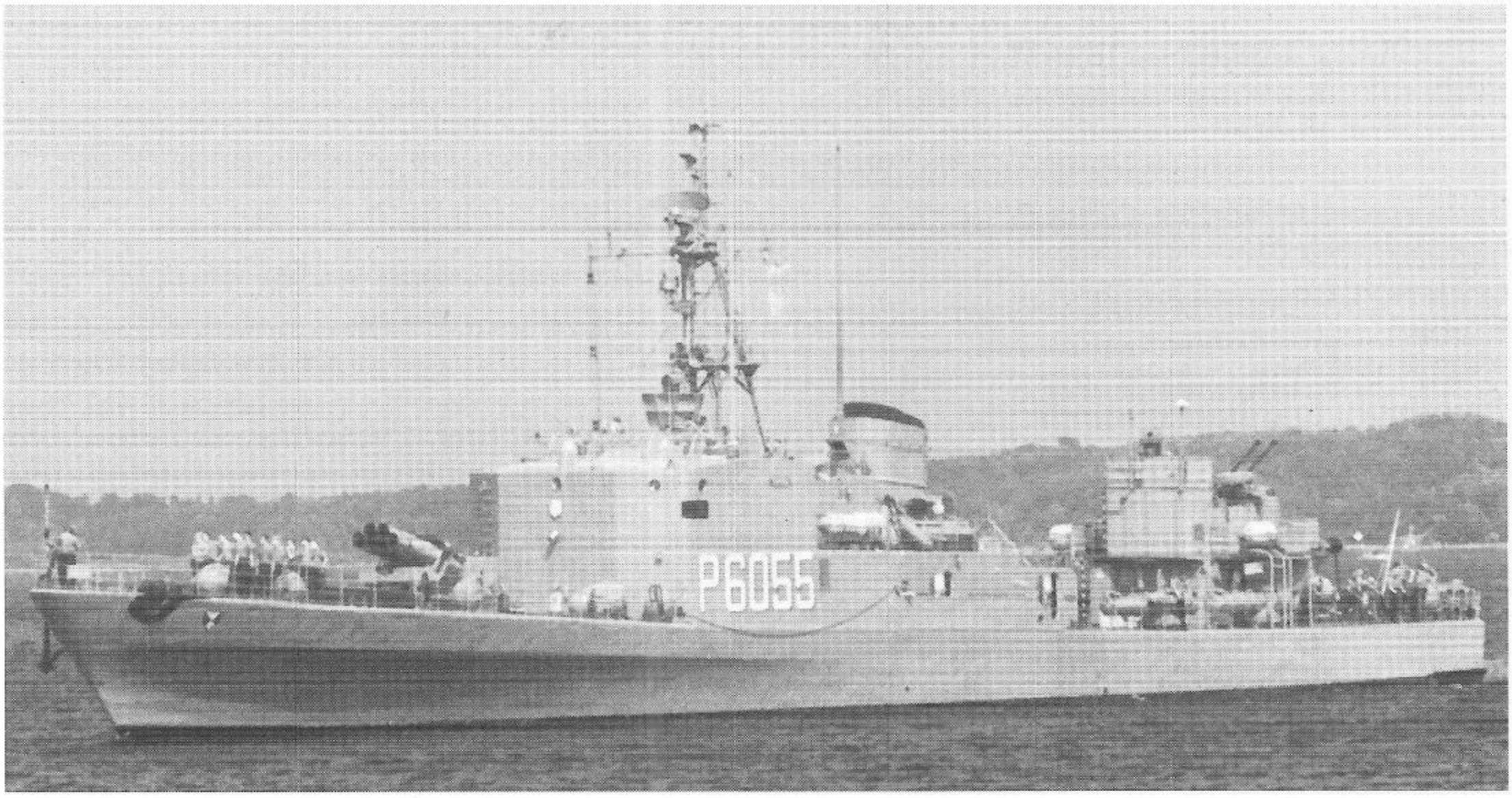
ANTI-SUBMARINE MORTARS

Bofors 375 mm ASW rocket system

There is a single, four-tube, 375 mm ASW rocket launcher located on the foredeck. The system consists of a rocket launcher, a handling system, the ship sonar and a fire-control system. The two launch tubes are mounted on trunnions with an automatic contact device to connect the rockets with the fire-control system. The hydraulic laying machinery is in the front of the mounting and a flame deflector in the rear; there is also an automatic electro-hydraulic handling system. The rounds are stored vertically beneath the mounting and selected by an operator. The rate of fire is one round a second and rockets may be fired singly or in a salvo. There are two types of rocket, both with Hexotonal filling. The Type E (Erika) rocket has Stidar time and impact fuzes, while the Type N (Nelli) uses the Zambo proximity and impact fuzes. A total of 20 rounds is carried.

The mortar can be removed and replaced by a second Bofors 40 mm/L 70.

Specifications
Launcher
Tubes: 4
Traverse: 260° at 18°/s
Elevation: −15 to +90° at 18°/s
Crew: 4



Eleftheria *(P 64) when still in the German Navy as* Triton *(P 6055). These ships were designed as heavy torpedo recovery vessels, for which they proved unsuitable and were then used as ASW training ships. They are now employed as corvettes* (Horst Dehnst)

Specifications
2-tube launcher
Weight (excluding rockets): 3.8 t
Traversing speed: 30°/s
Elevating speed: 27°/s
Traverse limits: Unlimited

Manufacturer/Contractor
Bofors Weapon Systems.

DEPTH CHARGES

There are two depth-charge rails.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Signaal Mk 9 TFCS

RADARS

Thomson-CSF TRS 3001
E/F-band surface search radar.

Kelvin Hughes 14/9
An I-band navigation radar.

SONAR

STN Atlas Elektronik ELAC 1 BV
A hull-mounted, high-frequency active search and attack sonar.

Manufacturer/Contractor
STN Atlas Elektronik, Germany.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MAN V84V 5 MW (6,800 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These five ships were originally built as heavy torpedo recovery vessels, but were unable to perform this role satisfactorily and were given additional ASW armament and a sonar so that they could be used as training ships. They were eventually transferred to Greece, where they are employed as corvettes.

DESIGN

Doxa (ex-*Najade*) has a large deckhouse before the bridge which is now used as a sick bay.

Doxa *(P 63)* (Hellenic Navy)

HDW TYPE FS 1500 CORVETTE

OVERVIEW

Kasturi *(25) of the Royal Malaysian Navy is one of six HDW 1500 corvettes built for two navies* (Jane's)

The late 1970s was a lean period for European shipyards and German shipbuilder Howaldts Deutsche Werft (HDW) entered what was, for the company, a new market with a design for a 1,500 tonne corvette. It quickly won two orders, although intense international competition ensured that the profit margin was minimal. The first order was for four ships for the Colombian Navy (May 1980) and the second for two ships for the Royal Malaysian Navy (RMN) (July 1981).

DESIGN

Design work was carried out by Hamburg-based MarineTechnik-GmbH (MTG) and the design incorporated a number of features which were intended to keep costs to a minimum, including construction to Lloyds' rather than warship standards in most areas (although full warship standards were applied where it was important for combat capability). In addition, the number of plate thicknesses were reduced to a minimum to simplify fabrication, although there was a small penalty in freeboard and maximum speed. The crew requirement was also kept down to 83, although accommodation was available for 128. Two basic versions were available, one with full helicopter facilities and one without a hangar.

The basic design is the same for both Colombian ships and Malaysian ships, but with some differences. The RMN required that the ships should be able to remain afloat and continue to manoeuvre with two adjacent watertight compartments flooded. This resulted in an additional compartment between the two engine rooms and an increase in hull length of exactly 2 m ((6.56 ft) from 95.3 m (312.7 ft) to 97.3 m (319.1 ft). The Malaysian ships also have an NBC citadel, with airlocks and filters, which is not required by the Colombians.

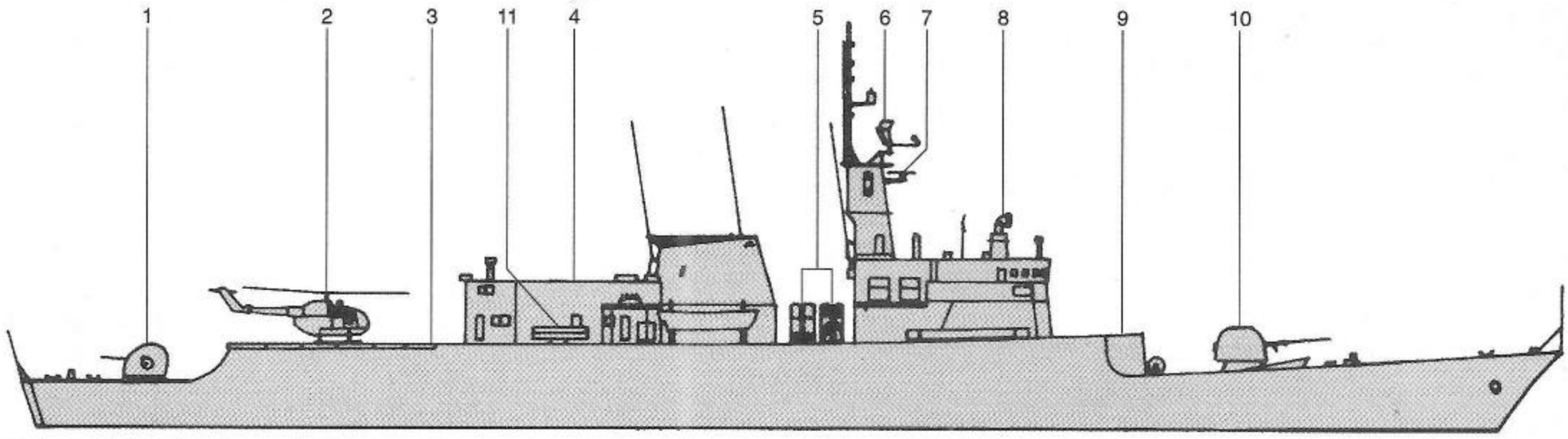
The bow has a pronounced rake, but this is not to protect a sonar dome, but for improved water deflection. A bow sonar dome was considered but rejected on the grounds that with such a shallow draft ship there would be a risk of damage due to slamming.

The Colombian ship has full helicopter facilities, including an HDW-developed traversing device to move the BO-105 (which has skids) between the flight deck and the hangar. The Malaysian ship has a flight deck, together with rearming and refuelling facilities, but no hangar. Combat system integration was subcontracted by HDW to Thomson-CSF for the Colombian ships and to Signaal for the Malaysian ships.

FURTHER ORDERS

Despite the success of the FS 1500 with these two navies and the addition of an even more capable 1,900 tonne design, no further orders have been forthcoming.

ALMIRANTE PADILLA (TYPE FS 1500)



Almirante Padilla (Ian Sturton)
1 *Breda twin 40 mm/70 automatic cannon* **2** *Eurocopter BO 105 CB ASW* **3** *Flight deck* **4** *Hangar* **5** *Aerospatiale MM 40 Exocet anti-ship missiles (eight)* **6** *Thomson CSF Sea Tiger air/sea search radar* **7** *Navigation radar; type unknown* **8** *Thomson CSF CASTOR IIB fire control* **9** *Surface-to-air missile (space/weight reserved)* **10** *OTOBREDA 76 mm (3 in)/62 Compact automatic gun* **11** *US Navy Mk 32 324 mm triple torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Colombia
Type: HDW Type FS 1500

Class: ALMIRANTE PADILLA

Built: 4
Active: 4

Displacement:
standard: 1,500 t
full load: 2,100 t

Dimensions
Length: 95.3 m (312.7 ft)
Beam: 11.3 m (37.1 ft)
Draught: 3.3 m (10.83 ft)

Speed: 27 kts (18 kts on two diesels)
Range: 7,000 n miles at 14 kts; 5,000 n miles at 18 kts

Complement: 94

SHIPS

ALMIRANTE PADILLA (CM 51)
Builder Howaldtswerke, Kiel, Germany
Laid down 17 Mar 1981
Launched 6 Jan 1982
Commissioned 31 Oct 1983

CALDAS (CM 52)
Builder Howaldtswerke, Kiel, Germany
Laid down 14 Jun 1981
Launched 23 Apr 1982
Commissioned 14 Feb 1984

ANTIOQUIA (CM 53)
Builder Howaldtswerke, Kiel, Germany
Laid down 22 June 1981
Launched 28 Aug 1982
Commissioned 30 Apr 1984

INDEPENDIENTE (CM 54)
Builder Howaldtswerke, Kiel, Germany
Laid down 22 Jun 1981
Launched 21 Jan 1983
Commissioned 24 Jul 1984

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Aerospatiale MM 40 Exocet medium-range anti-ship missile

Eight MM 40 Exocet launchers in two groups of four, are mounted immediately ahead of the stack, firing across the ship.

Specifications
MM 40 Block 2
Length: 5.80 m (19 ft)
Diameter: 35 cm (13.7 in)
Wing span: 1.13 m (3.7 ft)
Weight: 870 kg (1,918 lb)
Speed: Mach 0.9
Range: 2-40.5 n miles (4-75 km)
Warhead: 155 kg (341.7 lb) HE frag
Fuze: Impact/proximity
Guidance: Inertial and active radar

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

SURFACE-TO-AIR MISSILES (SAM)

There is an intention to fit SAM launchers forward of the bridge when funds become available. The type and number has yet to be decided (see 'Further Information').

TUBES

Two triple 324 mm US Mk 32 torpedo tubes are sited on the upper deck, either side of the hangar.

TORPEDOES

It is not known what types of torpedo are carried. These are the only ships in the Colombian Navy to carry 324 mm torpedo tubes.

GUNS

OTOBREDA 76 mm (3 in)/62 Compact

One OTOBREDA 76 mm/62 Compact is fitted forward in 'A' position. The 76/62 Compact can fire 80 rounds without reloading and the rate of fire is adjustable from 10 to 85 rds/min. The system is remotely controlled from the combat information centre and a reaction time of 2.8 seconds is quoted.

Specifications
Elevation: −15 to +85° at 40°/s
Training speed: 70°/s
Weight (unloaded): 7.5 t
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.5 n miles (16 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm/70 (twin) Compact

One twin 40 mm/70 Compact is mounted on the quarterdeck. This mounting is designed for use against high-performance combat aircraft, against anti-ship missiles and for surface engagements. The mounting consists of two 40 mm guns located 300 mm apart, a feeding system with magazine, a local control panel, a power supply rack, a converter and an air-water panel.

Specifications
Mounting
Weight (unloaded): 5.6/5.4 t
Traverse: Nominal 360° at 90°/s
Elevation: −13 to +85° at 60°/s
Crew: 2

Specifications
Gun
Calibre: 40 mm
Length of barrel: 72 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Range:
Max: 6.75 n miles (12.5 km)
Effective:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (13,000 ft)
Rate of fire: 600 rds/min
Ammunition: 2.4 kg (5.3 lb) (HCHE, PFHE), 2.5 kg (5.5 lb) (HE-T)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

ARGOSystems Phoenix II (AC-672)

Phoenix II (AC-672) is a radar warning receiver, covering the frequencies 1 to 18 GHz in five bands. The system uses automatic signal processing and target identification.

Manufacturer/Contractor

ARGOSystems, Sunnyvale, California, USA.

ELECTRONIC COUNTERMEASURES (ECM)

Scimitar ECM system

Scimitar was supplied to HDW for installation in these ships by Signaal. (Scimitar was originally developed by the British company, MEL; related systems are Signaal's Reprogrammable Advanced Multimode Shipborne ECM System (RAMSES) and the Canadian SLQ-503.) Scimitar is a modular naval electronic countermeasures system designed to provide protection against radar threats. It is an integrated responsive jammer capable of long-range jamming of search radars and the deception of missiles once launched. In these ships Scimitar operates in conjunction with Phoenix II, but in the back-up mode, it can be manually controlled (target designation and jamming) from the remote-control panel located near the EW operator. Scimitar operates in the I/J-band and is capable of high pulse and CW Effective Radiated Power (ERP). Multimode jamming is possible with multitarget handling capability.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

DECOYS

CSEE DAGAIE Mk 2 countermeasures system

There is one CSEE DAGAIE Mk 2 ten-barrelled, trainable launcher, which can be loaded with either infra-red (IR) or chaff rockets. The firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, wind speed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised fibreglass chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 µm bands.

Specifications

Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)

Manufacturer/Contractor

CSEE Défense, Paris, France.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Thomson-CSF TAVITAC

TAVITAC is an action data automation system, using a federated architecture (although the manufacturer refers to this as a 'star' system). It is designed to create a picture of the tactical situation around the ship using onboard sensors and to designate the targets for weapon systems. The system, which can carry up to 800 tracks, possesses a limited advisory capability in evaluating the tactical situation.

TAVITAC features the CIMSA Sintra 15M125 computer which is complemented for dedicated tasks by the CIMSA Sintra 15M05. The 15M05 is a 16-bit computer with 64 k memory while the more common 15M125 32-bit computer has a modular memory of 64-512 k words and an operating speed of 1 Mips. The software is written in LTR 2 language and the system elements are believed to be linked by a Gina databus network. There are two 15M125 computers which are used both to maintain the tactical picture and to operate groups of consoles.

Manufacturer/Contractor

Thomson-CSF, Paris Cedex, France.

WEAPONS CONTROL

Thomson-CSF Vega II gun fire control system

Vega II is a target designation and fire-control system of mainframe architecture, originally designed for fast attack craft and corvettes equipped with gun, missile or torpedo weapon systems. The system uses separate search and fire-control radars to provide versatility and resistance to enemy ECM through the use of different frequency bands. Vega II in the 'Almirante Padilla' class is similar to Vega I but is based upon the Thomson-CSF CDE digital processor and features some radar improvements; it is used to control the 76 mm gun against one air and two surface targets simultaneously.

The radar associated with Vega II in these vessels is Sea Tiger (TRS 3001) which is designed to detect air, surface or missile targets and to designate them for weapon systems. Visibility in clutter is achieved by complementary techniques including circular polarisation, pulse compression Doppler filtering and an anti-clutter reception chain. The transmitter features frequency agility and pulse compression over a wide frequency range. It has an average power of 1 kW and a peak power of 66 kW. There is a receiver with multiple reception chains including MTI. The Colombian Navy's Type FS 1500 corvettes use the Canopus A television director with Vega II.

Manufacturer/Contractor

Thomson-CSF, Division Systèmes Défense et Controle, France.

RADARS

Thomson-CSF TSR 3004 Sea Tiger surveillance radar

Sea Tiger is an E/F-band radar, whose main purposes are to detect and track missiles, including sea-skimmers in a very severe clutter and jamming environment. Its functions include, air surveillance, surface surveillance, anti-missile surveillance, and target designation for weapon systems (guns, missiles), with visibility in clutter being achieved through the use of circular polarisation, pulse compression, Doppler filtering and an anti-clutter reception chain. There is a roll-stabilised antenna with integrated IFF.

Antioquia *(CM 53) one of the four corvettes built in Germany for the Colombian Navy* (Harmut Ehlers)

Specifications
Detection range: 60 n miles (111 km) on 2 m² (fluctuation) target with Pd <= 50 per cent
Altitude detection: 15,240 m (50,000 ft)
Elevation pattern: Cosec² up to 50°
Sub-clutter visibility: >40 dB

Antenna
Gain: 30 dB
Polarisation: Circular/linear, switchable
Rotation speed: 15/30 rpm
Stabilisation: Better than ±15°
Transmitter: Frequency agile, pulse compression
Receiver: Noise figure better than 5.5 dB

Manufacturer/Contractor
Thomson-CSF, Systèmes Navals de Combat, Bagneux, France.

Navigation radar
There is a navigation radar antenna on the mast; type unknown.

Thomson-CSF CASTOR 2B
CASTOR 2B is the gun fire-control radar. This is an I/J-band, Doppler-filtering, tracking radar, which is able to acquire and track targets in conditions of active jamming, chaff and heavy clutter. The system uses fully coherent transmission, frequency agility, analysis of received jamming signals within all the useful bandwidths, auto-adaptive Doppler filtering and central management by computer to match the radar to the environmental conditions at all times.

Operationally, CASTOR 2B provides fully automatic acquisition to achieve very short reaction times, short burst operation (1.5 ms) with simultaneous frequency agility and Doppler processing and pulse-to-pulse operation giving true frequency agility. Other facilities include TV tracking or combined TV/radar tracking; passive tracking of a jammer with range information sent from a tracking device linked to a surveillance radar; display of the angular error between the shells and the target; display of the angular tracking error on a jammer; and autonomous surveillance, either continuous or by sector.

Specifications
Frequency: I/J-band
Peak power: More than 30 kW
Range: 0.27-14.6 n miles (0.5-27 km)
Acquisition mode: Fully automatic

Manufacturer/Contractor
Thomson-CSF Systèmes Navals de Combat, Bagneux, France.

IFF
Mk 10.

SONAR

STN Atlas Elektronik ASO 4-2
ASO 4-2 is a hull-mounted, medium-frequency, active attack sonar.

AVIATION

HELICOPTERS

Specifications
Flight deck: 17.3 × 11.3 m (57 × 37 ft)
Hangar: The hangar can house a BO-105 helicopter
Helicopter: Eurocopter MBB BO-105CB. All four ships can embark one BO-105 helicopter, which can be armed with machine guns or rocket pods, if necessary.

Specifications
Dimensions
Main rotor diameter: 9.84 m (32.28 ft)
Tail rotor diameter: 1.90 m (6.23 ft)
Length (including main and tail rotors): 11 m (36.08 ft)
Height (top of rotor head): 3.02 m (9.91 ft)
Weights:
empty, basic: 1,301 kg (2,868 lb)
max take-off: 2,500 kg (5,511 lb)
Performance (max T-O weight)
never-exceed speed (VNE) at sea level: 131 kts (242 km/h)
max cruising speed at sea level: 129 kts (240 km/h)
best range speed at sea level: 110 kts (204 km/h)
max rate of climb (sea level): 444 m (1,457 ft)/min
max operating altitude (2,500 kg): 3,050 m (10,000 ft)
max range:
at sea level: 300 n miles (555 km)
at 1,525 m (5,000 ft): 321 n miles (593 km)
endurance: 3 h 24 min
Power plant: 2–313 kW (420 shp) Allison 250-C20B turboshafts, each with a max continuous rating of 298 kW (400 shp)
Accommodation: 5 (pilot and co-pilot/passenger in front and 3 persons at rear)
Avionics: A wide variety of avionics is available including weather radar, Doppler and GPS navigation, 360° search radar, FLIR, TV broadcast and microwave datalink

PROPULSION

Specifications
System: Diesel
Main machinery: 4 MTU 20V 1163 TB92, 17.2 MW (23,400 hp)
Shafts: 2
Propellers: 2, five-bladed, controllable pitch

FURTHER INFORMATION

PROGRAMME

The order for four Type FS 1500 was placed in late 1980 and *Almirante Padilla* started trials in July 1982.

SYSTEM INTEGRATION

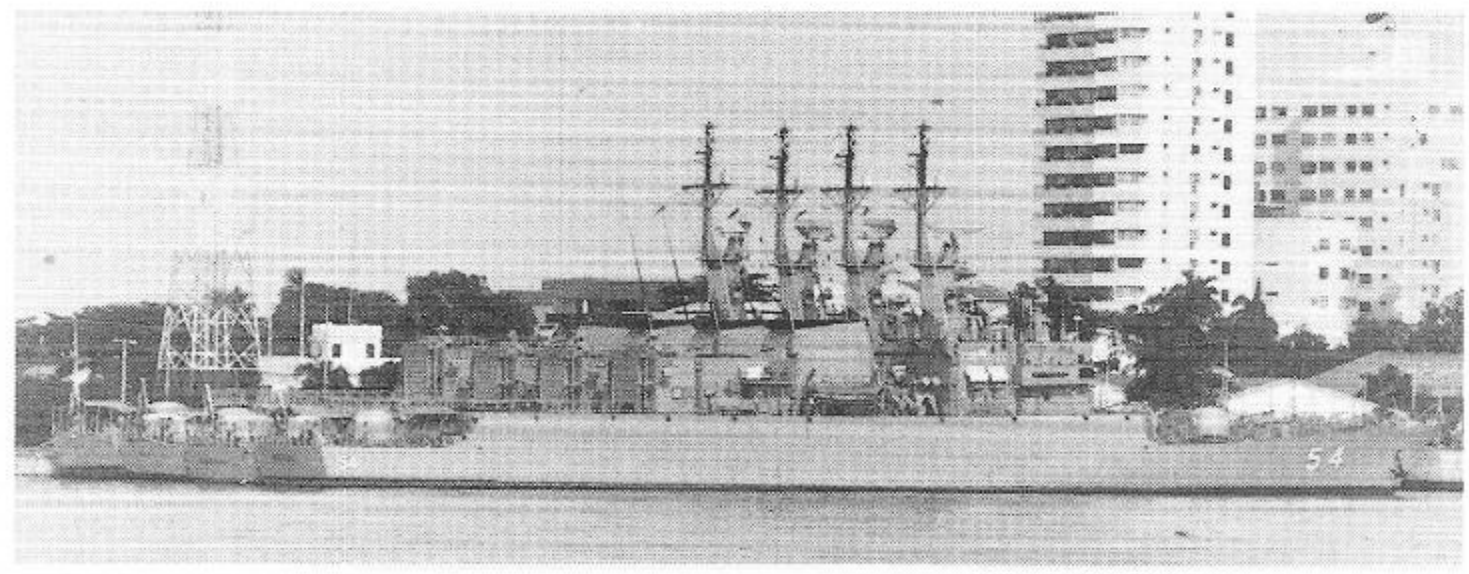
When delivered, the electronic warfare system came from a variety of sources. The ESM suite was the ARGOSystems Phoenix, ECM was the Signaal Scimitar, and the chaff launchers the CSEE Défense Dagaie. This caused integration problems, which were exacerbated by the fact that the Sea Tiger main radar was not only from a fourth manufacturer, but also had several new features, which took a little time to resolve. Much work was needed, particularly on the software, to integrate these systems, which led to some delay in the programme. The problems have long since been resolved but were an early illustration of the difficulties of integrating equipment from different sources.

PROPULSION

There are four MTU diesels, two on each shaft, with one in the forward engine room and the other in the after engine room. These drive through a Renk reduction gearbox located at the forward end of the after engine room.

A CODAG system of one gas turbine and two diesels was considered at the design stage but rejected principally because of the space required for the turbine air downtake and the exhaust uptake.

The machinery control centre is combined with the damage control centre and is located at the stern of the ship, and extends across the full width. Control consoles are provided by Siemens.



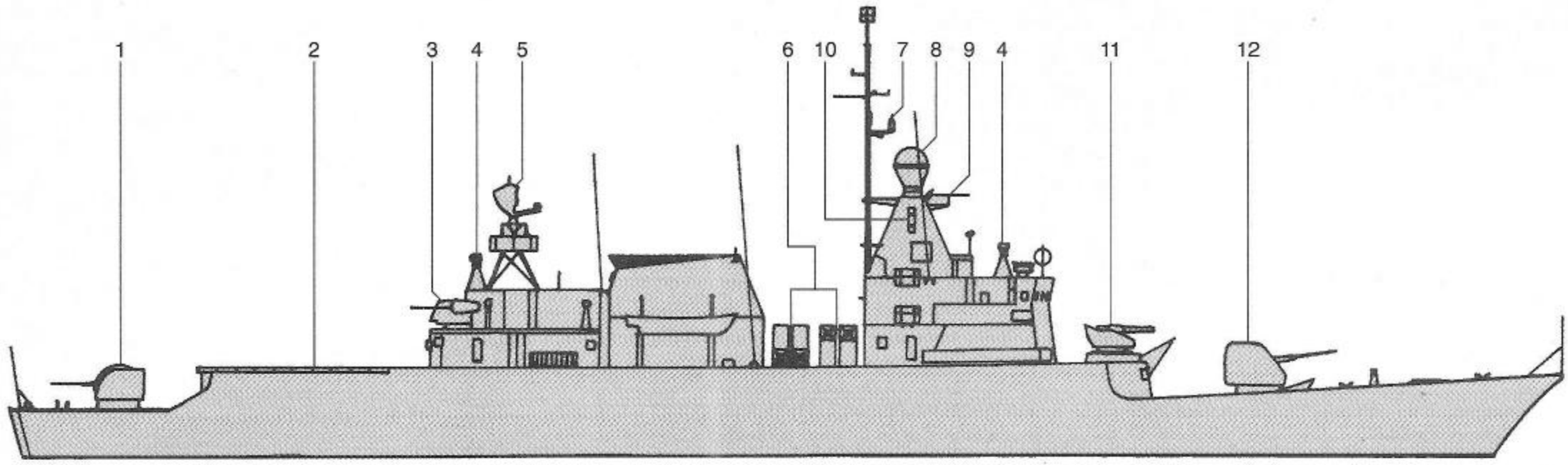
All four ships of the 'Almirante Padilla' class together (H & L van Ginderen Collection)

MODERNISATION

Since the ships were delivered in 1983-84 there has been talk of fitting a SAM system in the space allocated for it on the platform before the bridge. Systems such as Barak, Albatros/Aspide, Crotale and Sea Sparrow have all been mentioned, but no decision has yet been made.

A modernisation programme remains the top priority and plans to replace the engines were reported in 1994, but so far no funds have been earmarked.

KASTURI (FS 1500)



Kasturi (Ian Sturton)
1 *Bofors 57 mm/70 automatic gun* **2** *Flight deck (no hangar)* **3** *ESCO twin 30 mm cannon (two)* **4** *Signaal LIOD electro-optic director (guns)* **5** *Signaal DA08 air/surface search radar* **6** *Aerospatiale Exocet MM 38 anti-ship missiles (four)* **7** *MEL Rapids jammer* **8** *Signaal WM22 fire-control radar* **9** *Racal-Decca TM1226C navigation radar* **10** *MEL Scimitar radar* **11** *Bofors 375 mm twin tube ASW rocket launcher* **12** *Creusot-Loire 100 mm (3.9 in)/55 Mk 2 Compact automatic gun*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Malaysia
Type: HDW FS 1500

Class: KASTURI

Built: 2
Active: 2

Displacement:
standard: 1,500 t
full load: 1,850 t

Dimensions
Length: 97.3 m (319.1 ft)
Beam: 11.3 m (37.1 ft)
Draught: 3.5 m (11.5 ft)

Speed: 28 kts; 18 kts on two diesels
Range: 3,000 n miles at 18 kts; 5,000 n miles at 14 kts

Complement: 124 (13 officers)

SHIPS

KASTURI (25)	
Builder	Howaldtswerke, Kiel, Germany
Laid down	3 Jan 1983
Launched	14 May 1983
Commissioned	15 Aug 1984

LEKIR (26)	
Builder	Howaldtswerke, Kiel, Germany
Laid down	3 Jan 1983
Launched	14 May 1983
Commissioned	15 Aug 1984

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Aerospatiale MM 38 Exocet medium-range anti-ship missile

There are two pairs of launchers for MM 38 Exocet immediately before the stack, pointing across the ship at an angle of 90°. The missile system includes a control console and a co-ordinate converter to interface the missile with the ship's sensors. Targets are acquired by the ship's search radar and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence. This involves turning on the thermal battery, releasing the mechanical safety locks, igniting the booster, and finally, breaking the umbilical cord; the total process takes some 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change of course during its flight.

The attack consists of three phases:

Cruise phase. The cruise phase starts as the missile clears the container and the missile, powered by the sustainer motor, flies towards the general location of the target at a height of about 100 m (328 ft), which is low enough to reduce the chance of detection but adequate for target acquisition. This phase can be as long as 11.9 n miles (22 km) and ends when the seeker acquires the target. The seeker is a Dassault Electronique ADAC *(Auto Directeur Anti-Clutter)* active monopulse radar, working in the I-band (8-10 GHz), with a typical range of 13 n miles (24 km) against FACs.

Approach phase. On detecting the target, the missile descends to 9 to 15 m (30 to 50 ft).

Terminal phase. During this final phase the missile descends to 8 m (26 ft) (2 to 5 m (7 to 16 ft) in a calm sea) for a sea-skimming run in to the target.

A salvo may be fired in 12 to 20 seconds.

Kasturi *(25). Foredeck weapons are a Creusot-Loire 100 mm (3.9 in)/55 Mk 2 Compact and a Bofors twin-tube 375 mm ASW rocket launcher* (H & L van Ginderen Collection)

Specifications

MM 38
Length: 5.21 m (17 ft)
Diameter: 35 cm (13.8 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s
Booster: 100 kg (220 lb) SNPE Epervier boost motor; burn time of 2.4 s
Warhead: Luchaire 165 kg (364 lb) fragmentation warhead
Fuzes: Delayed impact fuze and autopilot-controlled proximity fuze

Manufacturer/Contractor

Aerospatiale Missiles, Paris, France.

GUNS

Creusot-Loire 100 mm (3.9 in)/55 Mk 2 Compact

The Malaysian ships are fitted with a single Creusot-Loire 100 mm (3.9 in)/55 Mk 2 Compact in 'A' position (the ships were, in fact, the first to be fitted with these weapons). The weapon is controlled from the Combat Information Centre (CIC) using a control box and can be fired in single rounds or with two-, three- or six-round salvos.

The Malaysian guns were due to be upgraded to Compact Mk 2 standard from 1994. This introduces software-controlled microprocessors into the control equipment. There is a new control box for the combat information centre which displays the location of every shell in the mounting. In addition a maintenance console is now attached to the ammunition management control cabinet. This provides a built-in test equipment capability and allows faults to be overcome with the aid of a user-friendly menu.

Specifications

Calibre: 100 mm
Length of barrel: 55 calibres
Muzzle velocity: 870 m/s (2,854 ft/s)
Traverse: 360° at 50°/s
Elevation: −15 to +80° at 35°/s
Crew: 2 (loaders)
Range:
anti-surface: 9.15 n miles (17 km)
anti-air: 6,000 m (19,700 ft)
Rate of fire: 10, 40 or 90 rds/min
Ammunition: 13.5 kg (29.8 lb) (projectile)

Manufacturer/Contractor

Giat, France.

Bofors SAK 57 mm/70

One Bofors SAK 57 mm/70 Mk 1 is mounted on the quarterdeck and is housed in a glass-reinforced plastic shield. This weapon is intended to engage air and surface targets and to provide gunfire in support of troops ashore. There are attachments on the side of the shield to enable illuminants to be launched.

Specifications

Calibre: 57 mm
Length of barrel: 70 calibres
Traverse: 360° at 55°/s
Elevation: −10 to +77° at 40°/s
Crew: 3
Range: 9 n miles (17 km)
Rate of fire: 220 rds/min
Projectile weight: 2.4 kg (5.31 lb)

Manufacturer/Contractor

Bofors Weapon Systems, Sweden.

ESCO 30 twin 30 mm mounting

There are two twin ESCO (formerly Emerson) 30 mm cannon, which are located at the two corners at the after end of the superstructure. The ESCO 30 is a twin 30 mm, 70 calibre weapon designed for air defence, surface engagement and anti-missile operations, using either local or remote control. The ESCO 30 employs two Oerlikon KCB positively locked, gas-operated cannon with the gunner's cabin between them and forward of the elevating mass. Behind the cabin and in a sealed compartment, are the elevating and training drives together with flexible chutes to channel ammunition from the magazine.

The gunner's cabin is equipped with a daylight reflex, or an image-intensifier, sight, together with gyro-assisted line of sight stabilisation. Ready use ammunition is stored in an integral, below-deck, drum magazine with a capacity of 985 rounds for each barrel in a continuous, disintegrating-link belt. These are transferred to the guns through separate chutes by means of electrically operated drives which automatically respond to the individual demand for ammunition supply. Normally, the mount uses ship's power supplies, but this is backed up by an on-mount battery, providing sufficient power to fire a full complement of ammunition, and finally, there is the traditional hand-crank mechanism operated by the gunner.

Specifications

Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Traverse: 360° at 80°/s
Elevation: −15 to +80° at 80°/s
Crew: 1
Range: anti-ship (max): 3.25 n miles (6 km)
Rate of fire: 600 rds/min/barrel (nominal) or 140 rds/min/barrel (sustained)
Ammunition: 870 g (31 oz) (HEI/HEI-T, SAPHEI, TP/TP-T)

Manufacturer/Contractor

Electronics & Space Corporation (ESCO), St Louis, Missouri, USA.

ANTI-SUBMARINE MORTARS

Bofors Type 375

One twin-barrelled trainable launcher is mounted on the platform deck immediately before the bridge. This weapon has a range of 3,600 m (3,940 yd) and is provided with elevation and bearing data by the ship's sonar via the command system. The fuze is set with the rocket in the tube. The rockets have two different types of motors, designed to provide different ranges. The rocket has a flat, low trajectory, in order to reduce the reaction time available to the target.

Specifications

Weight of launcher (excluding rockets): 3.8 t
Traverse: 360° at 30°/s
Elevating speed: 27°/s

Manufacturer/Contractor

Bofors Underwater Systems, Sweden.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

MEL RAPIDS

The ESM system is RAPIDS (RAdar Passive IDentification System), which covers the frequencies 2-18 GHz in four bands. It is claimed to be capable of tracking ten signals, locking on to any three and locating the emitter bearing with an accuracy of 3°. There is a library of 64 platforms and 256 emitters.

ELECTRONIC COUNTERMEASURES (ECM)

MEL Scimitar ECM system

Scimitar was supplied to HDW for installation in these ships by Signaal. (Scimitar was originally developed by the British company, MEL; related systems are Signaal's Reprogrammable Advanced Multimode Shipborne ECM System (RAMSES) and the Canadian SLQ-503.) Scimitar is a modular naval electronic countermeasures system designed to provide protection against radar threats. It is an integrated responsive jammer capable of long-range jamming of search radars and the deception of missiles once launched.

Scimitar is capable of high pulse and CW Effective Radiated Power (ERP). Multimode jamming operation is possible with multitarget handling capability. There are two antennas in small 'egg-shaped' radomes on each side of the ship, at the end of the yard-arms.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Lekir *(26). Unlike the Colombian ships the Malaysian corvettes do not have a helicopter hangar. Large radar is Signaal DA08 with Signaal 'egg' housing a WM22 fire-control radar forward of the mast. To the left of the 'egg' is the antenna for the Racal-Decca TM1226C navigation radar* (H & L van Ginderen Collection)

DECOYS

CSEE DAGAIE Mk 2 countermeasures system

There is one CSEE DAGAIE Mk 2 ten-barrelled, trainable launcher which can be loaded with either IR or chaff rockets. The firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, wind speed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either 3 to 5 and 8 to 14 μm IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised fibreglass chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 μm bands.

Specifications

Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)

Manufacturer/Contractor

CSEE Défense, Paris, France.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Sensor Weapon Control and Command System (SEWACO)

SEWACO is an integrated sensor, weapon and command system built around a common command and control (C^2) system. At its heart is the DAISY-MA C^2 system which is designed to present raw and/or processed sensor data from search and fire-control radars together with IFF, sonar, electronic warfare and electro-optic systems to create a picture of the tactical situation. The data may also be used to designate targets to weapon systems and to assist in operations with auxiliary functions such as ASW helicopter direction and tactical navigation.

DAISY-based SEWACO systems, such as the one installed in the Malaysian FS 1500s use the earlier generation of Signaal mainframe architecture SMR computers. The Malaysian ships also use the CIDIS (Combat Information Display System), which features software-driven Vertical Display Consoles (VDC) and Horizontal Display Consoles (HDC).

In Malaysia's FS 1500s, the SEWACO works in conjunction with LIOD electro-optic directors, DA08 search radar and the WM22 fire-control radar.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Link YM

The RMN purchased Link YM, which was developed in the UK by Ferranti as a digital link suitable for sale to non-NATO countries for naval and aircraft use. Different users have versions tailored to their own needs; Link YM, for example, is exclusive to the RMN. Link Y, generally, uses a standard message format of two 24-bit words and a transmission speed of 300 to 1,200 bits/s.

IFF

US Mk 10.

RADARS

Type	DA-08	TM 1226C	WM 22
Company	Signaal	Racal-Decca	Signaal
Role	Air	Navigation	Fire control
Band	E/F	I	I/J
Beam	1.5 × csc² to 40°	1.2°	Search: 1.5 × 7° Track: 2.4°
Peak Power	145 kW	25 kW	200 kW
Gain	33 dB	30 dB	33.5 dB
Pulsewidth	35/69 µs	0.05/0.25/1.0 µs	0.22/0.45 µs
PRF	1,000/500 pps	—	3,600/1,800 pps
Scan rate	10/20 rpm	28 rpm	60 rpm
Typical range	100 n miles (185 km) for 2 m² target	48 n miles (89 km)	25 n miles (46 km)

WEAPONS CONTROL

Signaal WM22

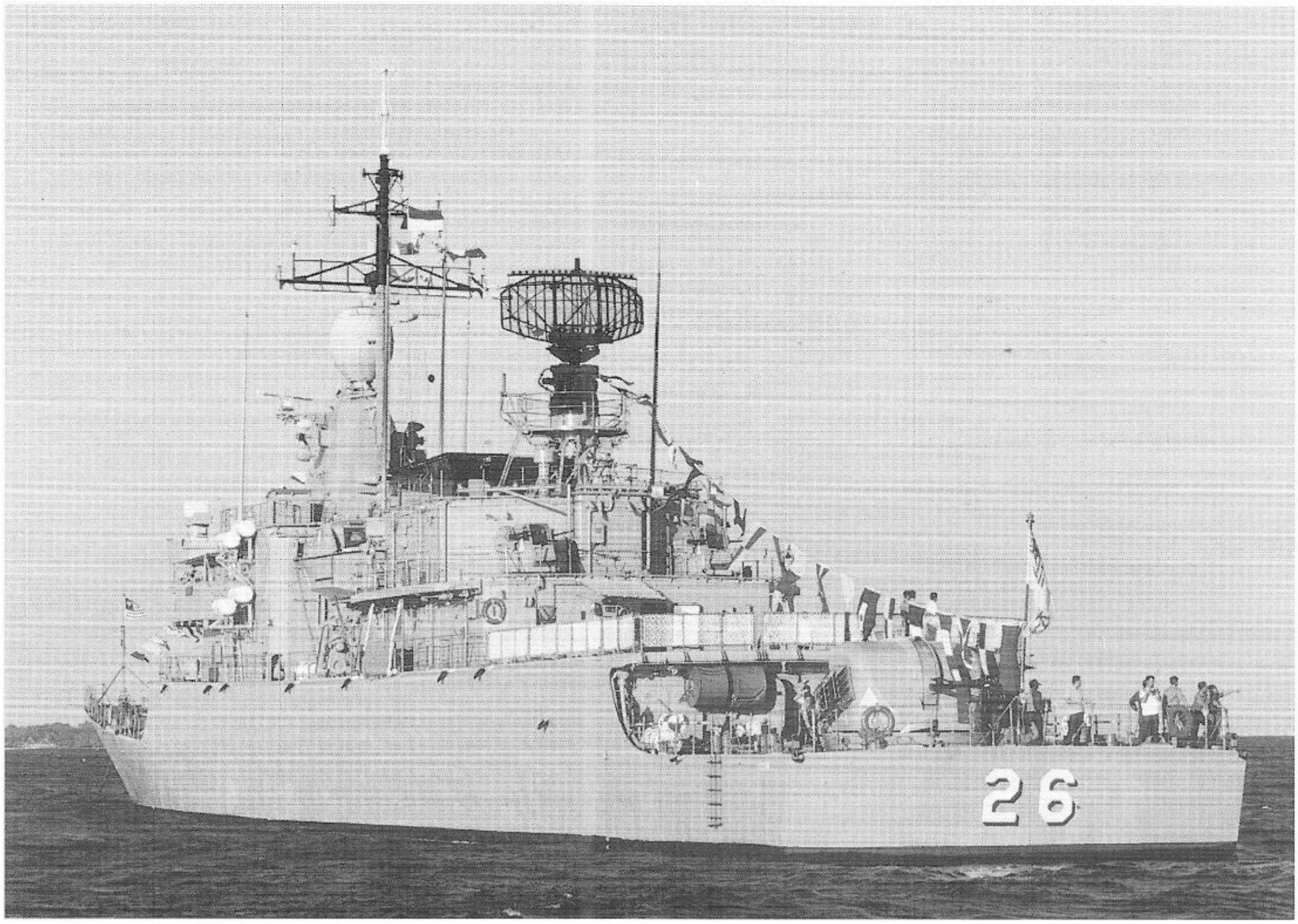
WM22 I/J-band fire-control radar is one of Signaal's family of M20/WM20 multichannel fire-control systems designed for gun and other weapon systems and using a combined radar antenna system. It is designed to provide continuous air and surface warning, navigation aid, combat information, target designation and weapon control. The WM22 features a mainframe architecture with reprogrammable computers. It is capable of simultaneously controlling two medium and/or two light calibre guns. The search radar may include digital MTI while the tracking radar may have a pulse Doppler facility. The radar is capable of automatically tracking an air target and/or two surface targets simultaneously.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Signaal LIOD electro-optic director

There are two LIOD (Lightweight Optronic Director) directors, a weapon control system designed to



Lekir *(26) second in a class of two corvettes built for the Royal Malaysian Navy by HDW in Germany in 1983-84. The ships are German-designed and -built, have French and Swedish weapons, and British and Dutch electronics* (Jane's)

conduct automatic or manual rate-aided tracking of an air and surface target while controlling two or more dual-purpose guns of different types. The system tracks targets moving at up to 800 m/s (2,600 ft/s) and can track large warships at 11 n miles (20 km) and fighter-size aircraft at 5.4 n miles (10 km). It consists of an electro-optical director, one or two TDS directors and a control console. The main director has a TV camera with a field of view of 2 to 20°, an 8 to 12 µm IR camera with a field of view of 1.2/7.5° and an Nd:YAG laser rangefinder. The two cameras operate to the CCIR standard. The console, which also houses the SMR-MU general purpose computer, receives data not only from the electro-optic systems but also from the ship's reference systems. Tracking is by the optical contrast technique whereby the target is tracked against its background as viewed by a TV or infra-red camera. The TV camera has automatic filters to adjust for light conditions. Alternatively a correlation tracker can be implemented which is capable of automatic target acquisition. Range information is provided by a laser rangefinder. Alternatively a laser-tracker can be fitted. Both the camera and rangefinder are co-mounted on the director head unit, which is provided with appropriate servos and anti-vibration mountings. The daylight version is fitted with a TV camera and laser, while the high-performance model has a TV camera, infra-red camera and laser rangefinder.

Specifications

Director
Traverse: 360° at 130°/s
Elevation: −30 to +115° at 130°/s

Laser rangefinder
Beam divergency: 1.2-1.5 µrad
Pulse length: 20 ns
Max repetition frequency: 10 Hz
Fields of view: 3-30° (TV camera); 3° (IR camera)

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

SONARS

STN Atlas DSQS-21CZ

DSQS-21CZ is a hull-mounted, medium-frequency, active search and attack sonar. It employs computer-aided detection, classification and tracking, with information presented on colour CRT displays to permit Doppler coding and discrimination of data on the integrated displays.

Specifications

Diameter of transducer arrays: 1 m (3.28 ft)
Number of pre-formed beams: 32

Manufacturer/Contractor

STN Atlas Elektronik, Bremen, Germany.

AVIATION

HELICOPTERS

Specifications

Flight deck: 17.3 × 11.3 m (57 × 37 ft)
Hangar: There is no hangar (see 'Modernisation') but the ship has refuelling and rearming facilities
Helicopter: The RMN operates a small number of Westland Wasp helicopters, which can use the flight deck

Westland Wasp HAS Mk 1

Specifications

Dimensions:
main rotor diameter: 9.83 m (32.25 ft)
tail rotor diameter: 2.29 m (7.5 ft)
fuselage length: 9.24 m (30.33 ft)
height to top of rotor hub: 2.72 m (8.92 ft)
Weights:
empty: 1,566 kg (3,452 lb)
max take-off: 2,495 kg (5,500 lb)
Performance:
max level speed (sea level): 104 kts (193 km/h)
economic cruising speed: 96 kts (177 km/h)
max range: 263 n miles (487 km)
Power plant: 1—710 ehp (derated) Rolls-Royce/Bristol Nimbus 503 turboshaft
Avionics: PTR 170 and PV 141 VHF and UHF homing radio with standby UHF
Weapons: 1 Mk 46 or 2 Mk 44 torpedoes or 2 AS.12 anti-ship missiles

PROPULSION

Specifications

System: Diesel
Main machinery: 4 MTU 20V 1163 TB92, 17.2 MW (23,400 hp)
Shafts: 2
Propellers: 2 five-bladed, controllable pitch

FURTHER INFORMATION

PROGRAMME

The order for these two ships was placed in February 1981 and fabrication began early 1982. They were both launched on the same day (14 May 1983) and commissioned on the same day (15 August 1984). There was some discussion of an order for a second pair but this was shelved.

They are rated as corvettes by the RMN even though they are actually larger ships than *Rahmat* (24), which is rated as a frigate.

DESIGN

The basic design is the same as that of the Colombian ships, but with some important differences. The RMN required that the ships should be able to remain afloat and continue to manoeuvre with two adjacent watertight compartments flooded. This resulted in an additional compartment between the two engine rooms and an increase in hull length of some 2 m (6.5 ft). The Malaysian ships also have an NBC citadel, with airlocks and filters, which are not required by the Colombians.

SYSTEM INTEGRATION

Systems integration in the Malaysian corvettes was subcontracted to Signaal. The work went rather more smoothly than on the Colombian ships, possibly because the lessons from that experience were fed across.

MODERNISATION

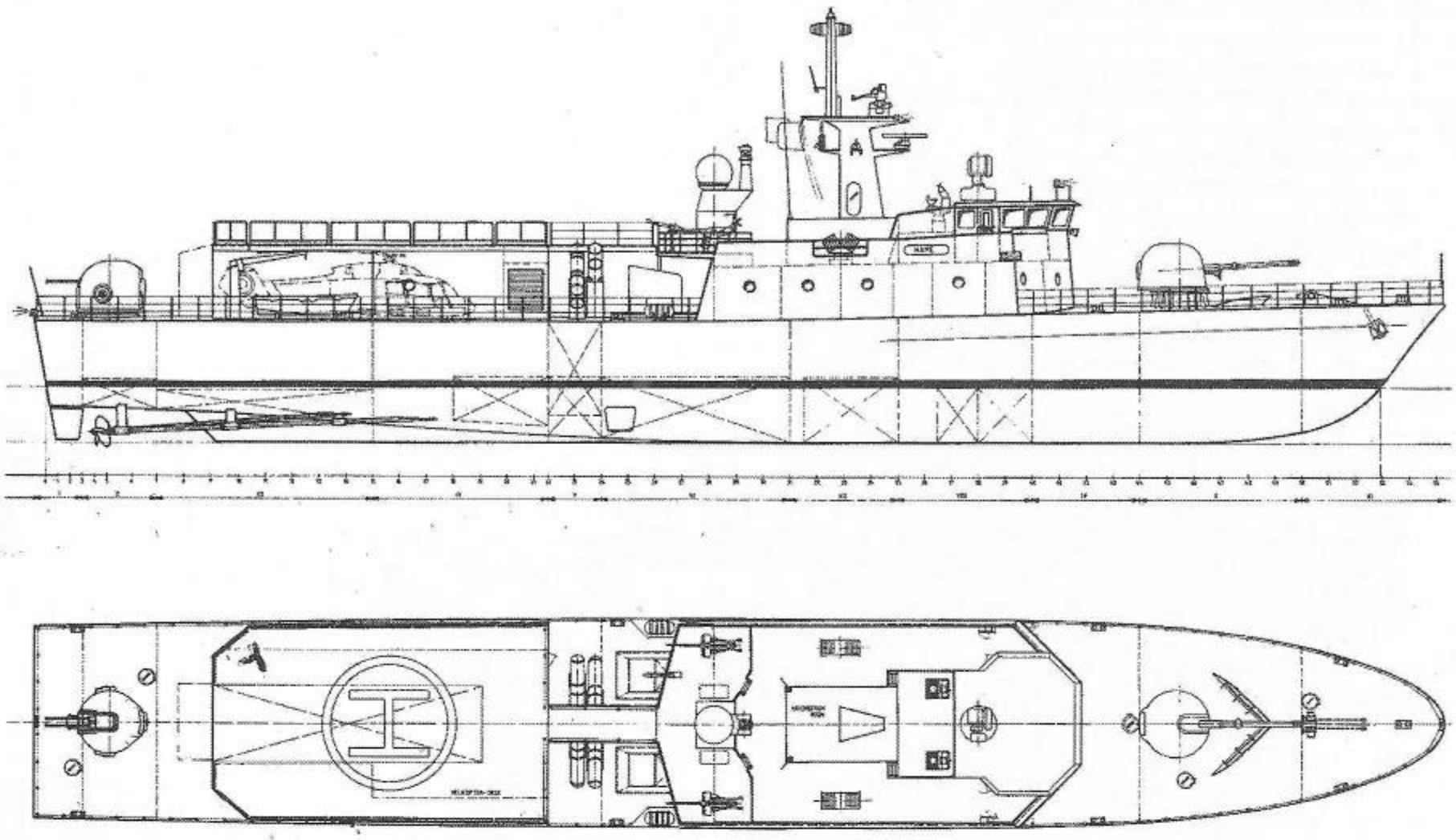
These two ships may be fitted with telescopic hangars in due course.

GUNS

The RMN was the first naval customer for the Creusot-Loire 100 mm Compact gun, taking delivery of four: two for the two FS 1500 corvettes delivered and two for either the possible order for a further two FS 1500s, or alternatively for mid-life refits of *Rahmat* and *Hang Tuah.* In the event, none of these has happened and the 100 mm turrets were installed in the 'Musytari' class patrol ships, instead.

LÜRSSEN 62 m CORVETTE

OVERVIEW



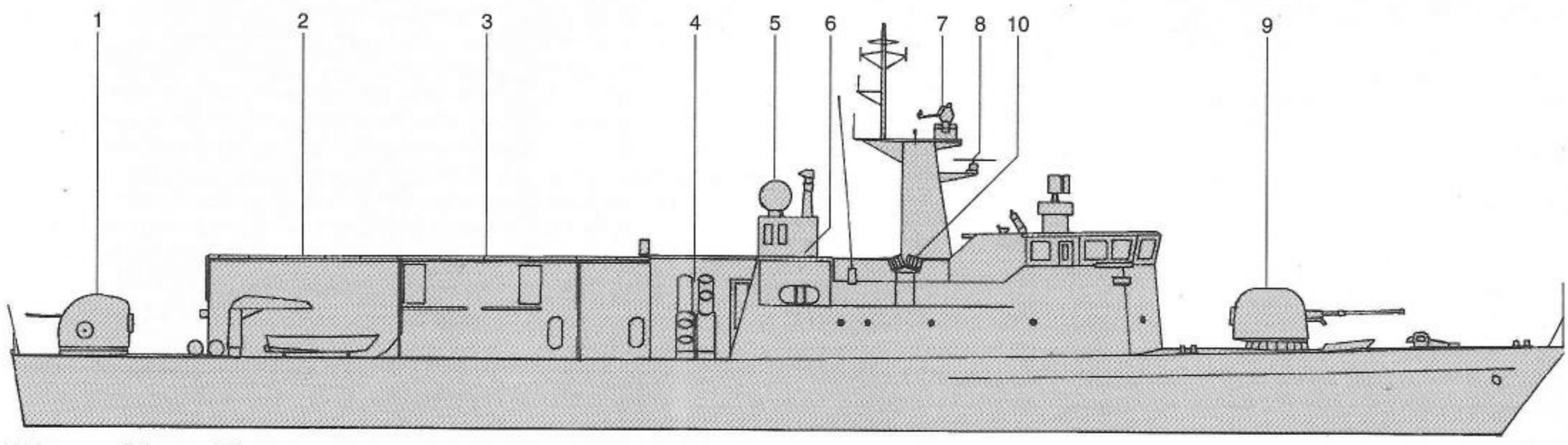
Two views of Lürssen's 62 m design. Note, in particular, the space occupied by the helicopter in the hangar (Fr Lürssen)

The 62 m design is one of a series of warship designs from the German company, Fr. Lürssen of Bremen-Vegesack. The three versions currently in service are generally similar, being virtually the same length: Bahrain — 62.95 m (206.52 ft); Singapore — 62.4 m (204.7 ft); UAE — 63 m (206.7 ft). They also have very similar armament and sensor fits. All have a steel hull and aluminium superstructure.

The major difference is that two of the classes — the Bahreini 'Al Manama' and the UAE 'Muray Jib' — have a flight deck and hangar, making them among the smallest ships to have such a capability. The flight deck is approximately 14.9 m (49 ft) long and 9.3 m (30 ft) wide and is on the roof of the hangar, the helicopter being moved between the two by an elevator.

Pilot's view of the flight deck with the sliding sections open to reveal the hangar below. Note also the twin 40 mm gun on the flight deck
(Fr Lürssen)

AL MANAMA (LÜRSSEN 62)



Al Manama *(Lürssen 62)*
1 *OTOBREDA twin 40 mm/70 Compact automatic AA guns* **2** *Flight deck* **3** *Hangar (below flight deck)* **4** *Aerospatiale MM 40 Exocet anti-ship missiles (four)* **5** *Satcom* **6** *Oerlikon GAM-BO1 20 mm/93 cannon (fitted for but not with)* **7** *Ericsson Sea Giraffe 50HC air/surface search radar* **8** *Racal-Decca 1226 navigation radar* **9** *OTOBREDA 76 mm(3 in)/62 Compact automatic gun* **10** *CSEE Défense Dagaie decoy launcher*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Bahrain
Type: Lürssen 62

Class: AL MANAMA

Purchased: 2
Active: 2

Displacement:
at ½ provisions: 536 t
full load: 632 t

Dimensions
Length: 62.95 m (206.52 ft)
Beam: 9.30 m (30.51 ft)
Draught: 2.90 m (9.51 ft) (at propeller)

Speed:
at 536 t: 34.70 kts
at 632 t: 32 kts
Range: 4,000 n miles at 16 kts

Complement: 43 (7 officers)

SHIPS

AL MANAMA (50)
Builder Lürssen Werft, Bremen-Vegesack, Germany
Commissioned 14 Dec 1987

AL MUHARRAQ (51)
Builder Lürssen Werft, Bremen-Vegesack, Germany
Commissioned 3 Feb 1988

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Aerospatiale MM 40 Exocet

Four launcher-containers for Aerospatiale MM 40 Exocet are located in the waist, immediately forward of the hangar. As is usual with such missiles, they are pointed to the opposite side of the ship, at an angle of 12° to the horizontal, with the motor exhaust being ejected over the side. Targets are acquired by the ship's sensors and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence in which the thermal battery is turned on, the mechanical safety locks are released, the booster is ignited and the umbilical cord is broken, the total process taking 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change in the course of its flight. Once the missile has cleared the launcher-container, the sustainer carries it into the cruise phase, during which it travels towards the general location of the target at a height of about 100 m (328 ft), which is low enough to reduce the chance of detection but adequate for target acquisition. Once the target is detected the missile descends to 9 to 15 m (29.5 to 49 ft) in the approach phase before descending to 8 m (26 ft) (2 to 5 m (6.56 to 16 ft) in a calm sea) for a sea-skimming terminal phase. A salvo may be fired in 12 to 20 seconds.

Specifications
MM40 Block 1
Length: 5.78 m (19 ft)
Diameter: 35 cm (13.7 in)
Wing span: 1.13 m (3.7 ft)
Weight: 855 kg (1,885 lb)
Speed: Mach 0.9
Range: 2-38 n miles (4-70 km)
Guidance: Inertial and active radar

GUNS

OTOBREDA 76 mm (3 in)/62 Compact

One OTOBREDA 76 mm/62 Compact is mounted in 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air-defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications
Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres
Traverse: 360° at 70°/sec
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm L/70 Compact (Type 70) twin mounting

One OTOBREDA 40 mm L/70 Compact (Type 70) twin mounting is mounted on the quarterdeck. The Compact twin 40 mm mounting is designed for use against high-performance combat aircraft, against anti-ship missiles and for surface engagements.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 600 rds/min/mount
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (2.2 n miles)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Oerlikon GAM-BO1 20 mm/93 cannon

There are fittings to mount two single, manually operated Oerlikon GAM-BO1 20 mm/93 cannon on the small platforms on the upper deck either side of the helicopter control cabin. There is, however, no photographic evidence that these have ever been installed.

Specifications
Calibre: 20 mm
Length of barrel: 93 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km (4,920 ft)
anti-air: 1,150 m (3,800 ft)
Rate of fire: 1,000 rds/min
Round weight: 241 g (0.5 lb)
Projectile: 122 g (0.26 lb)
Elevation: −15 to +90°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Cutlass E ESM system

Cutlass E is designed for operation in very dense signal environments, receiving signals in the 1 to 18 GHz frequency range, measuring their parameters, comparing these with those in the radar library which contains the parameters of 2,000 radars, and displaying the information, all within one second. The EW operator is presented with a tabular display for threat identity and threat evaluation and a tactical display giving a pictorial representation of the RF environment. Selected digital outputs can be sent to other local systems and hard copy printout of the intercepted radar is also available. The tabular display can indicate 150 intercepts, in the order of priority. Cutlass is wide open in both bearing and frequency; that is, it does not employ sweep techniques, giving a very high intercept probability (nearly 100 per cent). Cutlass B1 uses the Cutlass processor and an Instantaneous Frequency Measurement (IFM) receiver. It has a 32-element array antenna to provide bearing measurement by phase analysis techniques. This antenna also provides RF for the IFM. In both systems the processor is provided with fast and accurate information on incoming pulses.

Specifications

Frequency coverage: 2-18 GHz
Accuracy: 2° RMS in bearing
Coverage: 360° azimuth; +40 to −10° elevation
Pulse density capability: 500,000/s
Radar store capability: 2,000 modes

Manufacturer/Contractor

Racal Radar Defence Systems, Chessington, Surrey, UK.

ELECTRONIC COUNTERMEASURES (ECM)

Racal Cygnus B1 jammer

The Cygnus radar jammer operates in the I or J-bands and was designed for integration with Cutlass ESM equipment. Cygnus uses both responsive noise and deception jamming to provide an effective jamming capability against all types of radar including early warning, target acquisition and missile guidance. It has a narrow beamwidth giving high effective radiated power (300 kW) and is kept on target by a built-in, interferometer-type, passive tracking system in both azimuth and elevation. The tracking system may also be used to relay accurate position data to systems of other ships. RF received by the tracking antennas is also used as the basis of transmitted RF and modulation and power management is under the control of a processor which also controls the tracking procedure. Types of modulation sequence available include range gate pull off and false target generation.

Manufacturer/Contractor

Racal Radar Defence Systems, Chessington, Surrey, UK.

DECOYS

CSEE DAGAIE Mk 2 countermeasures system

There are two CSEE DAGAIE Mk 2 ten-barrelled, trainable launchers mounted on the upper deck either side of the mast. These can be loaded with either infra-red (IR) or chaff rockets. The firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, windspeed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either 3-5 and 8-14 µm IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense, providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised glass fibre chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 µm bands.

Specifications

Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)

Manufacturer/Contractor

CSEE Defénse, Paris, France.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

CSEE Panda Mk 2

There are two Panda Mk 2 directors. This is an autonomous deck-mounted device for use in air defence operations as the primary system and can rotate through a nominal 360° on a mounting bracket with electrical connectors. This element consists of a binocular optical unit with auxiliary sight, gyrometric units, bearing and elevation electrical units, servo controls, a ballistics computer on the right of the mounting and control and communications units. The optical sensor offers × 8 and × 2.5 magnification with fields-of-view of 19° and 6° respectively.

It operates in two modes: surveillance/target tracking and fire control. In the former the target may be designated by the ship's radar and the director slews to face it. The target is acquired visually and identified, then tracked by the operator who moves the director with a joystick. In the fire-control mode the operator selects air or surface engagement and inserts target range data. The relevant guns are then slaved to the director whose operator then conducts the engagement.

In Panda Mk 2 the optical sensor is supplemented by a Philips low-light TV/IR electro-optic director.

Specifications

Height: 1.35 m (4.4 ft)
Width: 1.5 m (4.9 ft)
Weight: 480 kg (1,058 lb)
Traverse: 360° at 60°/s
Elevation: −25 to +65° at 60°/s

Manufacturer/Contractor

CSEE Défense, France.

RADARS

Ericsson Sea Giraffe 50 HC

The Sea Giraffe is used for air and surface search, with the antenna sited at the masthead.

Specifications

Operating frequency: G/H-band
Output power: 60 kW; average power 1,200 W
Antenna rotation rate: 60/30 rpm
Instrumented range: 25, 50, 100 and 150 km
Tracking capacity: More than 30 automatically initiated air targets; more than 50 manually initiated surface targets
Antenna sidelobe levels: −45 dB
Beamwidth, bearing: 1.8°
Elevation coverage: 0-70°
Accuracy: 20 m range; 0.3° azimuth

Manufacturer/Contractor

Ericsson Radar Electronics AB, Ground Systems Division, Molndal, Sweden.

Racal-Decca 1226

Specifications

Role: Navigation
Band: I
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm
Typical range: 48 n miles (88.8 km)

Manufacturer/Contractor

Racal-Decca, UK.

CelsiusTech 9LV 331

9LV 331 (LV = *lucht varn*) consists of one 9LV100 electro-optic director and one 9LV200 radar/TV/laser/IR fire-control director. It is capable of simultaneous engagement of several targets, including one air target. It controls 40 and 76 mm guns and Exocet.

Manufacturer/Contractor

CelsiusTech, Sweden.

AVIATION

HELICOPTERS

Specifications

Flight deck: 14.9 × 9.3 m (49 × 30 ft)
Hangar: The hangar accommodates one helicopter; see 'Further Information'
Helicopters: 1 Eurocopter BO-105

One Eurocopter BO-105

Dimensions
main rotor diameter: 9.84 m (32.28 ft)
tail rotor diameter: 1.90 m (6.23 ft)
length (including main and tail rotors): 11 m (36 ft)
height (top of rotor head): 3.02 m (9.91 ft)
Weights
empty, basic: 1,301 kg (2,868 lb)
max take-off: 2,500 kg (5,511 lb)
Performance (max T-O weight)
never-exceed speed (VNE) at sea level: 131 kts (242 km/h)
max cruising speed at sea level: 129 kts (240 km/h)
best range speed at sea level: 110 kts (204 km/h)
max rate of climb (sea level): 444 m/min (1,457 ft)/min
max operating altitude (2,500 kg): 3,050 m (10,000 ft)
max range:
at sea level: 300 n miles (555 km)
at 1,525 m (5,000 ft): 321 n miles (594 km)
endurance: 3 h 24 min
Power plant: 2 313 kW (420 shp) Allison 250-C20B turboshafts, each with a max continuous rating of 298 kW (400 shp)
Accommodation: 5 (pilot and co-pilot/passenger in front; three persons at rear)
Avionics: A wide variety of avionics is available including weather radar, Doppler and GPS navigation, 360° search radar, FLIR, TV broadcast and microwave datalink

One of the Bahreini Navy Lürssen 62 corvettes. The flight deck measures 14.9 × 9.3 m (49 × 30 ft) and is one of the smallest on any ship. The hangar is beneath the flight deck (Fr Lürssen)

PROPULSION

Specifications

System: Diesel
Main machinery: 4 MTU 20V 538 TB92, 9.42 MW (12,820 hp)
Shafts: 4
Ship's services: 3–170 kVA

FURTHER INFORMATION

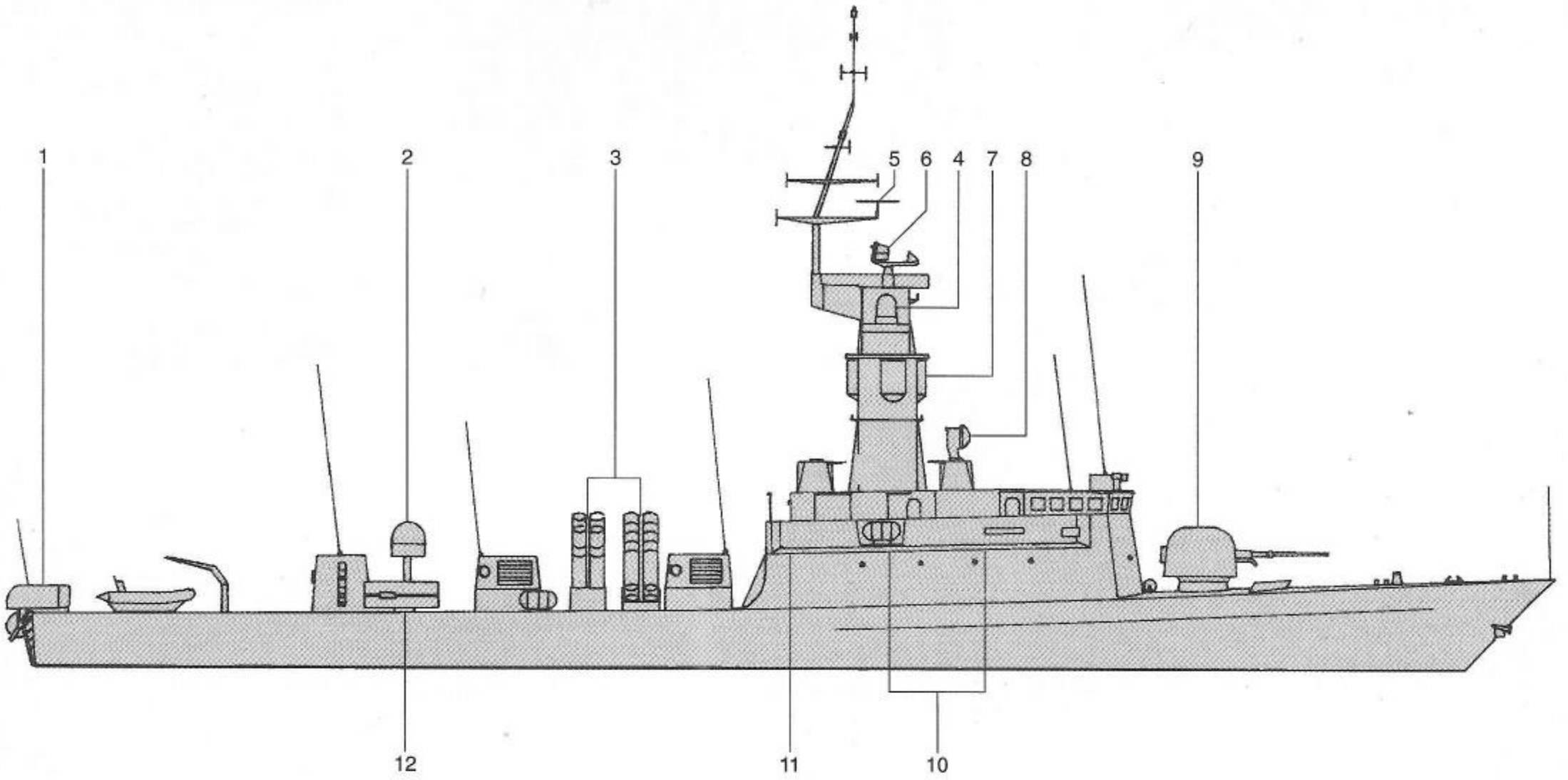
PROGRAMME

Two ships were ordered in February 1984 and entered service in February 1988. It was originally planned to purchase SA 365F helicopters and AST-15 SSMs for use with these ships, but this did not occur and BO-105 helicopters are used instead.

MODERNISATION

It is planned to upgrade these ships in 1999, which will include a SAM self-defence system.

VICTORY (LÜRSSEN 62)



Victory (Ian Sturton)
1 *Thomson-CSF TSM 2064 variable depth sonar* **2** *Satcom* **3** *McDonnell Douglas Harpoon anti-ship missiles (eight)* **4** *Elisra SEWS ESM* **5** *Kelvin Hughes Type 1007 navigation radar* **6** *Ericsson Sea Giraffe 150HC air/sea search radar* **7** *Rafael RAN-1101 jammer* **8** *Elta EL/M-2221(X) fire control* **9** *76 mm (3 in)/62 Super Rapid automatic gun* **10** *CIS-50 12.7 mm heavy machine gun* **11** *Plessey Shield 12-barrel decoy launcher* **12** *Whitehead B515 triple 324 mm torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Singapore
Type: Lürssen 62

Class: VICTORY

Built: 6
Active: 6

Displacement:
full load: 595 t

Dimensions
Length: 62.4 m (204.7 ft)
Beam: 8.5 m (27.9 ft)
Draught: 3.1 m (10.2 ft)

Speed: 35 kts
Range: 4,000 n miles at 18 kts

Complement: 49 (8 officers)

SHIPS

VICTORY (P 88)
Builder Lürssen Werft, Bremen-Vegesack, Germany
Launched 8 Jun 1988
Commissioned 18 Aug 1990

VALOUR (P 89)
Builder Singapore SB and Marine, Jurong, Singapore
Launched 10 Dec 1988
Commissioned 18 Aug 1990

VIGILANCE (P 90)
Builder Singapore SB and Marine, Jurong, Singapore
Launched 27 Apr 1989
Commissioned 18 Aug 1990

VALIANT (P 91)
Builder Singapore SB and Marine, Jurong, Singapore
Launched 22 Jul 1989
Commissioned 25 May 1991

VIGOUR (P 92)
Builder Singapore SB and Marine, Jurong, Singapore
Launched 1 Dec 1989
Commissioned 25 May 1991

VENGEANCE (P 93)
Builder Singapore SB and Marine, Jurong, Singapore
Launched 23 Feb 1990
Commissioned 25 May 1991

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84D-1A Block 1C Harpoon

Eight Harpoon anti-ship missile canisters are mounted immediately aft of the superstructure; there are two groups of four launchers each, with one group pointing across the ship to the opposite beam. The missiles are the Block 1C version, which has additional options compared to previous blocks, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 lb)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n mile (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg (11,905 lb) thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors
McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

TUBES

B-515 (ILAS-3) 324 mm anti-submarine torpedo launching system

There are two B-515 (also known as ILAS-3) triple mounts on the main deck level with the Satcom dome. The tubes are manually loaded and trained but remotely operated from the combat information centre, although emergency local operation is possible.

Specifications
Length: 3.4 m (11.15 ft)
Height: 1.2 m (3.94 ft)
Width: 1.285 m (4.2 ft)
Weight: 1,050 kg (2,315 lb) (unloaded)

Manufacturer/Contractor
Whitehead, Division of Gilardini SpA.

TORPEDOES

A 244/S
Six A 244/S lightweight anti-submarine torpedoes are carried (no reloads). The seeker in this weapon is the Alenia CIACIO-S which is capable of active, passive or mixed modes for closing on to its target and it can discriminate between decoys and real targets, as well as between target noise and reverberations. It also has a series of preset programmable search patterns and tactical manoeuvres (including re-attack procedures). The computerised homing system also provides for presettable combinations of signal processing, spatial filtering and tactical torpedo manoeuvring. The software may be reprogrammed by the user to meet new tactical conditions. Upon launching, the A 244/S initially steers a straight course and, if the target is not detected, it then begins a search pattern which may be either a spiral between preselected depths or a helix pattern.

Specifications
Length: 2.7 m (8.86 ft)
Diameter: 324 mm
Weight: 215 kg (474 lb) (warshot version)
Warhead: 34 kg (75 lb) shaped charge HBX-3 HE
Propulsion: Electric; silver/zinc batteries
Range: 3.5 n miles (6.5 km)
Speed: 30 kts
Guidance: Active/passive sonar, self-adaptive programmed patterns

Manufacturer/Contractor
Whitehead SpA, Salviano, Italy.

GUNS

OTOBREDA 76 mm (3 in)/62 Super Rapid
There is one OTOBREDA 76 mm (3 in)/62 calibre Super Rapid gun in a single turret immediately forward of the bridge.

Specifications
Elevation: −15 to +85°
Training speed: 60°/s
Elevation speed: 35°/s
Muzzle velocity: 925 m/s (3,034 ft/s)
Rate of fire: 120 rds/min
Weight of shell: 6 kg (13.23 lb)
Range: 8.5 n miles (15.75 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

CIS 50 12.7 mm machine gun**
Four machine guns are carried.
(* CIS = Chartered Industries of Singapore)

Victory *(P-88), nameship of a class of six ships. On the transom is the Thomson-CSF TSM 2064 VDS. Further forward are a triple B515 324 mm torpedo launcher and four Harpoon canisters. The tower mast and the pole topmast carry numerous EW arrays* (H & L van Ginderen Collection)

ELECTRONIC WARFARE SYSTEMS

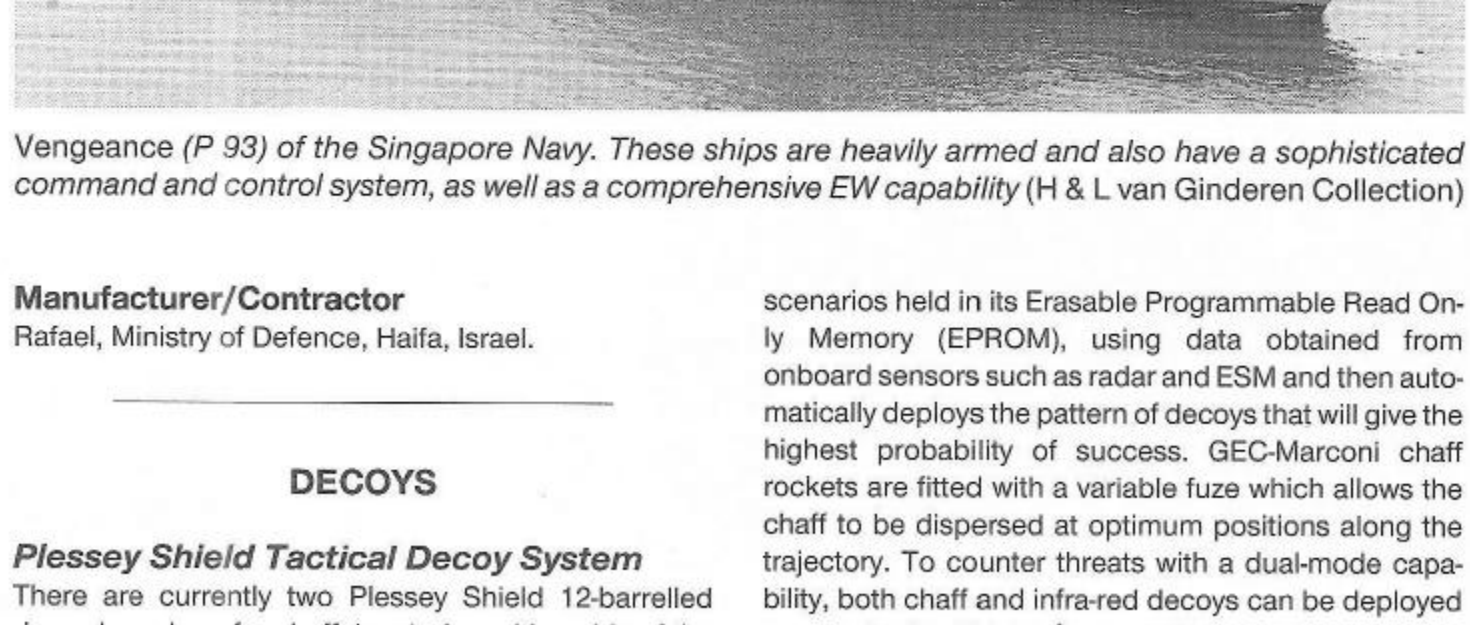
ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Rafael SEWS/RAN-1110 electronic warfare suite
SEWS/RAN-1110 (SEWS = Shiphoused Electronic Warfare System) is a fully integrated, modular and computerised shipborne electronic warfare suite, in which the SEWS elements provide the ESM techniques for the detection, analysis and identification of threat emissions, while the RAN-1110 provides the ECM measures to decoy and/or jam. The ESM subsystem is based on the C-Pearl system with high sensitivity, wide dynamic range and accurate IFM and IDF receivers covering the frequency band of 1 to 18 GHz, and a real-time processing system that analyses the information and identifies the threats by comparing the parameters to a stored emitter library. The receiver data includes frequency, bearings, amplitude, time of arrival, pulsewidth, CW, scan rate and pulse coding. Analysed threat data is displayed superimposed on a map of the area covered, together with true and relative bearing.

Following identification, the ECM subsystem responds automatically according to the threat or as commanded by the operator. It is based on the Shark/ RAN-1101 and consists of two advanced MultiBeam Array Transmitters (MBATs), each covering 180° in azimuth. These transmitters enable immediate positioning of a transmitting beam and are capable of coincidence jamming in the direction of the received threat. Both stabilised and unstabilised MBATs are available.

Specifications
SEWS (ESM)
Spatial coverage: 360° azimuth; 30° elevation
Frequency coverage: 1-18 GHz
Sensitivity: −60 dBm
Dynamic range: 60 dB
Frequency accuracy: 1.5° RMS
Direction accuracy: 2° RMS (high band); 5° RMS (low band)

RAN-1110 (ECM)
Spatial coverage: 360° azimuth; 25° elevation
Frequency coverage: 7.5-18 GHz
ERP: 78 dBm typical
Simultaneous transmission: 16 directions
Beam switching time: 100 ns



Vengeance *(P 93) of the Singapore Navy. These ships are heavily armed and also have a sophisticated command and control system, as well as a comprehensive EW capability* (H & L van Ginderen Collection)

Manufacturer/Contractor
Rafael, Ministry of Defence, Haifa, Israel.

DECOYS

Plessey Shield Tactical Decoy System
There are currently two Plessey Shield 12-barrelled decoy launchers for chaff, located on either side of the superstructure amidships (see 'Modernisation').

Shield is a microprocessor-controlled, fully automatic missile decoy system, which is designed to provide effective protection for various sizes of ship, including fast attack craft, corvettes, frigates and destroyers. On detecting a threat, Shield selects the most appropriate response from up to six million scenarios held in its Erasable Programmable Read Only Memory (EPROM), using data obtained from onboard sensors such as radar and ESM and then automatically deploys the pattern of decoys that will give the highest probability of success. GEC-Marconi chaff rockets are fitted with a variable fuze which allows the chaff to be dispersed at optimum positions along the trajectory. To counter threats with a dual-mode capability, both chaff and infra-red decoys can be deployed automatically. Shield offers four protection modes — confusion; distraction; seduction/breaklock; and seduction dump — and uses two types of decoy — chaff and infra-red — which may be used on their own, or in combination with each other.

Manufacturer/Contractor
Plessey, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Elbit AIO command system

The Elbit Action Information Organisation (AIO) system is based on Elbit's Naval Tactical Command & Control System (NTCCS), which first entered service on Israel's Sa'ar 4.5 FACs. That system was designed to accelerate the decision making process by providing data on potential targets, friendly forces and weapon system status by using inputs from shipborne sensors and those of friendly forces. System highlights include extracting and updating target data, track-while-scan operation, the ability to process two radars simultaneously and real-time handling of up to 50 air and surface targets. It also processes and displays navigation data, exchanges messages with shore-based headquarters and records tactical data for future debriefing.

Manufacturer/Contractor

Elbit Ltd, Haifa, Israel.

Satcom

There is a Satcom terminal.

RADARS

Ericsson Sea Giraffe 150 HC

The Sea Giraffe is used for air and surface search, with the antenna sited at the masthead.

Specifications

Operating frequency: G/H-band
Output power: 60 kW; average power 1,200 W
Antenna rotation rate: 60/30 rpm
Instrumented range: 25, 50, 100 and 150 km
Tracking capacity: More than 30 automatically initiated air targets; more than 50 manually initiated surface targets
Antenna sidelobe levels: −45 dB
Beamwidth, bearing: 1.8°
Elevation coverage: 0-70°
Accuracy: 20 m (65.6 ft) range; 0.3° azimuth

Manufacturer/Contractor

Ericsson Radar Electronics AB, Ground Systems Division, Molndal, Sweden.

Kelvin Hughes 1007

Specifications

Role: Navigation
Band: I/J
Beam: 1.0 × 18°
Peak power: 25 kW
Gain: 31 dB
Pulsewidth: 0.08/0.3/0.8 μs
PRF: 1,600/800/400 pps
Scan rate: 26 rpm

Manufacturer/Contractor

Kelvin Hughes, UK.

Elta EL/M-2221(X)

The fire-control system is based upon the Elta EL/M-2221GM I/J (8-20 GHz) and K-band (20-40 GHz), monopulse, coherent tracking and illumination radar which is supplemented, on the right-hand side of the mounting, by a Rafael thermal imager. The system features a dish antenna with front feed on four 'legs', the 700 kg (2,296 lb) antenna having an elevation of −25 to +85°. Search, acquisition and tracking may be conducted in either I/J or K-bands and the system can track the target or targets. The system controls the guns with the assistance of a separate ballistic computer. The radar's below-deck units consist of a servo-control and transceiver cabinets and data is fed into the main processing and control unit with overall control conducted through an IAI MBT Systems and Space Technology Fire-Control Console (FCC).

Manufacturer/Contractor

Elta. Israel.

SONAR

Thomson Sintra TSM 2643 Salmon

TSM2643 Salmon is a compact, active, Variable-Depth Sonar (VDS), based on an acoustic array of 24 staves in a streamlined fish, with a towing winch, transmitter and receiver unit and operator console with colour display. Embedded facilities include passive listening, sound ray tracer, integrated on-board simulator, and acoustic propagation prediction.

Specifications

Acoustic array: 24 identical staves of 7 transducers, weight 260 kg (573 lb)
Frequency: 19 kHz approximately
Transmitter: Omnidirectional transmission in CW and FM modes
Receiver: 36 preformed beams; advanced processing coherent in FM with pulse compression and spectrum analysis (FFT) in CW

Manufacturer/Contractor

Thomson Sintra ASM, France.

PROPULSION

Specifications

System: Diesel
Main machinery: 4 MTU 16V 538 TB93, 11 MW (15,020 hp)
Shafts: 4

FURTHER INFORMATION

PROGRAMME

Ordered in June 1986 to a Lürssen MGB 62 design, similar to the ships for Bahrain and UAE but without the helicopter facilities.

DESIGN

The design is essentially that of the Lürssen 62, as supplied to Bahrain and the UAE, but with the helicopter facilities removed. Despite the removal of the hangar, flight deck and elevator, however, the ships have demonstrated poor roll characteristics, almost certainly due to the large and heavy mast, which only exists in the Singaporean vessels.

MODERNISATION

The first priority appears to be to reduce the rolling, which has been a problem since the ships were commissioned. A roll-damping system was fitted in one ship in 1992 and is still under trial. It is possible that the mast may have to be rebuilt and reduced in size, possibly being replaced by two lighter, lattice masts.

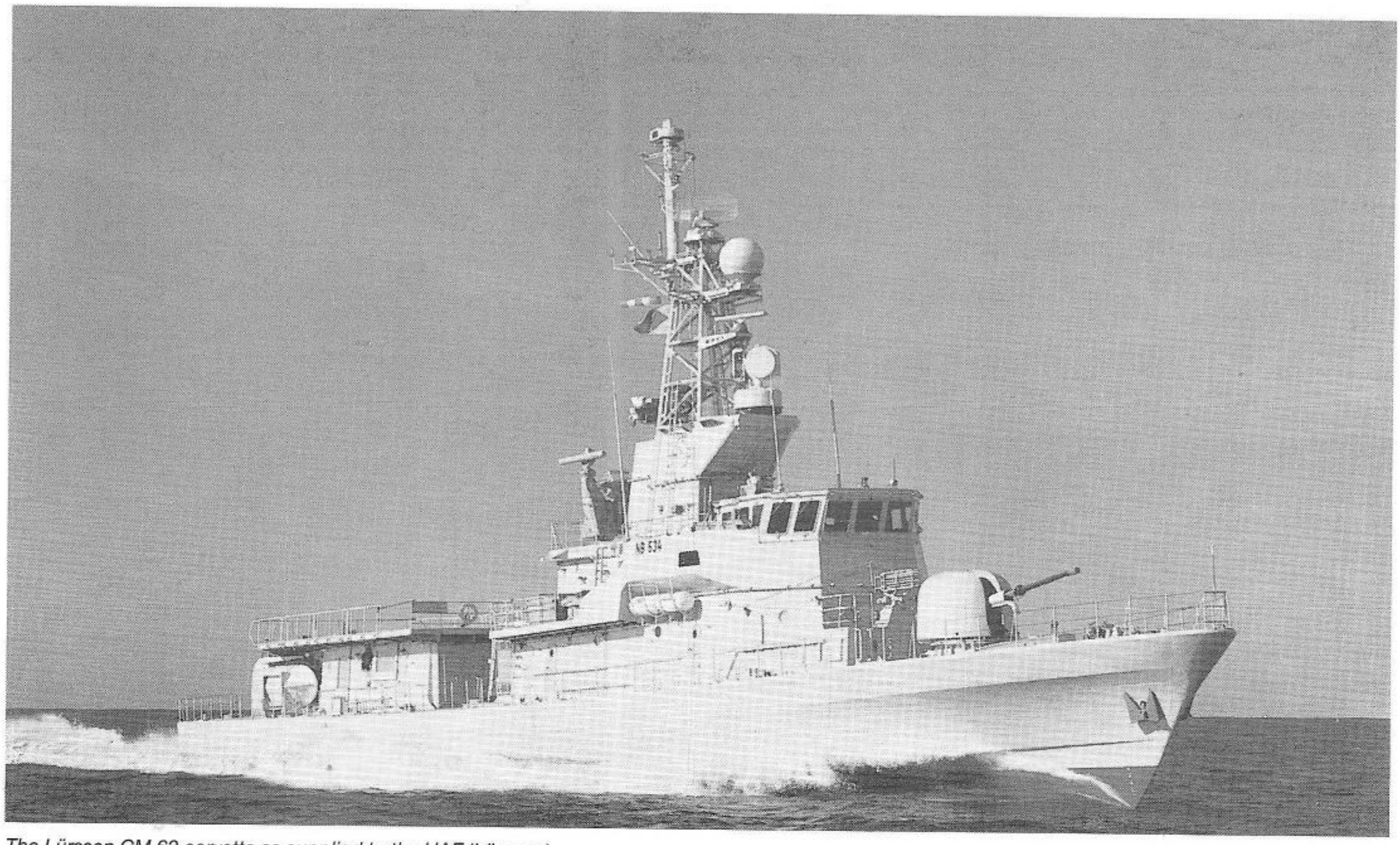
It is also intended to install a close-range missile defence system, probably either Barak I or Matra Simbad CIWS, which would include a second fire-control radar on the platform aft of the mast. It is also planned to replace the Plessey Shield by two twin Rafael long-range chaff launchers, which would be positioned below the bridge wings.

The Elbit EL/M-2221(X) fire-control system is currently used to control the guns, but it was originally designed to be part of the Barak SAM system. It will, therefore, be fully integrated into the system, when Barak is installed. It is also intended that a second set will be fitted aft of the mast to provide a second channel of fire.

DEPLOYMENT

These six corvettes form 188 Squadron, which is part of Coastal Command, whose primary peacetime mission is anti-piracy patrols, a particularly pressing task in these waters.

MURAY JIB (LÜRSSEN 62)



The Lürssen CM 62 corvette as supplied to the UAE (Lürssen)

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: UAE
Type: Lürssen 62

Class: MURAY JIB

Purchased: 2
Active: 2

Displacement:
full load: 708.5 t

Dimensions
Length: 64.50 m (212 ft)
Beam: 9.80 m (32 ft)
Draught: 3.10 m (10.2 ft)

Speed: 34 kts
Range: 3,930 n miles at 15 kts

Complement: 43 (7 officers)

SHIPS

MURAY JIB (CM 01)
Builder Lürssen, Bremen-Vegesack, Germany
Commissioned Nov 1990

DAS (CM 02)
Builder Lurssen, Bremen-Vegesack, Germany
Commissioned Jan 1991

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Aerospatiale MM 40 Exocet

The 'Muray Jib' class is equipped with 8 MM 40 sea skimming anti-ship missiles in two groups of two, firing across the ship.

Specifications
MM 40 Block 2
Length: 5.80 m (19 ft)
Diameter: 35 cm (13.7 in)
Wing span: 1.13 m (3.7 ft)
Weight: 870 kg (1,918 lb)
Speed: Mach 0.9
Range: 2-40.5 n miles (4-75 km)
Warhead: 155 kg (341.7 lb) HE frag
Fuze: Impact/proximity
Guidance: Inertial and active radar

Manufacturer/Contractor
Aerospatiale, France.

SURFACE-TO-AIR MISSILES (SAM)

Thomson-CSF Crotale Navale Modulaire

The eight-cell launcher for the Crotale Navale Modulaire system is located on the quarterdeck, immediately aft of the helicopter platform. The missile (designated R440N) can manoeuvre at up to 25 *g* in each axis and can reach Mach 2.3 in 2.5 seconds. Modular Crotale Naval uses the same missile as the original system but the launcher and the director are separated and the electronics are dispersed around the ship. The launcher, which is 3.87 m (12.7 ft) high, has eight containers, together with the infra-red localiser, and weighs 4.2 tonnes, while the below-decks electronics, including the launch control unit, weigh 850 kg (1,874 lb). The director weighs 800 kg (1,764 lb) and has the radar antenna on the right-hand side. The electro-optic trackers are on the left-hand side together with the missile guidance antenna. The control console is in the CIC. There is an eight-round reload system for Crotale Navale Modulaire, but does not appear to be installed in these UAE ships.

Specifications
Missile
Length: 2.9 m (9.5 ft)
Diameter: 16 cm (6.3 in)
Wing span: 54 cm (21 in)
Weight: 84 kg (185 lb)
Speed: Mach 2.4
Range: 700 m to 13 km (0.3 to 7 n miles)
Altitude: 4,000 m (13,120 ft)

Manufacturer/Contractor
Thomson-CSF, France.

GUNS

OTOBREDA 3 in (76 mm)/62 Mod 6 Super Rapid

There is one OTOBREDA 76 mm (3 in)/62 calibre Super Rapid gun in a single turret immediately forward of the bridge.

Specifications
Elevation: −15 to +85°
Training speed: 60°/s
Elevation speed: 35°/s
Muzzle velocity: 925 m/s (3,034 ft/s)
Rate of fire: 120 rds/min
Weight of shell: 6 kg (13.23 lb)
Range: 8.5 n miles (15.75 km)
Ammunition carried: 400 rds

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Signaal/General Electric SGE-30 30 mm Goalkeeper close in weapons system
One Signaal/General Electric 30 mm 7-barrelled Gatling Goalkeeper close in weapons system is mounted at the after end of the main superstructure. Goalkeeper is an autonomous, fully automatic system, consisting of a General Electric Sea Vulcan 30 gun, I-band search radar, I/K-band tracking radar, TV camera and ancillaries. The Sea Vulcan 30 is based upon the electrohydraulically powered GAU-8/A 30 mm seven-barrel, Gatling gun, with each barrel firing once during each revolution of the barrel cluster. The gun is very reliable, with 33,000 mean rounds between stoppages. The mounting has an ammunition capacity of 1,190 rounds carried in a linkless system using a feed and storage drum, which is claimed to be sufficient for several target engagements before reloading is necessary. The warhead kill capability of Goalkeeper against anti-ship missiles is achieved by use of APDS (Armour-Piercing Discarding Sabot) rounds which have high-density, tungsten-alloy penetrators. For 'soft' targets, HEI and TP types of ammunition can be used.

The I-band search radar uses a 2,050 × 280 mm linear array antenna with an integrated sidelobe suppression antenna. The antenna rotates at 60 rpm and has a horizontal beamwidth of 1.7° and a vertical beam width of 60°. The radar is powered by a water-cooled, synthesiser-driven, TWT transmitter with high output power for greater frequency and PRF flexibility in the face of ECM threats.

Specifications
Calibre: 30 mm
Muzzle velocity: 1,020 m/s (3,345 ft/s) (TP, HEI); 1,150 m/s (3,772 ft/s) (APDS)
Traverse: 360°
Elevation: −25 to +85°
Mounting weight: 6,800 kg (14,991 lb)
Crew: 0
Range: 200 m to 3 km (1.61 n miles)
Rate of fire: 4,200 rds/min
Ammunition: 369 g (813 lb) (TP, HEI, HEISD, API, MPDS)
Ammunition carried: 3,600 rds

Manufacturers/Contractors
Hollandse Signaalapparaten BV, Hengelo, Netherlands (system/radar).
General Electric Company, Armament Systems Department (gun).

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-EMI Cutlass E ESM system
Cutlass E is designed for operation in very dense signal environments, receiving signals in the 1 to 18 GHz frequency range, measuring their parameters, comparing them with those in the radar library which contains the parameters of 2,000 radars, and displaying the information — all within one second. The EW operator is presented with a tabular display for threat identity and threat evaluation and a tactical display giving a pictorial representation of the RF environment. Selected digital outputs can be sent to other local systems and hard copy printout of the intercepted radar is also available. The tabular display can indicate 150 intercepts, in the order of priority. Cutlass is wide open in both bearing and frequency: that is, it does not employ sweep techniques, giving a very high intercept probability (nearly 100 per cent). Cutlass B1 uses the Cutlass processor and an Instantaneous Frequency Measurement (IFM) receiver. It has a 32-element array antenna to provide bearing measurement by phase analysis techniques. This antenna also provides RF for the IFM. In both systems the processor is provided with fast and accurate information on incoming pulses.

Specifications
Frequency coverage: 2-18 GHz
Accuracy: 2° RMS in bearing
Coverage: 360° azimuth; +40 to −10° elevation
Pulse density capability: 500,000/s
Radar store capability: 2,000 modes

Manufacturer/Contractor
Racal Radar Defence Systems, Chessington, Surrey, UK.

ELECTRONIC COUNTERMEASURES (ECM)

Racal-EMI Cygnus B1 jammer
The Cygnus radar jammer operates in the I or J-bands and was designed for integration with Cutlass ESM equipment. Cygnus uses both responsive noise and deception jamming to provide an effective jamming capability against all types of radar including early warning, target acquisition and missile guidance. It has a narrow beamwidth giving high effective radiated power (300 kW) and is kept on target by a built-in, interferometer type, passive tracking system in both azimuth and elevation. The tracking system may also be used to relay accurate position data to systems of other ships. RF received by the tracking antennas is also used as the basis of transmitted RF and modulation and power management is under the control of a processor which also controls the tracking procedure. Types of modulation sequence available include range gate pull off and false target generation. A total of 59 charges is carried.

Manufacturer/Contractor
Racal Radar Defence Systems, Chessington, Surrey, UK.

DECOYS

CSEE DAGAIE Mk 2 countermeasures system
There are two CSEE DAGAIE Mk 2 ten-barrelled, trainable launchers, which can be loaded with either infrared (IR) or chaff rockets. The firing sequence runs automatically, once triggered by a missile alarm from a variety of sources, such as radar, ESM systems or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, wind speed and direction, ship heading and speed data.

The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Défense providing seduction, distraction and seduction/dissimulation modes. The electromagnetic decoys are normally based upon aluminised glass fibre chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 µm bands.

Specifications
Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)

Manufacturer/Contractor
CSEE Défense, Paris, France.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

CSEE Najir
Najir (designated DMAc by the French Navy) is an autonomous, deck-mounted director for use in air defence operations to complement the radar fire-control system. It has similar functions to Panda/Naja but the manned element supplements the Ericsson Nd:YAG laser rangefinder with an SAT Murene thermal imager operating in the 8-11 µm range. The latest production Najir features Radamec television cameras and consideration is being given to an eye-safe laser rangefinder. The manned element has, in addition to three sensors, a servo cabinet, a ballistic unit based upon two Motorola 68000 microprocessors and a power supply box.

Specifications
Najir
Height: 1.35 m (4.4 ft)
Width: 1.5 m (4.9 ft)
Weight: 560 kg (1,235 lb)
Max velocity
(traverse): 90°/s
(elevation): 60°/s

Manufacturer/Contractor
CSEE Défense, France.

RADARS

Ericsson Sea Giraffe 50 HC
The Sea Giraffe is used for air and surface search, with the antenna sited at the masthead.

Specifications
Operating frequency: G/H-band
Output power: 60 kW; average power 1,200 W
Antenna rotation rate: 60/30 rpm
Instrumented range: 25, 50, 100 and 150 km
Tracking capacity: More than 30 automatically initiated air targets; more than 50 manually initiated surface targets
Antenna sidelobe levels: −45 dB
Beamwidth, bearing: 1.8°
Elevation coverage: 0-70°
Accuracy: 20 m range; 0.3° azimuth

Manufacturer/Contractor
Ericsson, Sweden.

Racal-Decca 1226

Specifications
Role: Navigation
Band: I
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB

Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm
Typical range: 48 n miles (89 km)

Manufacturer/Contractor
Racal-Decca, UK.

CelsiusTech 9LV 223
9LV 223 (LV = *lucht varn*) consists of one 9LV100 optronic director and one 9LV200 radar/TV/laser/IR fire control director. It is capable of simultaneous engagement of several targets, including one air target and controls Exocet, 76 mm and 40 mm guns.

Manufacturer/Contractor
CelsiusTech, Sweden.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 14.9 × 9.3 m (49 × 30 ft)
Hangar: The hangar accommodates one helicopter; see 'Further Information'

HELICOPTER

Aerospatiale Alouette SA 316 Alouette

Specifications
Dimensions:
main rotor diameter: 11.02 m (36.15 ft)
length overall (rotor turning): 12.84 m (42.15 ft)
fuselage length: 10.17 m (33.3 ft)
height to rotor head: 3.00 m (9.84 ft)
Weights
empty: 1,143 kg (2,520 lb)
max take-off: 2,200 kg (4,850 lb)
Performance
max speed (never exceed): 113 kts (210 km/h)
max cruising speed: 100 kts (185 km/h)
service ceiling: 3,200 m (10,500 ft)
range (max fuel): 267 n miles (495 km)
Engines: 1–694 kW (870 shp) Turbomeca Artouste IIIB turboshaft derated to 425 kW (570 shp)
Accommodation: 7 (pilot plus 6)
Weapons: In the ASW role the Alouette III would carry 2 lightweight torpedoes

Das *(02), preparing to land a helicopter* (Lürssen)

PROPULSION

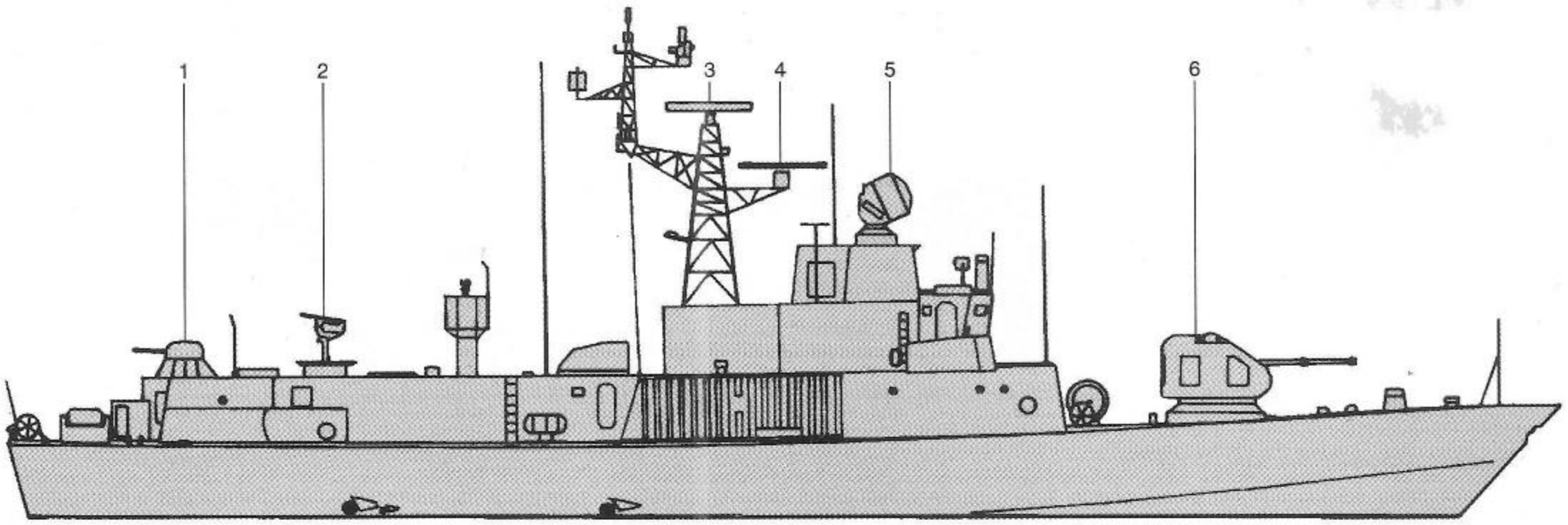
Specifications
System: Diesel
Main machinery: 4 MTU 16V 538 TB92, 10 MW (13,640 hp)
Shafts: 4
Ships's services: 4—152 kVA diesel-generator sets

FURTHER INFORMATION

PROGRAMME

These ships were ordered in late 1986 and are very similar to those purchased by Bahrain. They were delivered in October 1991.

ORKAN (SASSNITZ)



Orkan (Ian Sturton)
1 *AK-630M six-barrel 30 mm CIWS* **2** *SA-N-5 Grail SAM launcher* **3** *NUR-27XA surface search radar* **4** *SRN 443XTA navigation radar* **5** *MR-123 (Bass Tilt) fire-control radar* **6** *AK-176M 76 mm (3 in)/60 automatic gun*

GENERAL SPECIFICATIONS

Country of origin: Germany (former DDR)
Operator: Poland
Type: Sassnitz (Type 660)

Class: ORKAN

Purchased: 3
Active: 3

Displacement:
standard: 326.3 t
full load: 369 t

Length: 48.9 m (160.4 ft) (oa); 45 m (147.6 ft)(wl)
Beam: 8.65 m (28.38 ft)
Draught: 2.2 m (7.2 ft)

Speed: 36 kts
Range: 1,700 n miles at 18 kts; 2,400 n miles at 13 kts

Complement: 36 (7 officers)

SHIPS

ORKAN (421)		**PIORUN** (422)		**GROM (ex-Huragan)** (423)	
Builder	Peenewerft, Germany/ Northern Shipyard, Gdansk, Poland	**Builder**	Peenewerft, Germany/ Northern Shipyard, Gdansk, Poland	**Builder**	Peenewerft, Germany/ Northern Shipyard, Gdansk, Poland
Launched	7 Jul 1990	**Launched**	19 Oct 1990	**Launched**	11 Dec 1990
Commissioned	18 Sep 1992	**Commissioned**	11 Mar 1994	**Commissioned**	25 Mar 1995

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 'GRAIL' (Strela-2M)

There is one, four-missile launcher for the SA-N-5 short-range SAM system. SA-N-5 is the NATO designation for the Russian Strela-2M (Strela = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and partially pulls the trigger to activate the missile gyros, which take some four to six seconds to warm up. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spinning it up. Then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the target and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela-2M (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has better fragmentation uniformity.

A Polish report describes this system as 'FAM-14' and the missile as Strzala-2M.

Specifications

(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 5.5 km (2.9 n miles)
Altitude: 18 - 4,500 m (60 - 15,000 ft)
Guidance: IR homing

Manufacturer/Contractor

Fakel

GUNS

AK-176M 76 mm (3 in)/60

There is one single 76 mm (3 in) gun on the foredeck which is intended for air defence, surface engagement and shore bombardment roles. The AK-176 is a four-man mounting which may be either operated from the weapon control centre or from a local control station. The AK-176 is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'. This radar is also associated with the AK-630 and the two may form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the Kondensor sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day-night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight. 254 rounds are carried.

Specifications

Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: n/k
Traverse: 360° at 35°/s
Elevation: −3 to +85° at 30°/s
Ammunition (total): 16 kg (35.3 lb)
Rate of fire: 120-130 rds/min
Range:
anti-surface: 3.75 n miles (7 km)
anti-air: 10,000 m (32,800 ft)

30 mm/65 AK-630M close in weapons system

The single 30 mm AK-630 six-barrel anti-aircraft gun is mounted on the roof of the after superstructure. This weapon has five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AK-630 weapon is a water-cooled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to that of the

Phalanx, firing bursts of up to 400 rounds, but unlike the US weapon AK-630 features a separate radar director, Bass Tilt.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,919 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (13,000 ft)
electro-optic fire control: 5,000 m (16,500 ft)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
Weight:
UOF-84 HE-I: 384 g (13.5 oz)
UOR-84 HE-T: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

ELECTRONIC WARFARE SYSTEMS

DECOYS

Decoy/chaff launchers

There are two decoy launchers for chaff and IR decoys, designated Derkacz-2 and ORA-1. These appear to be related to the Russian PK-10.

COMMAND AND CONTROL SYSTEMS

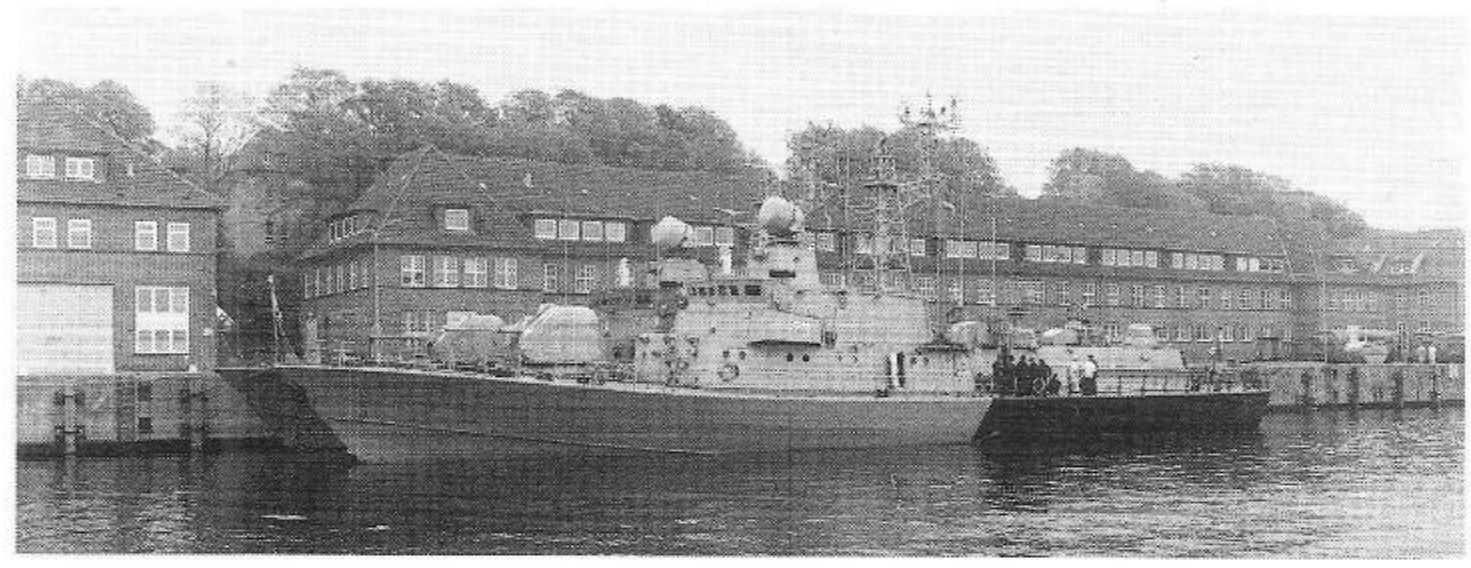
RADARS

NUR-27XA

Polish-designed and -produced I-band surface search radar.

Bass Tilt MR-123

Bass Tilt is an H/I-band fire-control radar which entered service in the mid-1970s and is part of the fire-control system for the AK-176M and AK-630M CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (4 ft) in diameter, inclined at an angle of approximately 45°. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings. A Polish report describes this system as Wympiel-AME.



Grom *(423) of the Polish 'Orkan' class. Six of these ships were ordered from Peenewerft, Germany, but only three were completed* (H M Steele)

SRN 443XTA

I-band navigation radar.

IFF

Square Head; Salt Pot.

PROPULSION

Specifications

System: Diesel
Main machinery: 3 Type M 520 diesels 10.80 MW (14,685 hp)
Shafts: 3
Auxiliary power: 3 Wola 104ZPM-135R6TC, each 180 kW

FURTHER INFORMATION

PROGRAMME

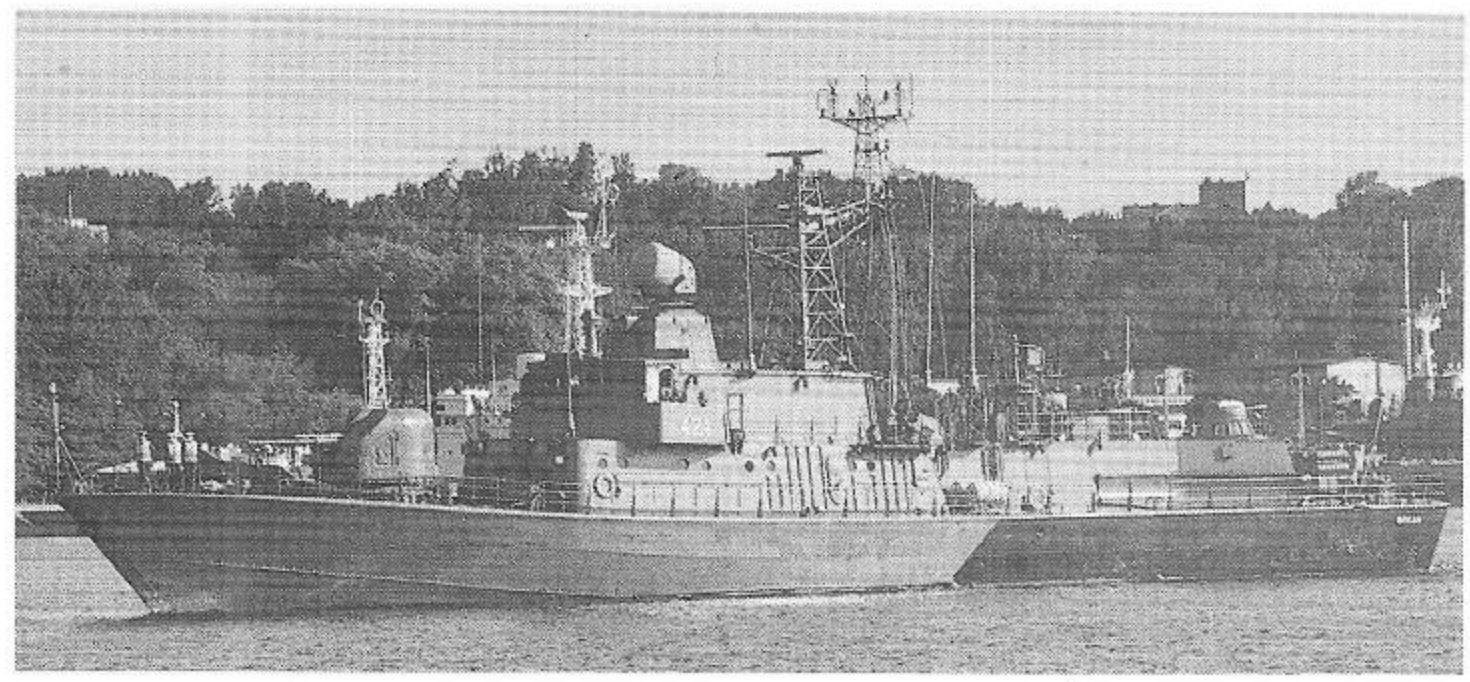
The original design was produced in the (then) DDR for a common corvette for the Warsaw Pact and was designated 'Balcom 10' by NATO (Balcom = Baltic Combatant). The original plan to produce up to 50, of which six would have been for Poland, but this was overtaken by the collapse of the Warsaw Pact and the re-unification of Germany. The Polish Navy, however, managed to obtain three partially-completed hulls which were taken to Gdansk and fitted out.

Three other ships were also completed in Germany and now serve in the Küstenwache (border guard). These are armed with just one Bofors 40 mm cannon, have two MTU diesels in place of the original Russian type, and have Racal radars.

DESIGN

The prototype vessel was armed with two quadruple launchers for the Russian SS-N-25 'Exocet-type' missile, but these were not available to the Poles when they completed the ships. It is, however, planned to fit eight SSMs of an undisclosed type in due course. Plank Shave radar has been replaced by a Polish set.

Unlike the German coastguard vessels of the same class, these ships retained the three Russian engines.



Orkan *(421)* (J Cislak)

OPERATIONAL

In peacetime these three corvettes form the 1st Division of the 3rd Flotilla of the Polish Navy and are based in Gdynia.

PARCHIM

OVERVIEW

During the Cold War, the German Democratic Republic (East Germany — DDR) possessed a fairly busy shipyard at Wolgast, known as Peenewerft. This yard produced a number of designs, the largest of which was the 1,950 tonne 'Frosch' class landing ship, and several types were selected by the (then) Soviet Union for use elsewhere within the Warsaw Pact. One of these designs was the Parchim.

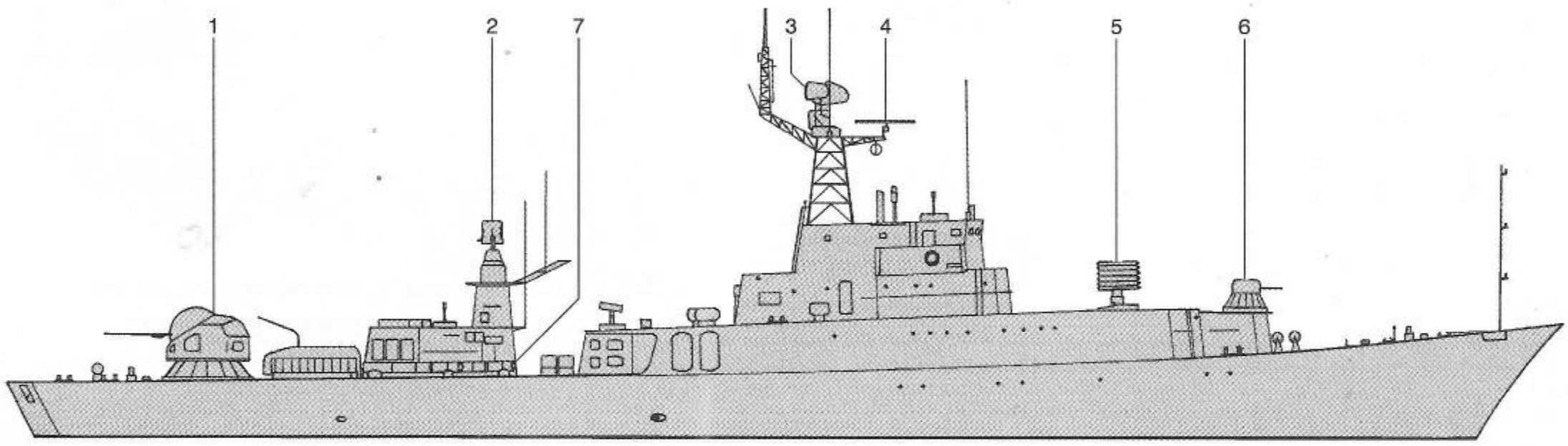
The Parchim design originated in a requirement from the DDR Navy (Volksmarine) for a replacement for the 'Hai' class light anti-submarine patrol boats. 16 were built for the *Volksmarine* between 1977 and 1985 and all served in the Baltic. They were not particularly well-armed, having one twin 57 mm mount and two SA-N-5s for close in air defence, while their ASW armament comprised two RBU-6000s, four 400 mm torpedo tubes and a depth-charge projector. They were, however, able to carry 60 mines, rather more than many other ships. Their primary ASW sensor was the Russian dipping sonar which required the ship to stop to operate, using the so-called 'dip-and-dash' technique. They were not fitted with roll dampers and were reputed to be poor sea-boats.

The (then) Soviet Navy ordered twelve of an improved design, designated 'Parchim II' by NATO. This had a more effective air search radar, a 76 mm gun in place of the twin 57 mm, a 30 mm Gatling and four 533 mm torpedo tubes in place of the four 400 mm tubes. The ASW sensors remained the same however.

On the end of the Cold War and the reunification of Germany, the *Volksmarine* ceased to exist and the Peenewerft was absorbed into a German industrial combine. The *Bundesmarine* absorbed five of the former-GDR Parchim Is for a brief period, leaving the other eleven in reserve, but then placed all 16 on the export market and sold them to Indonesia.

The Russian Navy has retained all twelve of its Parchim IIs in service and all were refitted at Rostock in 1994-95.

KAPITAN PATIMURA (PARCHIM I)



Kapitan Patimura (Ian Sturton)
1 *Twin 57 mm/80 ZIF-72* **2** *Muff Cob fire-control radar (for 57 mm guns)* **3** *Strut Curve air/surface search radar* **4** *TSR-333 navigation radar* **5** *RBU-6000 anti-submarine rocket launcher* **6** *AK-230 twin 30 mm CIWS* **7** *Four 400 mm torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Germany (former DDR)
Operator: Indonesia
Type: Parchim I

Class: KAPITAN PATIMURA

Purchased: 16
Active: 16

Displacement:
standard: 769 t

Dimensions
Length: 75.2 m (246.7 ft)
Beam: 9.8 m (32.2 ft)
Draught: 3.5 m (11.5 ft)

Speed: 28 kts
Range: 1,750 n miles at 18 kts

Complement: 62 (9 officers)

SHIPS

KAPITAN PATIMURA (371)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 11 May 1983 (*Prenzlau* (231))
Transferred (Indonesia) 4 Jan 1993
Recommissioned 23 Sep 1993

UNTUNG SUROPATI (372)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 29 Oct 1983 (*Ribnitz* (233))
Transferred (Indonesia) 4 Jan 1993
Recommissioned 23 Sep 1993

NUKU (373)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 23 Nov 1982 (*Waren* (224))
Transferred (Indonesia) 4 Jan 1993
Recommissioned 15 Dec 1993

LAMBUNG MANGKURAT (374)
Builder Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*) 26 Jul 1985 (*Angermünde* (214))
Transferred (Indonesia) 4 Jan 1993
Recommissioned 12 Jul 1994

CUT NYAK DIEN (375)
Builder Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*) 12 Feb 1982 (*Lübz* (221))
Commissioned (FGN) (P 6169)
Transferred (Indonesia) 4 Jan 1993
Recommissioned 25 Feb 1994

SULTAN THAHA SYAIFUDDIN (376)
Builder Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*) 30 Jun 1982 (*Bad Doberan* (222))
Transferred (Indonesia) 4 Jan 1993
Recommissioned 25 Feb 1995

SUTANTO (377)
Builder Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*) 9 Jul 1981 (*Wismar* (241))
Commissioned (FGN) (P 6170)
Transferred (Indonesia) 4 Jan 1993
Recommissioned 10 Mar 1995

SUTEDI SENOPUTRA (378)
Builder Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*) 9 Apr 1981 (*Parchim* (242))
Transferred (Indonesia) 4 Jan 1993
Recommissioned 9 Sep 1994

WIRATNO (379)
Builder Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*) 19 Sep 1981 (*Perleberg* (243))
Transferred (Indonesia) 4 Jan 1993
Recommissioned 19 Sep 1994

MEMET SASTRAWIRIA (380)

Builder	Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*)	30 Dec 1981 (*Bützow* (244))
Transferred (Indonesia)	4 Jan 1993
Recommissioned	2 June 1995

TJIPTADI (381)

Builder	Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*)	1 Feb 1985 (*Bergen* (213))
Transferred (Indonesia)	4 Jan 1993
Recommissioned	1996

HASAN BASRI (382)

Builder	Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*)	10 Nov 1982 (*Güstrow)* (223))
Transferred (Indonesia)	4 Jan 1993
Recommissioned	1996

IMAM BONJOL (383)

Builder	Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*)	27 Jan 1984 (*Teterow* (234))
Transferred (Indonesia)	4 Jan 1993
Commissioned (FGN)	(P 6168)
Recommissioned	26 Apr 1994

PATI UNUS (384)

Builder	Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*)	4 Jul 1983 (*Ludwiglust* (232))
Transferred (Indonesia)	4 Jan 1993
Recommissioned	21 Jul 1995

TEUKU UMAR (385)

Builder	Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*)	21 Sep 1984 (*Grevesmühlen* (212))
Transferred (Indonesia)	4 Jan 1993
Recommissioned	1996

SILAS PAPARE (386)

Builder	Peenewerft, Wohlgast, Germany (former-DDR)
Commissioned (DDR *Volksmarine*)	31 Aug 1984 (*Gädebusch* (211)
Commissioned (FGN)	(P 6167)
Transferred (Indonesia)	4 Jan 1993
Recommissioned	1996

WEAPONS SYSTEMS

TUBES

400 mm tubes

There are four 400 mm torpedo tubes located either side of the after deckhouse.

GUNS

57 mm/80 ZIF-72

There is one twin ZIF-72 'Y' position on the quarterdeck. This weapon is an evolutionary development of the twin-barrel ZIF-31B, but it has clearly been designed for prolonged air defence engagements and for this reason has a slightly longer (4.57 m), water-cooled barrel. It may also be used against surface and coastal targets.

The mounting is operated by two men from the fire-control station associated with the 'Muff Cob' radar system. 'Muff Cob' has its antenna in a 1 m (3.28 ft) wide, weather-proof mounting suspended from a trunnion-yoke carried on a traversing mounting. The radar is supplemented by an electro-optic sensor. The height of the mounting is about 3 m (9.8 ft) and the H-band radar can probably tilt from −10 to +50° as with the gun mounting. It is likely that control of the mounting is conducted from the compartment which houses the radar display system.

Specifications

Length of barrel: 80 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Traverse: ±200°
Elevation: −10 to +85°
Range:
- **anti-surface:** 3.25 n miles (6 km)
- **anti-air:** 6,000 m (20,000 ft)

Rate of fire: 120 rds/min/barrel
Projectile weight: 6.61 kg (14.6 lb)

30 mm 65 AK-230 twin mounting

A single AK-230 twin 30 mm mount is located at the forward end of the superstructure. AK-230 is a remotely operated, twin barrel, automatic anti-aircraft gun designed to engage air targets at heights of up to 4,000 m (13,120 ft). It is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically powered mounting consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system. Russian ammunition for this weapon consists of two rounds; BR-83 and OF-83D (see Specifications). The fire control radar is the I/J-band Muff Cob fire-control radar, whose maximum acquisition range is approximately 22 n miles (40 km), with each radar director controlling two gun mountings.

Tjiptadi *(381). The purchase of these ships boosted the number of patrol ships in the Indonesian Navy* (H & L van Ginderen Collection)

Specifications

NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,450 ft/s)
Range:
- **anti-surface:** 2.2 n miles (4 km)
- **anti-air:** 4,000 m (13,120 ft)

Rate of fire: 1,000 rds/min/ gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Crew: 2 (off mount)

Ammunition
BR-83:
- **type:** Armour-piercing tracer
- **weight (complete round):** 1.47 kg (3.24 lb)
- **weight (projectile):** 0.35 kg (0.77 lb)

OF-83D:
- **type:** High explosive
- **weight (complete round):** 1.40 kg (3.09 lb)
- **projectile:** 0.27 kg (0.60 lb)

ANTI-SUBMARINE MORTARS

RBU 6000

Two automatic, 300 mm calibre, 12-barrelled trainable launchers with a range of 6,000 m (19,680 ft) are fitted aft of the 30 mm gun. The launch tubes are arranged in a circular fashion and are reloaded automatically by bringing them into the vertical and then indexing one by one while depth bombs are loaded from below.

Specifications

Length: 1.8 m (5.9 ft)
Range: 6,000 m (19,680 ft)
Warhead: 31 kg (68 lb)

DEPTH CHARGES

There are two depth charge racks.

MINES

There are two mine rails, which can discharge up to 60 mines over ramps in the transom.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog

There are two Watch Dog arrays. Watch Dog is an intercept and radar warning system which has been in service for over 30 years. It is a wide-open system with an array consisting of four tiers of eight microwave horns, covering frequencies from D to H-band and normally has two arrays, one on each side of the ship.

DECOYS

PK-16

There are two PK-16 launchers. PK-16 is a Russian naval decoy system about which details were first revealed in 1993. The system consists of KT-216

launchers, a control console and three munitions. The launcher has ten 120 mm barrels fixed at an angle of about 45°. The launcher appears to be turnable. The control console appears to be a relatively simple design capable of controlling up to four launchers. The munitions are all for seduction purposes. The SR-50 is a chaff round with a payload of 11 kg (24 lb). The SOM-50 is a heat-seeker/laser-guided missile seduction round with 7.3 kg (16 lb) payload while the SK-50 is a combined round with 9.1 kg (20 lb of payload.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar

The air search radar is the Russian MR-302 (NATO = Strut Curve) a medium-range, general purpose, F-band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m² aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

TSR 333

TSR-333 is an I-band navigation radar.

Muff Cob

Muff Cob is the director for the 57 mm fire-control system and is the large cylindrical radome atop the small tower overlooking the quarterdeck. The radome is supported by a trunnion yoke in a traversing mounting and is thus capable of both elevation and traverse. There is a device to the left of the radome (from the front), with a remotely-controlled cover, which may be a TV camera. The F/G-band radar is named Muff Cob by NATO and Bars (Wildcat) by the Russian Navy.

IFF

High Pole B.

SONAR

MGK-332T sonar suite

According to recent information, these ships are fitted with a sonar suite named MGK-332T. There are two principle elements:

- a hull-mounted active search and attack, medium-frequency sonar, believed to operate in the 20-30 kHz range.
- a Variable Depth Sonar (VDS) known as Elk Tail, which is a high-frequency, helicopter-type VDS, and is lowered into the water from the forward of two doors in the starboard side of the ship.

PROPULSION

Specifications

System: Diesel

Main machinery: 3 Type M 504 diesels, 7.95 MW (10,812 hp)

Shafts: 3

FURTHER INFORMATION

PROGRAMME

These ships were all built for the DDR *Volksmarine,* being commissioned between 1983 and 1984. On unification in 1991 four were temporarily commissioned into the Federal German Navy, while the remainder was paid off. All 16 ships were then purchased by Indonesia, being formally transferred on 4 January 1993 and commissioned into the Indonesian Navy on 25 August 1993. The first three arrived in Indonesia in November 1993.

MODERNISATION

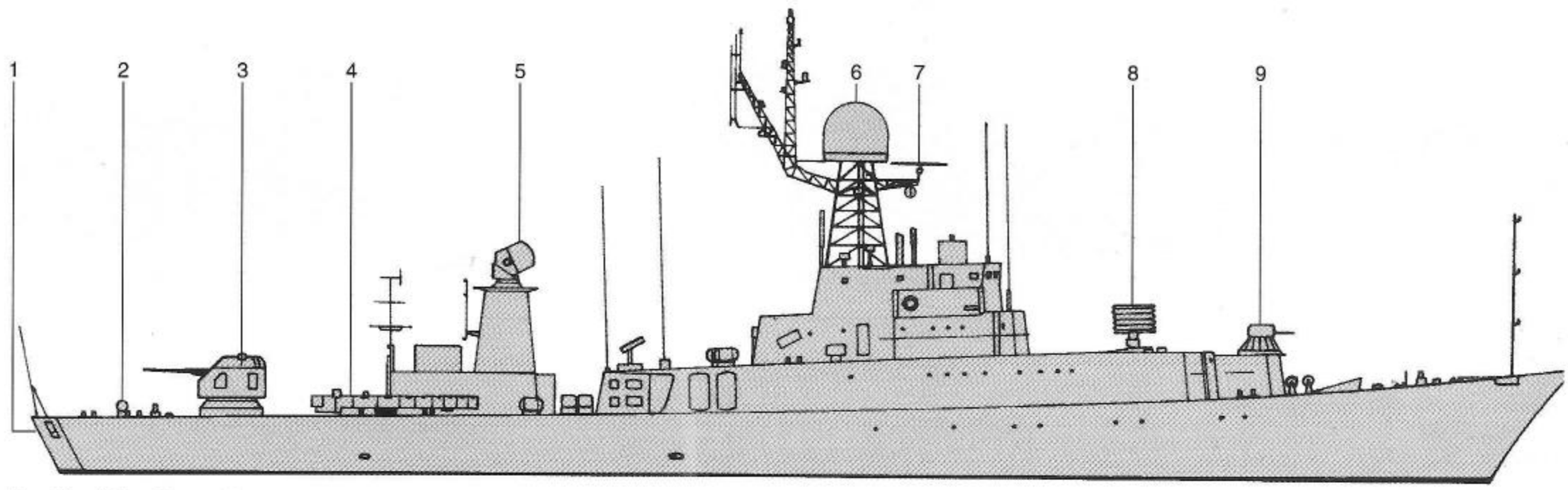
All were refitted prior to sailing for Indonesia. The work included turning some of the voids into additional fuel tanks to increase the range, and adding air conditioning to make them more habitable in the tropics.

OPERATIONAL

These 16 ships represented a sudden and massive increase in the front-line strength of the Indonesian Navy and created some turbulence concerning manning and maintenance. Some reports suggest that the ships are being poorly maintained, although this is probably due to a lack of crews trained to maintain these specific ships.

Memet Sastrawiria *(380)* (H & L van Ginderen Collection)

PARCHIM II (TYPE 133.1M)



Parchim II (Ian Sturton)
1 *MGK-335 Platina Variable Depth Sonar (VDS)* **2** *PK-16 16-tube chaff decoy launcher (two)* **3** *AK-176M 76 mm (3 in)/60 automatic gun* **4** *533 mm (21 in) torpedo tubes (four)* **5** *Bass Tilt fire-control radar* **6** *Cross Dome/Positive E air/surface search radar* **7** *Navigation radar (TSR 333, Nayala or Kivach III)* **8** *RBU-6000 12-tube ASW rocket launcher* **9** *AK-630M six-barrel 30 mm CIWS*

GENERAL SPECIFICATIONS

Country of origin: Germany (former GDR)
Operator: Russia
Type: Type 133.1 M

Class: PARCHIM II

Acquired: 12
Active: 12

Displacement:
standard: 769 t
full load: 960 t

Dimensions
Length: 75.2 m (246.7 ft)
Beam: 9.8 m (32.2 ft)
Draught: 4.4 m (14.4 ft)

Speed: 28 kts
Range: 2,500 n miles at 12 kts

Complement: 70 (8 officers)

SHIPS

MPK-67, -99, -105, -192, -205, -213, -216, -219, -224, -228, -229, JUNGA

Builder	Peenewerft, Wolgast, Germany (DDR)
Launched	1985-89
Commissioned	1986-89

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 Grail

There are two quad launchers per ship. The Strela 2 (9M32M) missiles in the SA-N-5 missile system are housed in glass fibre launcher-containers. When the operator acquires the target he/she activates the thermal battery and when the seeker has acquired the target an audio signal is received. The operator then takes the first pressure on the trigger to activate the missile gyros which are warmed up in four to six seconds. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then takes the full pressure on the trigger to launch the missile. The booster burns for 0.05 seconds to eject the missile from the launch tube at a speed of 28 m/s (92 ft/s) and to spin it; then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out. The missile homes on the 'hottest' part of the target and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead.

Specifications

Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 2.9 n miles (5.5 km)
Altitude: 18-4,500 m (60-15,000 ft)

Manufacturer/Contractor

Fakel, Russia.

TUBES

533 mm (21 in) torpedo tubes

There are four 533 mm (21 in) torpedo tubes mounted in two groups of two either side of the after deckhouse.

TORPEDOES

The normal types of Russian 533 mm (21 in) torpedoes are carried.

GUNS

AK 176M 76 mm (3 in)/60

There is one AK-176M 76 mm gun mounted on the quarterdeck. The AK-176M is designed for air defence, surface engagement and shore bombardment roles and is a four-man mounting which may be operated from the weapon control centre or from a local control station. The barrel is cooled externally by taking seawater from the ship's fire main through a jacket which lies around the liner.

The AK-176M is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'. This radar is also associated with the AK-630M and the two form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the *Kondensor* sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day/night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight. Some vessels appear to have the mounting in a stand-alone configuration supported by other fire-control radars.

Specifications

Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,214 ft/s)
Traverse: 360° at 35°/s
Elevation: −7 to +85° at 30°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 120 rds/min

30 mm/65 AK-630

There is a single, six-barrelled AK-630 CIWS at the forward end of the superstructure. This weapon has five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AK-630 gun is a water-cooled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but, unlike the US weapon, AK-630 features a separate radar director.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres

MPK-223, a Parchim II class corvette of the Russian Navy (H & L van Ginderen Collection)

Number of barrels: 6
Muzzle velocity: 890 m/s (2,920 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (4,374 yd)
electro-optic fire control: 5,000 m (5,468 yd)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
UOF-84 HE-I: weight: 384 g (13.5 oz)
UOR-84 HE-T: weight: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

ANTI-SUBMARINE MORTARS

RBU 6000

Two 12-tubed trainable launchers per ship with a range of 6,000 m (19,680 ft) are mounted immediately in front of the bridge screen. There are 12 300 mm calibre launch tubes arranged in a circular fashion, which are reloaded automatically by bringing them into the vertical and then indexing one by one while depth bombs are loaded from below.

Specifications
Length: 1.8 m (5.9 ft)
Range: 6,000 m (19,680 ft)
Warhead: 31 kg (68 lb)

DEPTH CHARGES

There are two depth-charge racks.

MINES

Mine rails are fitted; 60 mines can be carried.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog

There are two Watch Dog arrays. Watch Dog is an intercept and radar warning system which has been in service for over 30 years. It is a wide-open system with an array consisting of four tiers of eight microwave horns, covering frequencies from D to H-band and normally has two arrays, one on each side of the ship.

DECOYS

PK-16

There are two PK-16 launchers. PK-16 is a Russian naval decoy system about which details were first revealed in 1993. The system consists of KT-216 launchers, a control console and three munitions. The launcher has ten 120 mm barrels fixed at an angle of about 45°. The launcher appears to be turnable. The control console appears to be a relatively simple design capable of controlling up to four launchers. The munitions are all for seduction purposes. The SR-50 is a chaff round with a payload of 11 kg (24 lb). The SOM-50 is a heat-seeker/laser-guided missile seduction round with 7.3 kg (16 lb) payload while the SK-50 is a combined round with 9.1 kg (20 lb) of payload.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Hood Wink and Odd Box

These are two electro-optic systems; no details are known.

RADARS

Cross Dome/Positive E

Cross Dome is an E/F-band air and surface search radar, which is under the large radome at the masthead. The same radar is to be found in the Gepard export frigate and in the Indian Navy Khukri and Abhay ('Nanuchka II') class corvettes.

Parchim II. Note the Cross Dome radar and the Bass Tilt on a substantial square section tower, which distinguish this version from Parchim I

TSR 333 or Nayala or Kivach III
I-band navigation radars.

Bass Tilt fire-control radar
Bass Tilt is an H/I-band fire-control radar which entered service in the mid-1970s and is part of the fire-control system for the ADG-630 CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (4 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.56 ft) high and 1.45 m (4.8 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

IFF
High Pole A

SONARS

MGK-335 Platina sonar suite
According to recent information, these ships are fitted with a sonar suite named MGK-335 Platina. There are two principle elements:

- a hull-mounted sonar (NATO = Bull Horn), which is an active search and attack, medium-frequency sonar, believed to operate in the 20-30 kHz range.
- a variable depth sonar known as Lamb Tail, which is a high-frequency, helicopter type, Variable Depth Sonar (VDS).

PROPULSION

Specifications
System: Diesel
Main machinery: 3 Type M 504A diesels; 7.95 MW (10,812 hp)
Shafts: 3

FURTHER INFORMATION

PROGRAMME

These were built in the DDR at Peenewerft, Wolgast for the (then) Soviet Navy. The first was commissioned on 19 December 1986 and the last on 6 April 1990.

STRUCTURE

Similar design to the ex-DDR 'Parchim I' class but with some armament differences.

MODERNISATION

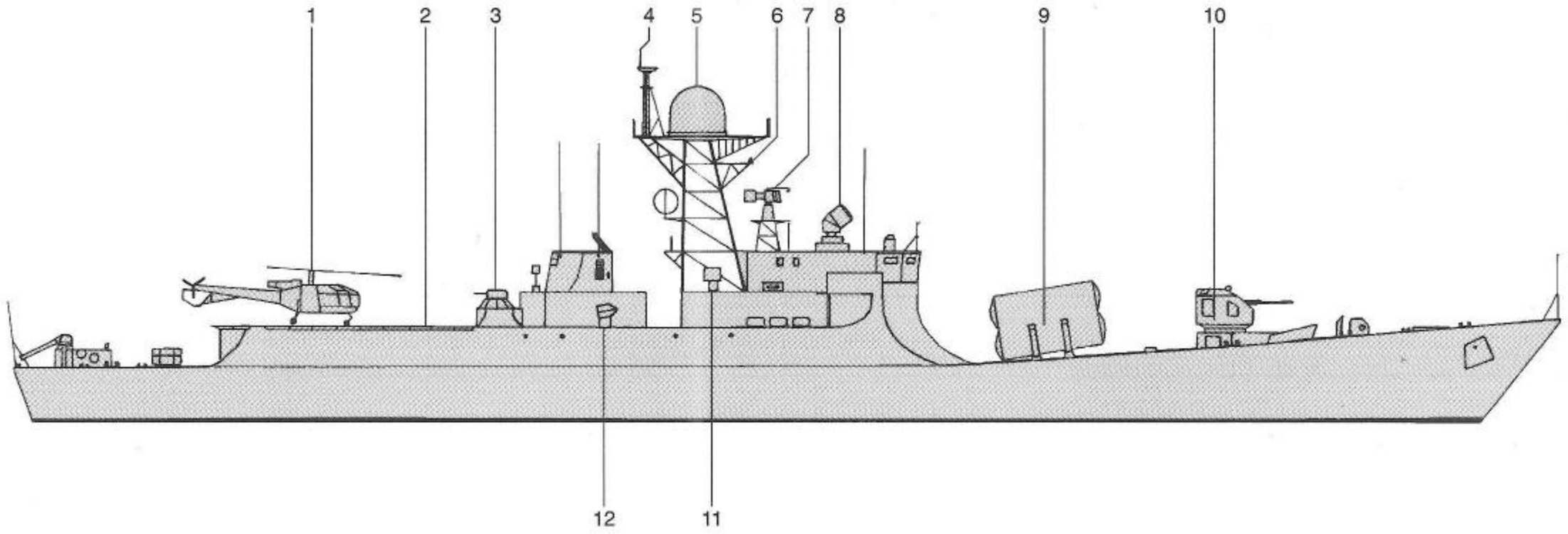
All ships in the class were refitted at Rostock in 1994/95.

OPERATIONAL

All operate in the Baltic.

Parchim II of the Russian Navy. Curiously the base for the Cross Dome radar is fitted, but there is no radar array or radome (US Navy)

KHUKRI (PROJECTS 25 and 25 A)



Khukri (Ian Sturton)
1 *HAL Chetak (Alouette III) helicopter* **2** *Flight deck* **3** *AK. 630 30 mm/65 6-barrel CIWS* **4** *Bharat Ajanta P radar intercept* **5** *Cross Dome (Positive E) air search radar* **6** *Bharat 1245 navigation radar* **7** *Plank Shave air/surface search radar* **8** *Bass Tilt fire control* **9** *SS-N-2d anti-ship missiles (four)***10** *AK 176 76 mm (3 in)/60 gun***11** *SA-N-5 Grail manually aimed launcher* **12** *16-barrel chaff launcher*

GENERAL SPECIFICATIONS

Operator: India
Type: Project 25/25A

Class: KHUKRI

Built: 5
Active: 5

Building: 1
Proposed: 2

Displacement:
full load: 1,350 t

Length: 91.1 m (298.8 ft)
Beam: 10.5 m (34.4 ft)
Draught: 2.5 m (8.2 ft)

Speed: 25 kts
Range: 4,000 n miles at 16 kts

Complement: 80 (11 officers)

SHIPS

KHUKRI (P 49)		**KIRPAN** (P 44)		**KORA** (-)	
Builder	Mazagon Dock Ltd, Bombay, India	**Builder**	Garden Reach SY, Calcutta, India	**Builder**	Garden Reach SY, Calcutta, India
Laid down	27 Sep 1985	**Laid down**	15 Nov 1985	**Laid down**	10 Jan 1990
Launched	3 Dec 1986	**Launched**	16 Aug 1988	**Launched**	23 Sep 1992
Commissioned	23 Aug 1989	**Commissioned**	12 Jan 1991	**Commissioned**	1996
KUTHAR (P 46)		**KHANJAR** (P 47)		**KIRCH** (-)	
Builder	Mazagon Dock Ltd, Bombay, India	**Builder**	Garden Reach SY, Calcutta, India	**Builder**	Garden Reach SY, Calcutta, India
Laid down	13 Sep 1986	**Laid down**	15 Nov 1985	**Laid down**	31 Jan 1992
Launched	15 Apr 1989	**Launched**	16 Aug 1988	**Launched**	1996
Commissioned	7 Jun 1990	**Commissioned**	22 Oct 1991	**Commissioned**	1998

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

SS-N-2d (Rubezh P-22) ('Styx') medium-range anti-ship missile

The 'Khukri' class is armed with four SS-N-2d 'Styx' missiles with two pairs of missile launch tubes on the foredeck, in a mounting similar to that in the 'Veer' ('Tarantul') class, also operated by the Indian Navy. The outer part of the bridge screen acts as a blast-deflector. There are no reloads.

The SS-N-2d was introduced into Soviet service in 1967 and is essentially an SS-N-2a with an added infra-red seeker. This relatively large anti-ship missile is powered by a liquid-fuelled rocket motor, with a solid fuel booster attached. Once the target is detected the ship must close, with the aim of being within the optimum engagement distance, some 15 to 20 n miles (28 to 37 km). Once ready to launch, the ship must face the target, maintain a speed of 15 kts or less, and hold its course for 20 to 30 seconds before launching the first salvo of two missiles. These may be followed, a minute later, by the second pair. Upon launch, the missile climbs at an angle of 45° to one of five preset altitudes (100, 150, 200, 250 or 350 m (328, 492, 656, 820 or 1,148 ft)), where the onboard radar searches for a target and the receiver is switched on for very short periods to receive signals from a designated range, the range gate being 1 km (0.54 n miles) on either side of the target. The radar locks only after eight returns have been received, at distances of 3.5 to 12 n miles (6.5 to 22 km), whereupon the seeker guidance system switches off the autopilot. A throw-off gyroscope takes the missile on target a few seconds before impact as it becomes too close for radar-generated homing signals. Russian Navy tacticians calculate that seven to eight missiles are required to destroy a cruiser-size target and four for a destroyer, making salvo firing a major feature of any tactical engagement scenario with SS-N-2d missiles to ensure destruction of the target.

Specifications

(SS-N-2d)
Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.87 ft)
Speed: Mach 0.9
Weight (without booster): 2,600 kg (5,732 lb)
Warhead: 454 kg (1,000 lb) hollow-charge
Fuzes: Impact, proximity
Range: 3-54 n miles (5.5-100 km)
Guidance: Autopilot with active radar (supplemented in some with IR)

MS-2 seeker
Frequency: I-band (8-12 GHz) (four presets)
PRF: 300-500 pps (adjustable)
Altitude control: Barometric pressure device

Manufacturer/Contractor

Raduga, Moscow, Russia.

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 'Grail' (Strela-2M)

There are two, four-missile launchers for the SA-N-5 short-range SAM system. SA-N-5 is the NATO designation for the Russian *Strela*-2M (*Strela* = arrow), which is the naval version of the very widely used Strela-2

(NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired, the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and partially pulls the trigger to activate the missile gyros, which take some four to six seconds to warm up. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spinning it up. Then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has better fragmentation uniformity.

Specifications
(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg 21.98 lb)
Speed: Mach 1.7
Range: 5.5 km (2.9 n miles)
Altitude: 18 - 4,500 m (60 - 15,000 ft)
Guidance: IR homing

Manufacturer/Contractor
Fakel, Russia.

GUNS

AK-176 76 mm (3 in)/60
There is one single 76 mm (3 in) gun on the foredeck which is intended for air defence, surface engagement and shore bombardment roles. The AK-176 is a four-man mounting which may be either operated from the weapon control centre or from a local control station.

Khukri *(P 49). Note the AK 176 76 mm gun and four SS-N-2d anti-ship missile launchers on the foredeck. The flight deck will accept a Chetak (Alouette) helicopter, and the ship has refuelling and rearming facilities, but no hangar* (H & L van Ginderen Collection)

The AK-176 is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'. This radar is also associated with the AK-630 and the two may form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the *Kondensor* sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day-night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight.

Specifications
Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: n/k
Traverse: 360° at 35°/s
Elevation: −3 to +85° at 30°/s
Ammunition (total): 16 kg (35.3 lb)
Rate of fire: 120-130 rds/min
Range:
anti-surface: 3.75 n miles (7 km)
anti-air: 10,000 m (32,800 ft)

30 mm/65 AK-630 close in weapons system
There are two 30 mm Gatling-type AK-630s mounted on platforms at the forward end of the flight deck. These have five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AK-630 weapon is a water-cooled, six-barrelled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but unlike the US weapon, AK-630 features a separate radar director, Bass Tilt.

Specifications
Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,919 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (13,000 ft)
electro-optic fire control: 5,000 m (16,400 ft)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
UOF-84 HE-I: 384 g (13.5 oz)
UOR-84 HE-T: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

ELECTRONIC WARFARE

ELECTRONIC SUPPORT MEASURES (ESM)

Bharat Ajanta P intercept
The Bharat Ajanta P ESM suite is a 1-18 GHz radar warning system, with a 1,500 emitter library, developed from the Elettronica RQN-3. The array is at the top of the mast.

Manufacturer/Contractor
Bharat Electronics, Bangalore, India.

DECOYS

PK-16
There are two Russian PK-16 chaff launchers, mounted on the main deck, on either side of the superstructure.

Bharat Toted towed torpedo decoy
There is a towed torpedo decoy, which is almost certainly the 'Toted' which was developed by the Naval Physical and Oceanic Laboratory (NPOL) at Cochin and is produced by Bharat Electronics. This consists of a towed 'fish' containing a piezoelectric transducer, a 400 m (1,300 ft) electromechanical cable and a high-gain, wideband amplifier. The system includes elements to prevent 'blue-on-blue' interference with sonars aboard the towing ships or other friendly ships in the area.

Manufacturer/Contractor
Bharat Electronics, Bangalore, India.

COMBAT AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Bharat Vympal command and weapon control system
India is developing its own naval fire control and command/weapon control systems, using licence-produced Western electronics (primarily Italian, but with some Dutch radars). The first such system is the Bharat Vympal which entered service when the second 'Khukri' class corvette, *Kuthar*, was commissioned in June 1990. The system has a distributed architecture and is based upon purpose-built workstations which use Barco 48.26 cm (19 in) raster scan displays with an HCI based upon QWERTY keyboard, numeric pad and probably rollerball. A corvette will have two to three

Khanjar *(P 47). The radome at the masthead is part of the Bharat Ajanta ESM system, while the large radome below it houses the Russian-designed Cross Dome (Positive E) radar* (Jane's/H M Steele)

such workstations, probably supplemented by a data processing unit linked by an FMC (now United Defence) Unicom-type local area network capable of 10-20 Mb/s. (First of class *Khukri* has a Selenia (now Alenia) system).

Manufacturer/Contractor

Bharat Electronics, Bangalore, India.

RADARS

Positive E/Cross Dome

There is a large radome on the platform at the top of the mast, which has been named 'Positive E' in Indian reports. This is a translation of the Russian name of the equipment ('*Pozitiv*') and the suffix 'E' on Russian equipment normally indicates an export version. It is also very similar to the Cross Dome radar installed at the masthead in the 'Gepard' class export frigate. The set appears to have an air/surface search function and has a range of some 70 n miles (130 km)

Plank Shave

The 'Khukri' class ships are fitted with Plank Shave atop a small tower on the bridge roof. This is an I-band set used for surface search and targeting the SS-N-2d missiles.

Bass Tilt

Bass Tilt is an H/I-band fire-control radar which entered service in the mid-1970s and is part of the fire-control system for the AK-630 CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (3.9 ft) in diameter, inclined at an angle of approximately 45°. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

Bharat 1245

The Bharat 1245 is an Indian-developed I-band navigation radar.

SONAR

These ships do not carry any sonar equipment, but are fitted with an STN Atlas echo-sounder.

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 15 × 10.5 m (50 × 34 ft)
Hangar: There is no hangar, but there are full refuelling and rearming facilities.

HELICOPTER

SA 316/SA 319B Chetak (Alouette III)

The ships currently operate the Chetak (licence-produced Alouette III), but it is intended that in the future they will operate the Hindustan Aeronautics Ltd (HAL) ALH (Advanced Light Helicopter). The ALH will operate either in the anti-ship role, carrying Sea Eagle, or in the anti-submarine role carrying a dunking sonar, torpedoes and depth charges.

Specifications

Dimensions:
main rotor diameter: 11.02 m (36.15 ft)
length overall (rotor turning): 12.84 m (42.15 ft)
fuselage length: 10.17 m (33.7 ft)
height to rotor head: 3.00 m (9.84 ft)
Weights
empty: 1,143 kg (2,520 lb)
max take-off: 2,200 kg (4,850 lb)
Performance
max speed (never exceed): 113 kts (210 km/h)
max cruising speed: 100 kts (185 km/h)
service ceiling: 3,200 m (10,500 ft)
max range: 267 n miles (495 km)
Engines: 1–694 kW (870 shp) Turbomeca Artouste IIIB turboshaft derated to 425 kW (570 shp).
Accommodation: 7 (pilot plus six).
Weapons: In the ASW role the helicopter would carry two lightweight torpedoes.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 SEMT-Pielstick/Kirloskar 18 PA6 V 280 diesels, 10.58 MW (14,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The 'Khukri' class were the first major warships to be completely designed and built in India, being designed by the Indian Navy Design Office (INDO) and built by Mazagon (two ships) and Garden Reach (the remainder).

The first two of these corvettes were ordered in December 1983, followed by orders for another two in 1985, and two more in April 1990. The class is intended to replace the Russian-built Petyas, which have been in service since the early 1970s. *Kora* (fifth of class) and following ships are to an upgraded design, but work has been slowed down due to delays in the supply of Russian equipment.

It was reported in October 1994 that a further two would be ordered, but no date was given and it now appears possible that the programme may end with the sixth ship, *Kirch*.

The indigenous content of the whole ship is about 65 per cent, with much of the electronics being either of Bharat design or produced by them under licence, while the diesels are assembled in India under licence by Kirloskar.

'Khukri' class corvette displays its nuclear fallout washdown capabilities. This picture shows clearly the blast deflection plates built into the bridge screen (Indian Navy)

DESIGN

The 'Khukri' class is designed for open ocean patrols and protecting the approaches to sensitive harbours and coastal installations, releasing larger warships, previously committed to such tasks to operate further into the Indian Ocean.

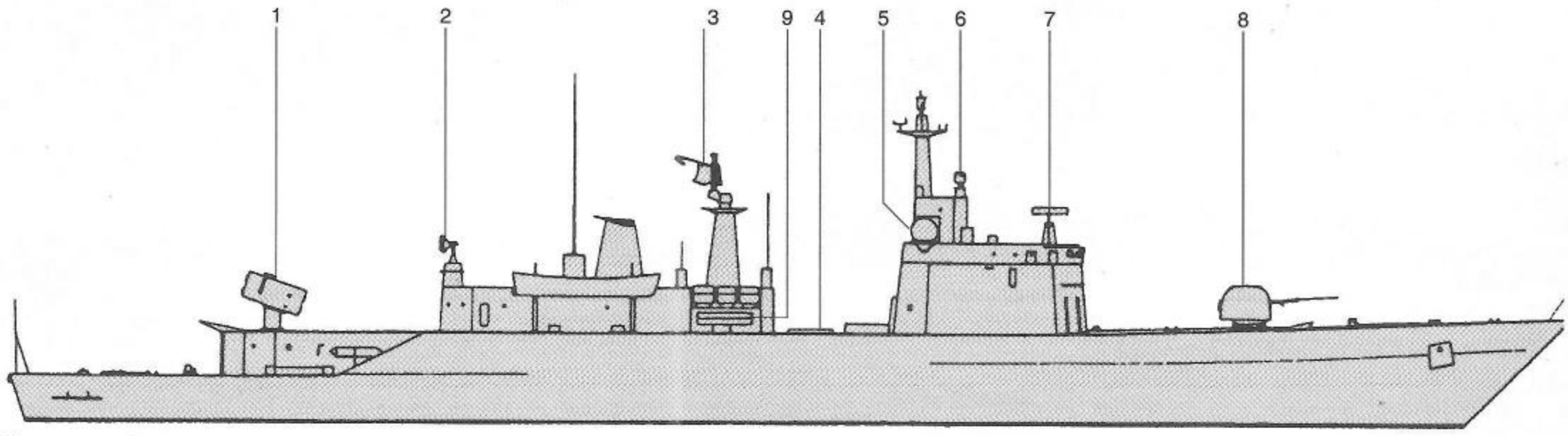
The hull and superstructure are to an original Indian design and are constructed of steel, although some components, such as the lattice masts, are of aluminium. Propulsion is diesel, with the first four sets of SEMT-Pielstick 18 PA6 V-280 being imported, but from the fifth hull onwards the engines are assembled in India by Kirloskar Oil Engines, of Puna.

All ships are fitted with roll-damping fins and have full air conditioning.

OPERATIONAL

Two ships are currently based in Bombay and two at Vishakapatnam.

MINERVA



Minerva (Ian Sturton)
1 *Riva Calzoni Albatros launcher for Alenia Aspide SAM* **2** *Alenia SPG-76 (RTN 30X) fire-control radar (Aspide SAM and gun)* **3** *Alenia SPS 74 (RAN 10S) air/surface search radar* **4** *Fitted for but not with (FFBNW) Teseo Otomat anti-ship missiles (four or six)* **5** *Satcom* **6** *Alenia Pegaso electro-optic director* **7** *SMA SPN 728(V)2 navigation radar* **8** *OTOBREDA 76 mm (3 in)/62 Compact automatic gun* **9** *ILAS-3 triple 324 mm torpedo tubes*

GENERAL SPECIFICATIONS

Operator: Italy

Class: MINERVA

Built: 8
Active: 8

Displacement:
light: 1,029 t
full load: 1,285 t

Dimensions
Length: 86.6 m (284.1 ft)
Beam: 10.5 m (34.5 ft)
Draught: 3.2 m (10.5 ft)

Speed: 24 kts
Range: 3,500 n miles at 18 kts

Complement: 123 (10 officers)

SHIPS

MINERVA (F 551)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 11 Mar 1985
Launched 3 Apr 1986
Commissioned 10 Jun 1987

URANIA (F 552)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 4 Apr 1985
Launched 21 Jun 1986
Commissioned 1 Jun 1987

DANAIDE (F 553)
Builder Fincantieri, Muggiano, Italy
Laid down 26 Jun 1985
Launched 18 Oct 1986
Commissioned 9 Sep 1987

SFINGE (F 554)
Builder Fincantieri, Muggiano, Italy
Laid down 2 Sep 1986
Launched 16 May 1987
Commissioned 13 Feb 1988

DRIADE (F 555)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 18 Mar 1988
Launched 11 Mar 1989
Commissioned 19 Apr 1990

CHIMERA (F 556)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 21 Dec 1988
Launched 7 Apr 1990
Commissioned 15 Jan 1991

FENICE (F 557)
Builder Fincantieri, Riva Trigoso, Italy
Laid down 6 Sep 1988
Launched 9 Sep 1989
Commissioned 11 Sep 1990

SIBILLA (F 558)
Builder Fincantieri, Muggiano, Italy
Laid down 16 Oct 1989
Launched 15 Sep 1990
Commissioned 16 May 1991

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Teseo Otomat

All ships are fitted for but not with six Teseo launchers between the masts.

Manufacturers/Contractors

OTOBREDA, La Spezia, Italy.
Matra, France.

SURFACE-TO-AIR MISSILES (SAM)

The Albatros system comprises two elements:

Riva-Calzoni launcher
Aspide missile

Riva-Calzoni Albatros launcher

The single, eight-cell Albatros launcher is located aft in 'X' position. Produced by Riva-Calzoni, it has eight launch cells, four on each side of the mounting, each with a frangible front and rear cover. Each cell contains a loading guide to which the launching rail of the missile is electrically and mechanically connected. There is currently no reload facility, although the space and weight for a magazine exists in the deckhouse beneath the launcher.

Specifications

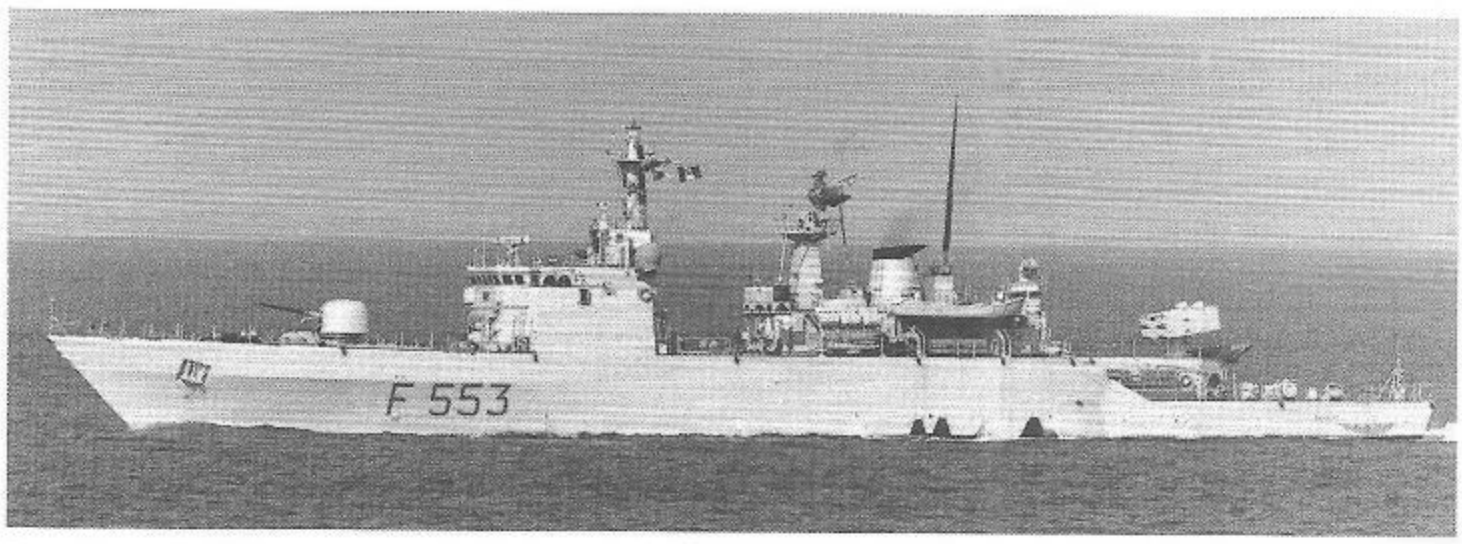
Albatros launcher
Height: 2.98 m (9.8 ft)
Width: 3.82 m (12.5 ft)
Length: 3.82 m (12.5 ft)
Weight (loaded): 8.5 t
Traverse: 360° at 45°/s
Elevation: −5 to +80° at 25°/s.

Alenia Aspide missile

The system uses the Alenia Aspide SAM, a missile developed by Selenia from the US Sparrow. Targets are detected by the ship's primary search radar and then allocated to the Signaal WM25 fire-control system. The target is acquired by the fire-control system radar and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews in the target's direction. The missile control system selects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds. When the decision is made to engage the target with missiles the reversible pre-launch commands are issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode. In the latter, two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at once may be controlled by the tracker, according to the manufacturer. They also claim the system can engage horizontal targets at up to 8.1 n miles (15 km), vertical ones at 2.7 n miles (5 km) and lateral ones at 4.3 n miles (8 km). A short reaction time gives the system the ability to destroy anti-ship missiles even when detection is late.

Specifications

Aspide missile
Length: 3.7 m (12 ft)
Diameter: 20.3 cm (8 in)
Wing span: 80 cm (2.6 ft)
Weight: 220 kg (485 lb)



Danaide *(F 553). These ships have both weight and space reserved for up to six Teseo anti-ship missiles, an Aspide reload capability and a variable depth sonar. If funded, this would make them very formidable for their size* (H & L van Ginderen Collection)

Speed: Mach 2.5
Range: 7 n miles (13 km)
Altitude: 15-5,000 m (49-16,400 ft)
Warhead: 33 kg (72.7 lb)
Guidance: Semi-active radar

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy (system/missile).
Riva-Calzoni, Bologna, Italy (launcher).

TORPEDOES

B515 (ILAS-3) anti-submarine torpedo launching system
There are two B515 (also known as ILAS-3) triple mounts on the main deck below the stack. The tubes are manually loaded and trained but remotely operated from the combat information centre, although emergency local operation is possible.

Specifications
Length: 3.4 m (11.1 ft)
Height: 1.2 m (4 ft)
Width: 1.285 m (4.2 ft)
Weight: 1,050 kg (2,315 lb) (unloaded)

Manufacturer/Contractor
Whitehead SpA, Italy.

Eurotorp Impact (MU-90) 324 mm torpedo
The Eurotorp Impact 324 mm ASW torpedo entered service in 1995, replacing the Mk 46 in Italian Navy service. A combined Franco-Italian project, the new torpedo uses the seeker developed for the French Murene, the warhead and guidance system developed for the Italian A 290, Murene software and battery and the A290 afterbody. The Thomson-Sintra seeker, with its Mangouste processor, uses very high capacity data processing for sophisticated signal processing and the weapon is reportedly capable of tracking up to 12 targets simultaneously. The 30-transducer planar array, two side arrays and depth finder all operate on separate frequencies to overcome reverberation and false echo problems. The Whitehead shaped charge warhead weighs some 50 kg (110 lb).

Specifications
Diameter: 324 mm
Speed: 45 kts
Propulsion: STN stepless, variable speed, electric motor driving a pump-jet propulsor
Battery: Silver oxide-aluminium battery with a potassium hydroxide electrolyte

Manufacturer/Contractor
Eurotorp, Sophia Antipolis Cedex, France.

GUNS

OTOBREDA 76 mm (3 in)/62 Compact
There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air-defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications
Calibre: 76.2 mm
Length of barrel: 62 calibres
Traverse: 360° at 70°/sec
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,952 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Selenia INS-3 ESM/ECM system
INS-3 (Integrated Naval System) is a Selenia (now Alenia) ESM/ECM system. The main components are ESM equipment, a 1-18 GHz radar warning system with a 1,500 emitter library, developed from the Elettronica RQN-3. The ECM system is the Elettronica TQN-2 jammer. INS-3 is used to trigger jamming and the Barricade countermeasures system. The array characteristic of the INS-3 is mounted at the head of the short extension on the foremast.

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

DECOYS

ML Aviation Barricade countermeasures system
The Barricade system provides ships with means of deploying chaff and infra-red (IR) decoys to counter missile attacks, using a layered defence against the various types of anti-ship missile. The system uses a 102 mm rocket and a redesigned launcher with four sets of triple-cell launchers. The system has a similar control unit to Barricade Mk III and the same tactical computer. The ammunition lockers each contain 24 rockets. There are four decoy modes:

- confusion, in which long-range (Stockade) rockets are fired to confuse enemy search radar and make target selection difficult
- distraction, in which medium-range chaff and/or infra-red rockets are fired in a pattern of six around the ship to present alternative targets to missiles during their search phase, affording defence against multiple missiles coming from different directions
- dump is used where a missile has locked on to the ship. The ship uses a jammer to remove the missile's range gate and then fires a single rocket to produce a chaff cloud on which the gate may be 'dumped' thus allowing the jammer to be redeployed.
- centroid, is a close-range, final defence mode, used against single missiles. If the incoming missile is locked on to the ship, a pattern of short-range chaff and/or IR rockets is fired to create a large alternative target close to the ship, which manoeuvres away, leaving the missile to home on to the decoy.

Manufacturer/Contractor
ML Wallop Defence Systems, Andover, Hampshire, UK.

AN/SLQ-25 Nixie towed torpedo decoy
One AN/SLQ-25 Nixie (Phase 1), solid-state, modular design electro-acoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them, while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom or in a partially or totally enclosed location on the main deck. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm (3.10 ft) long , 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body is deployed at a time.

Manufacturer/Contractor
Aerojet ElectroSystems, Sacramento, California, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

IPN 10 Mini SADOC
SADOC 2/IPN 10 (SADOC = *Systema Direzione della Operazioni di Combattimento*) is a mainframe architecture system designed to acquire, process and present data acquired by sensors but can also be used for a number of other functions, including threat evaluation and weapons control, ECM management, aircraft control, conducting ASW operations, as well as datalink and data bank management.

Data are received from onboard and offboard sensors via datalinks. The system has two or three Central Processing Units (CPU) mini-computers (Alenia 32-bit CDG-3032 with a 128 k memory), one of which usually acts as the immediate backup in the event of system failure. Within the consoles are Alenia 16-bit NDC-160 processors, with 64 k memories. Both possess mass memory modules for handling programmes and large amounts of data and an interface with a 10 Mbit/s serial databus. The basic software of the latter is under the control of two TAVITAC operating systems; the disk operating system and a time-sharing executive.

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

COMMUNICATIONS AND DATALINKS

Link 11
Satcom

WEAPONS CONTROL

NA 30/Dardo E

NA 30/Dardo-E is a multipurpose fire-control system designed to control up to three medium and light calibre guns of two calibres as well as Albatros point defence surface-to-air missiles and even anti-ship missiles. It consists of a Data Processing Unit (DPU), a supervisory console and the Orion RTN 30X fire-control radar. The DPU is based upon the Selenia (now Alenia) ESA 24 24-bit microprocessor with a memory access time of 250 µs and up to 21 I/O channels. The single-operator console has a 19 in (48.26 cm) and 15 in (38.1 cm) raster scan display for PPI, A/R radar data presentation and a 15 in (38.1 cm) raster scan display for pictures from the electro-optic trackers. The MCI consists of a multifunction keyboard, numeric keyboard, rollerball and joystick.

The RTN 30 is an I-band (8-10 GHz) radar whose above-deck equipment consists of the stabilised director with radar antenna, an infra-red thermal camera and a daylight TV camera. The director covers −30 to +85° in elevation and has slewing speeds of 126°/s (traverse) and 86°/s (elevation). The silicon target TV camera can operate in light conditions down to 2 lux and has a field of view of 3.01°. Below-decks equipment includes the transmitter and receiver cabinets as well as the servo unit. The range against missiles is up to 13.5 n miles (25 km).

The antenna is of the monopulse horn cassegrain type with polarisation twist. The transmission chain is fully coherent and uses a high average power transmitter with a peak power of 12 kW. This can operate in two modes; long pulse with coded waveform (0.5 s compressed, 6.5 s uncompressed) and short, single pulse (0.5 s). In both the final amplification is accomplished by a TWT. A multicanceller MTI and a data processor are in the receiver to perform accurate tracking in all conditions. Accuracy is enhanced by special anti-nodding and air defence spotting devices.

The engagement process, like that of Dardo, is completely automatic following target acquisition either through the ship's search radar or through the RTN 30 director. The system is capable of engaging targets up to Mach 3 and travelling only 3 m (10 ft) above the surface.

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

NA 18L Pegaso

The NA 18 is designed to control two guns of up to 76 mm calibre and can conduct ballistic calculations for two separate calibres simultaneously. It may be used as the primary fire-control system for small warships or as a complementary system for larger warships. It consists of a console which receives data from ship's radar and navigation sensors. It is supported by a transformer/power distribution unit and operates the electro-optic director through a servo unit. The console has a monochrome raster scan display and an optional raster scan PPI display, the other HCI features including dedicated buttons, a joystick and a rollerball.

The NA 18 director has 8-12 micron infra-red camera, a silicon target TV camera with focal length of 30 to 360 mm and a scene dynamic of 100 to 200,000 lux, and an Nd:YAG laser rangefinder with a peak power of 18 MW. The IR camera has fields of view of 4 × 2.6° and 2 × 1.3°. The NA 18L/Pegaso director is more compact and may be used with only the TV camera or with the full range of electro-optic sensors. These are similar to the ones in NA 18 but a 10 MW laser rangefinder is available as an option.

Specifications
Traverse: 360° at 1.8 rad/s
Elevation: −22 to +84° at 1.5 rad/s

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

RADARS

SPS-774 (RAN 10S)

E/F-band air/surface search radar with range of 155 km (85 n miles).

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

SMA SPN-728(V)2

I-band navigation radar.

Manufacturer/Contractor
SMA, Italy.

SONARS

Raytheon/Alenia DE 1167

This is a hull-mounted active search and attack sonar operating at 7.5-12 kHz. The DE 1167 features largely digital electronics. The inboard electronics comprises three cabinets and a single operator console. The outboard equipment comprises a transducer array and a 2.74 m (9 ft) dome for the 12 kHz (centre frequency) installation. DE 1167 is an active/passive, preformed beam, omni and directional transmission sonar which uses three non-interfering 600 Hz wide FM transmission bands centred around 12 kHz or 7.5 kHz. Passive mode may be used for torpedo detection.

Specifications
Centre frequency: 12 kHz
Source level: TRDT 227 dB (HM), omni 217 dB
Pulse type: 600, 2,000 Hz FM sweep; 100, 200, 50, 6 ms pulse lengths
Receiver type: Spatial polarity coincidence correlator between 36 pairs of half beams
Beam characteristics: 36 sets of left and right half beams
Active display: 300 range cells, 288 bearing cells; single and multiple echo history; 4 intensity levels
Passive display: Electronic bearing time recorder with medium time averaging
Track displays: Sector scan indicator and target Doppler indicator
Weight: 12 kHz

Manufacturers/Contractors
Raytheon, USA.
Alenia Elsag Sistemi Navali, Rome, Italy.

PROPULSION

Specifications
System: Diesel
Main machinery: Fincantieri GMT BM 230.20 DVM
Power output: 9.26 MW (12,600 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The first four were ordered in November 1982, followed by a second four in January 1987. A third batch of four was planned, but was cancelled when it was decided to order the 'Artigliere' class. They are intended for a number of roles including Economic Exclusion (EEZ) patrol, fishery protection and Commanding Officers' training.

STRUCTURE

The funnels were remodelled to reduce turbulence and IR signature. There are two roll dampers.

OPERATIONAL

Omega transit is fitted. First four based at Augusta, Sicily.

Sfinge *(F 554) ready for launch and showing its hull form* (Fincantieri)

FINCANTIERI 60 m CORVETTES

OVERVIEW

Italian shipbuilders have produced a successful series of corvettes for both the Italian and foreign navies, which started with the 'Albatros' class (950 tonnes) in 1954 and was followed by the 'De Cristofaro' class (1,020 tonnes) in 1964-65. This led Fincantieri to design and market a series of closely related designs which, for the purposes of this book, will be termed the 'Fincantieri 60 m corvettes.'

The first buyer was Libya, which ordered four ships in 1974. Known as the 'Wadi M Ragh' class, these were 57.8 m (189.6 ft) long, displaced 670 tonnes, and were armed with four Otomat SSMs, one 76 mm gun, two 35 mm Oerlikon cannons and two triple 324 mm torpedo tubes. They were powered by four diesels, had a range of 4,150 n miles (7,677.5 km) at 18 knots and a top speed of 31.5 knots.

The second order was placed by Ecuador in 1978, which purchased six as the 'Esmeraldas' class. These were very similar to the Libyan ships, having the same hull, and a displacement of 685 tonnes. The weapon fit was rather heavier, comprising six MM 40 Exocet SSMs, an octuple Albatros launcher, a 76 mm gun, two 40 mm cannon and six 324 mm torpedo tubes. The engines were also much more powerful, raising top speed to 37 knots. The most significant difference was that the Ecuadorean ships had a flight deck for a helicopter, which took up the after one-third of the ship's length, but without a hangar.

Then, in February 1981, Iraq placed an order for six corvettes, with the same hull and engines as the Ecuadorean 'Esmeraldas' class.

Four of these (F 214, F 216, F 218 and F 220) did not have a flight deck and had virtually the same weapons fit as the Libyan ships, but with six Teseo SSMs in place of the Exocets. The other two ships in the order (F 210 and F 212) again had the same hull and engines as the Esmeraldas, but in addition, had not only a flight deck, but also a telescopic hangar, which reduced the number of Otomat launchers to two.

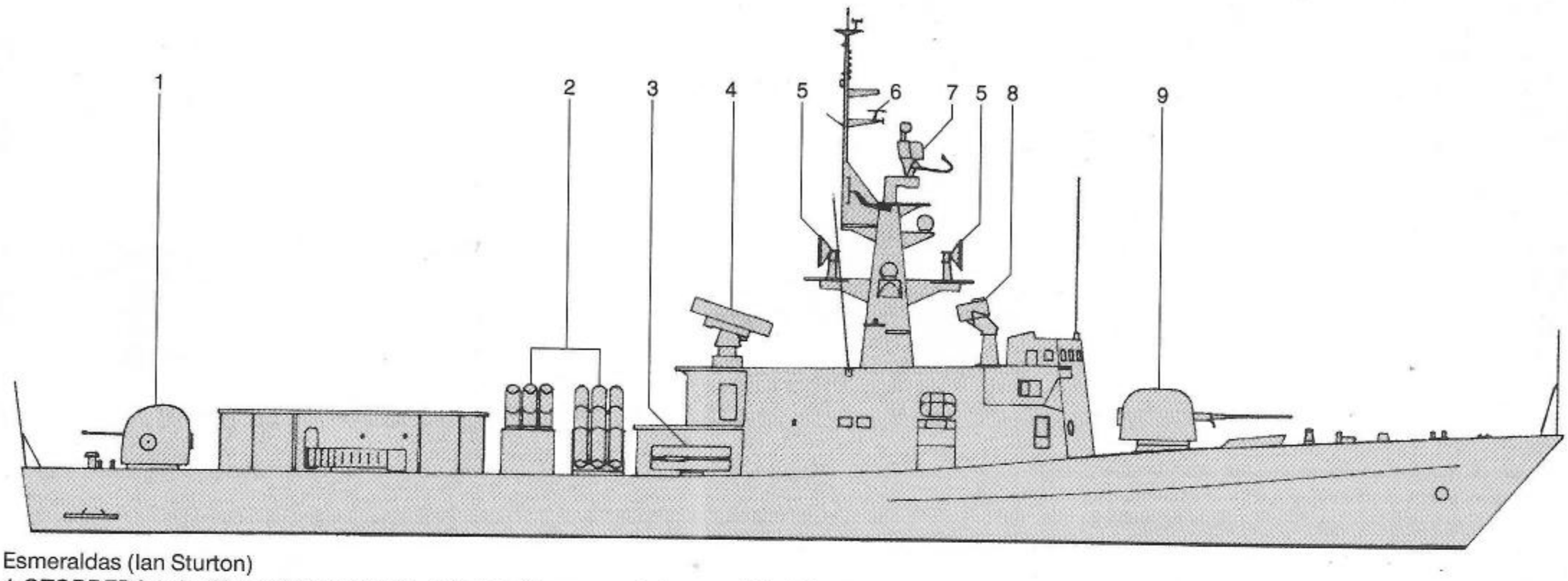
The Iraqi ships were all built on schedule and completed in 1986-87. Iraqi crews actually took over F 210 and F 212, even though at the time the ships still lacked some of the weapons systems, there was then a considerable delay due to the trade embargo imposed during the Iran-Iraq war. When that embargo was lifted, training with the ships started in 1990, but Iraq then invaded Kuwait and the United Nations imposed another embargo on military equipment for Iraq. This resulted in the Italians impounding all six ships, which were then held in La Spezia. F 210 and F 212 were held as 'enemy' ships and continued to fly the Iraqi flag and were manned by reduced Iraqi crews. The other four ships were simply not handed over and remained the property of Fincantieri. Fincantieri even carried out some work on the two helicopter corvettes, receiving payment via Cuba.

The non-delivery of these six ships for Iraq (plus four 'Lupo' class frigates and a replenishment oiler) raised considerable problems and the Italian Navy was eventually compelled to accept the four Lupos (see 'Lupo' class). Disposal of the six corvettes did not prove so easy and they were offered on the international market, with Morocco and Colombia both reported to be showing a strong interest, although neither has ever translated that interest into an actual order.

Then, it was announced in October 1995 that the Royal Malaysian Navy (RMN) had signed a contract for the purchase of two of the ships (the former Iraqi F 216 and F 218) which would be refurbished by Fincantieri with certain equipment being changed and then commissioned into the RMN in February 1997. This announcement was followed a year later by reports that the RMN is in the final stages of negotiation to buy both the helicopter carriers and one of the two remaining ships without a flight deck. The fate of the single remaining ship is not known.

Meanwhile, Fincantieri took the Iraqi Government to court in Italy over the losses the company has suffered through these contracts. The sums involved are alleged to be in the region of US$70 million, less what is received from the sale of the ships to the Italian and Malaysian navies.

ESMERALDAS (FINCANTIERI 60 m CORVETTES)



Esmeraldas (Ian Sturton)
1 *OTOBREDA twin 40 mm/70 automatic anti-aircraft weapon* **2** *Aerospatiale MM 40 Exocet anti-ship missile (two triple launchers)* **3** *Triple ILAS-3 324 mm torpedo tubes* **4** *Alenia Albatros launcher for Aspide SAM* **5** *Alenia Orion RTN-10X* **6** *SMA 3 RM 20 navigation radar* **7** *Alenia RAN-10S air/surface search* **8** *OTOBREDA 105 mm SCLAR launcher* **9** *OTOBREDA 76 mm (3 in)/62 Compact automatic gun*

GENERAL SPECIFICATIONS

Country of origin: Italy
Operator: Ecuador
Type: Fincantieri 60 m Corvette

Class: ESMERALDAS

Purchased: 6
Active: 6

Displacement:
standard: 605 t
full load: 685 t

Dimensions
Length: 62.3 m (204.4 ft)
Beam: 9.3 m (30.5 ft)
Draught: 2.5 m (8.0 ft)

Speed: 37 kts
Range: 4,000 n miles at 14 kts

Complement: 51

SHIPS

ESMERALDAS (CM 11)
Builder Fincantieri, Muggiano, Italy
Laid down 27 Sep 1979
Launched 1 Oct 1980
Commissioned 7 Aug 1982

MANABI (CM 12)
Builder Fincantieri, Ancona, Italy
Laid down 19 Feb 1980
Launched 9 Feb 1981
Commissioned 21 Jun 1983

LOS RIOS (CM 13)
Builder Fincantieri, Muggiano, Italy
Laid down 5 Dec 1979
Launched 27 Feb 1981
Commissioned 9 Oct 1983

EL ORO (CM 14)
Builder Fincantieri, Ancona, Italy
Laid down 20 Mar 1980
Launched 9 Feb 1981
Commissioned 11 Dec 1983

LOS GALAPAGOS (CM 15)
Builder Fincantieri, Muggiano, Italy
Laid down 4 Dec 1980
Launched 4 Jul 1981
Commissioned 26 May 1984

LOJA (CM 16)
Builder Fincantieri, Ancona, Italy
Laid down 25 Mar 1981
Launched 27 Feb 1982
Commissioned 26 May 1984

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Aerospatiale MM 40 Exocet

This class embarks a total of 6 missiles in 2 triple launchers. The MM 40 features inertial cruise, active radar homing to 40 n miles (70 km) at Mach 0.9 and a warhead of 165 kg (364 lb). The MM 40 has folding wings, a steel-cased CMDB sustainer and a Thomson-TRT RAM 01 altimeter. Compared with the MM 38 the booster is larger while the Block 1 seeker has a wider search and acquisition angle. The Block 2 missile features a new J-band (10-20 GHz) Super ADAC seeker which has improved (Electronic Counter-CounterMeasures) performance, associated electronics and a new guidance computer although no further details are available. Company literature indicates the presence of a smaller, 155 kg warhead with both impact and proximity fuzes. The new electronics permit the missile to optimise its sea-skimming height allowing it to operate in conditions to Sea State 7 even in severe Electronic CounterMeasures (ECM) conditions. The fire-control system has also been adapted with the development of the Cat-Visac console which can operate with two types of the Exocet missile simultaneously.

The new fire-control system allows improved target selectivity, attacks upon multiple targets by diverging and converging salvos.

Targets for the surface-launched missiles are acquired by the ship's sensors. The operator then aligns the axial gyros in the target's direction and begins the initiation sequence which can take up to a minute. The thermal battery is turned on, the mechanical safety locks are released, the booster is ignited and the umbilical cord is broken, the total process taking 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change in the course of its flight. Once the missile has cleared the launcher-container, the sustainer carries it into the cruise phase during which, it travels towards the general location of the target at a height of about 100 m (328 ft) which is low enough to reduce the chance of detection but adequate for target acquisition. Once the target is detected the missile descends to between 9 and 15 m (29.5 and 49 ft) in the approach phase before descending to 8 m (26 ft) (2 to 5 m (6.5 to 16 ft) in a calm sea) for a sea-skimming terminal phase. A salvo may be fired in 12 to 20 seconds.

Specifications (MM 40 Block 1)
Length: 5.78 m (19 ft)
Diameter: 35 cm (13.7 in)
Wing span: 1.13 m (3.7 ft)
Weight: 855 kg (1,885 lb)
Speed: Mach 0.9
Range: 2-38 n miles (4-70 km)
Guidance: Inertial and active radar

Manufacturer/Contractor
Aerospatiale, France

SURFACE-TO-AIR MISSILES (SAM)

Albatros SAM system

A quad launcher for the Aspide semi-active radar homing missile is mounted just aft of the main mast. Albatros is a modular system consisting of the Aspide missile, a guidance and launching subsystem, and a missile handling subsystem and complements the gun fire-control system to produce an overlapping, layered, air defence against both anti-aircraft and anti-ship missiles. Albatros may be used with one or two directors, the launcher being automatically slaved to one director

during the operation. The MCU receives missile orders from the MSCU and missile status data from the launcher, selects the missile and initiates the launch sequence.

Targets are detected by the ship's primary search radars and allocated to the fire-control system, whose radar acquires the target and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews towards the target. The missile control system selects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds.

When the decision is made to engage the target the reversible pre-launch commands are issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode, in which two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch, the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at once may be controlled by one tracker, according to the manufacturer, who also claims that the system can engage horizontal targets at up to 15 km, vertical ones at 5 km and lateral ones at 8 km. A short reaction time gives the system the ability to destroy anti-ship missiles, even when detection is late.

Specifications
Length: 3.7 m (12.1 ft)
Diameter: 20.3 cm (8 in)
Wing span: 80 cm (31.5 in)
Weight: 220 kg (485 lb)
Speed: Mach 2.5
Range: 7 n miles (13 km)
Warhead: 33 kg (72.75 lb)
Guidance: Semi-active radar

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

TUBES

324 mm ILAS-3 torpedo tubes
Esmereldas corvettes have two triple torpedo tubes for A244 lightweight anti-submarine torpedoes. The B515/ILAS-3 consists of three 324 mm diameter torpedo tubes with two tubes at the bottom of the installation and one on the top. The launcher weighs 1,050 kg (2,315 lb) unloaded and is designed for installation on an open deck, usually with one installation on each side of the ship. They are manually loaded and trained but remotely operated from the combat information centre. Emergency local operation is possible on each tube.

Specifications
Length: 3.4 m (11.15 ft)
Height: 1.2 m (3.94 ft)
Width: 1.28 m (4.2 ft)
Weight: 1,050 kg (2,315 lb)(unloaded)

Manufacturer/Contractor
Whitehead, SpA, Italy.

Esmeraldas *(CM 11). On a displacement of 650 tonnes these corvettes mount a 76 mm gun, a twin 40 mm gun, six Exocet anti-ship missiles, two sets of triple torpedo tubes, and a helicopter platform*

TORPEDOES

A244 Mod 1 torpedo
The A244 torpedo features self adaptive patterns to 3.8 n miles (7 km) at 33 knots and a 34 kg (74.95 lb) shaped charge warhead. The acoustic homing head has active, passive and mixed modes and has a large search volume covered by multiple preformed beams. Active acquisition range is in excess of 2,100 m (2,296 yd). The propulsion system uses a saltwater battery powering a DC counter-rotating motor providing direct drive to a two-bladed propeller shaft.

Specifications
Length: 2.75 m (9.0 ft)
Diameter: 324 mm (12.75 in)
Weight: 221 kg (487 lb)
Warhead: HBX-3 HE
Propulsion: Electric
Guidance: Active/passive sonar, self-adaptive programmed patterns

Manufacturer/Contractor
Whitehead SpA, Italy.

GUNS

OTOBREDA 76 mm (3 in)/62 Compact
The 76 mm/62 on the 'Esmereldas' class is located in the A gun position. The Compact mounting features extensive aluminium fabrication of the gun platform, the trunnion supports and the trunk. The 76/62 Compact can fire 80 rounds without reloading and the rate of fire is adjustable from 10 to 85 rds/min. The system is remotely controlled. A reaction time of 2.8 seconds is quoted.

Specifications
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.6n miles (16 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Bofors 40 mm/70 (twin)
A twin Bofors 40 mm/70 mounting is located aft, which can be used against air or surface targets. The Compact twin 40 mm mounting is designed for use against high performance combat aircraft, against anti-ship missiles and for surface engagements. The mounting consists of two 40 mm guns which are 300 mm apart, a feeding system with magazine, a local control panel, a power supply rack, a converter and an air-water panel.

Specifications
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (13,000 ft)
Rate of fire: 600 rds/min
Ammunition: 2.4 kg (5.30 lb) (HCHE, PFHE), 2.5 kg (5.51 lb) (HE-T)
Traverse: Nominal 360° at 90°/s
Elevation: −13 to +85° at 60°/s
Crew: 2

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Elettronica Gamma ED
Gamma is an ESM/ECM suite from Elettronica, which is, in essence, a simpler version of the widely used Newton system. Frequency range is 2-18 GHz and the system incorporates receivers, processors and jammers.

Manufacturer/Contractor
Elettronica, Rome, Italy.

DECOYS

OTOBREDA SCLAR Mk 2
The OTOBREDA multipurpose naval rocket launcher system consists of two launchers for SNIA 105 mm countermeasure or assault rockets and an Alenia UCLAR control unit. Although designed as a multirole rocket launcher SCLAR is normally used to fire decoys. SCLAR Mk 2 uses an ESA 24 microprocessor. The launchers are mounted on each side of the ship and they can be trained and elevated by remote-control. The control unit is linked to the ship's radar and a control panel in the ECM compartment provides the necessary operating signals. The data needed to stabilise the two launchers against pitch and roll is provided by the ship's gyrocompass.

Specifications
Mounting
Traverse: 300° at 60°/s
Elevation: −5 to +60° at 30°/s
Rate of fire: 1 rd/s (approx)

Rockets
Length: 1.85 m (6.07 ft) (SNIA 105 LR); 1.83 m (6 ft) (SNIA 105 MR)
Diameter: 105 mm (4.1 in)
Weight: 27 kg (59.5 lb) (SNIA 105 LR); 29 kg (63.9 lb) (SNIA 105 MR)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Alenia SADOC 2/IPN 10

SADOC 2 *(Sistema Automatico Direzione delle Operazioni de Combattimento)* entered service aboard the frigate *Lupo* in September 1977. It is designed to produce an up-to-date picture of the tactical situation within the vicinity of both the ship and task group and has a mainframe architecture designed for processing and presenting data acquired by sensors. It can also be used for a number of other functions, including, threat evaluation and weapons control, ECM management, aircraft control, conducting ASW operations and datalink data bank management.

The system has two or three Central Processing Units (CPU) mini-computers, with one usually acting as an immediate backup in the event of system failure. These are Selenia (now Alenia) 32-bit CDG-3032, with a memory of 128 k. Within the consoles are Selenia (now Alenia) 16-bit NDC-160, with memory of 64 k. Both possess mass memory modules for handling programmes and large amounts of data and an interface with a 10 Mbit/s serial databus. The basic software of the latter is under the control of two TAVITAC operating systems; the disk operating system and a time-sharing executive.

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

WEAPONS CONTROL

Elsag NA 10 Mod 2

The NA 10 system is designed for surface engagement, air engagements or shore bombardments and can control three guns of two calibres simultaneously. It uses an RTN-10X fire-control radar which was supplemented in earlier versions by two optical periscope sights. Electro-optical equipment which could be mounted on the director included InfraRed (IR) camera, TV camera and laser rangefinder while a CW illuminator could also be installed. The system is operated through the Main Control Unit (MCU) which is a console with ballistic computer. A TV display may be added when electro-optical units are used. The MCU is used for target acquisition, tracking and engagement either manually or automatically. Two periscope sights may also be used to provide supplementary target data input to the radar and permit a second target to be engaged.

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

RADARS

Alenia RAN 10S (SPS-774)

Specifications
Role: Air/surface search
Band: E/F
Beam: 1.5 × 17°
Peak power: 140 kW
Gain: 28 dB
Pulsewidth: 0.4 µs
PRF: 900 pps
Scan rate: 15/30 rpm
Range: 85 n miles (155 km)

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

SMA 3 RM 20

Specifications
Role: Navigation
Band: I
Beam: 1.2 × 25°
Peak power: 20 kW
Gain: 27 dB
Pulsewidth: 0.05/0.15/0.5/1.5 µs
PRF: 5,200/2,600/1,300/650 pps
Scan rate: 25 rpm

Manufacturer/Contractor
SMA, Florence, Italy.

Alenia RTN-10X

Specifications
Role: Fire control
Band: I/J
Peak power: 200 kW
Pulsewidth: 1.5 µs
PRF: 450-550 pps
Range (typical): 10.75 n miles (20 km) against missiles

SONAR

Thomson Sintra Diodon (TSM 2635)

A hull-mounted active search and attack sonar operating at 11, 12 or 13 kHz. Diodon is a panoramic sonar with a one-man console using a dual-screen high-resolution display. Embedded facilities include passive listening, sound ray tracer, an acoustic propagation system and a recording system that can be used for post-mission debrief.

Specifications
Acoustic array: 24 identical staves weighing 450 kg (992 lb)
Frequency: 12 kHZ approximately
Transmitter: Omnidirectional transmission in CW and FM modes.
Receiver: 36 pre-formed beams, advanced processing with replica correlator in FM, and spectrum analysis in CW.
Video processing: Simultaneous multitrack extraction (up to 64 targets)
Total weight: 1,500 kg (3,306 lb)

Manufacturer/Contractor
Thomson Sintra ASM, France.

AVIATION

Specifications
Flight deck: 11 × 9.3 m (36 × 30.5 ft)
Hangar: None.

HELICOPTERS

One Bell 706B JetRanger

Specifications
Operational speed: 115 kts (213 km/h)
Service ceiling: 13,500 ft (4,115 m)
Range: 368 n miles (680 km)
Sensors: None.
Weapons: None.
Role/weapon systems: Support helicopter for afloat reconnaissance and SAR.

PROPULSION

Specifications
System: Diesel
Main machinery: 4 MTU 20V 956 TB92, 16.27MW (22,140 hp)
Shafts: 4

FURTHER INFORMATION

PROGRAMME

These six ships were ordered in 1979 and delivered between 1982 and 1984.

DESIGN

These ships are similar to the Libyan Fincantieri corvettes ('Musa ben Nussair' class), but with a helicopter deck and larger engines, which give greater speed.

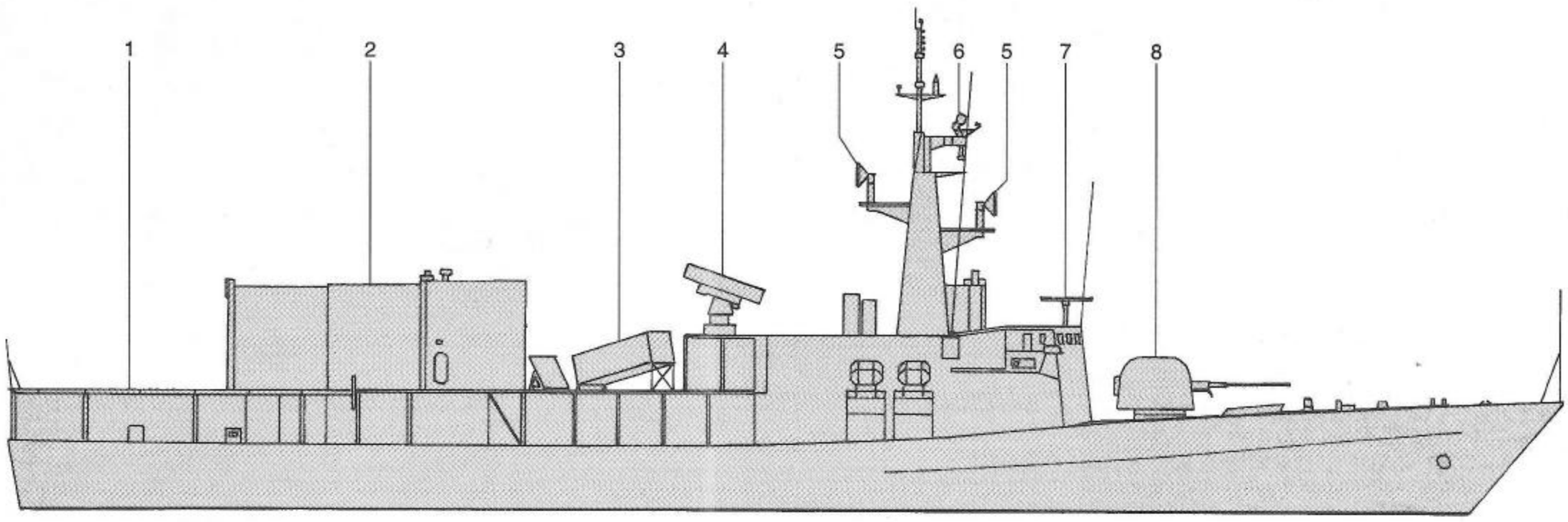
MODERNISATION

Contracts for updating command and weapons control systems were placed in 1993/94. One of the top priorities is for a datalink system compatible with the frigates.

DEPLOYMENT

El Oro (CM 14) was out of commission for two years from mid-1985 after a serious fire.

MUSSA BEN NUSSAIR (FINCANTIERI 60 m CORVETTES)



Mussad ben Nussair (Ian Sturton)
1 *Flight deck* **2** *Telescopic hangar* **3** *OTOBREDA/Matra Teseo Mk 2/Otomat launcher (two single launchers)* **4** *Alenia Albatros launcher for Aspide SAMs* **5** *Alenia Orion RTN-10X* **6** *Alenia RAN-10S air/surface search radar* **7** *SMA SPN-703 (3 RM 20) navigation radar* **8** *OTOBREDA 76 mm (3 in)/62 Super Rapid automatic gun*

GENERAL SPECIFICATIONS

Country of origin: Italy
Operator: Iraq (see 'Further Information'*)
Type: Fincantieri 60 m corvettes

Class: MUSSA BEN NUSSAIR

Built: 2
Active: 0

Displacement:
full load: 685 t

Dimensions
Length: 62.3 m (204.4 ft)
Beam: 9.3 m (30.5 ft)
Draught: 2.5 m (8 ft)

Speed: 37 kts
Range: 4,000 n miles at 18 kts

Complement: 51 (not including aircrew)

* At the time of closing for press these ships were still technically owned by Iraq, although Malaysia was showing an interest in buying them. See 'Overview'.

SHIPS

MUSSA BEN NUSSAIR (F 210)		**TARIQ IBN ZIAD** (F 212)	
Builder	Fincantieri, Muggiano, Italy	**Builder**	Fincantieri, Muggiano, Italy
Laid down	15 Jan 1982	**Laid down**	20 May 1982
Launched	22 Oct 1982	**Launched**	8 July 1983
Completed	17 Sep 1986	**Completed**	29 Oct 1986

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

OTOBREDA/Matra Teseo Mk 2

There are two single launchers for the Teseo Mk 2 system, using the Otomat missile, located immediately before the hangar. The Mk 2 version uses mid-course correction system to achieve longer ranges. All versions of the Otomat missile are housed in a launcher-container, which weighs 1.61 tonnes and is inclined at an angle of 15°, with the missile suspended from a ceiling launch rail. The target may be acquired by the ship's radar, by the radars of friendly ships or by helicopter radars. Data on the target's location are transmitted to the missile's autopilot and the turbojet is started. Once it has reached full power the boosters are ignited and the missile is launched. The missile can turn through an angle of ±200° so the warship does not have to be facing the target during the launch phase.

Once launched, the missile climbs to 150 m (492 ft) assisted by the boosters which burn for 4 seconds until it reaches cruising speed some 2.15 n miles (4 km) from the launch point when the boosters are jettisoned. The missile then descends to a cruising height of 15 to 20 m (49 to 66 ft) which is suitable for ensuring a good communications link with the mothership although still difficult for the target to observe. It continues towards the target with mid-course guidance correction until the radar seeker, which is azimuth only, is activated at a predetermined point and scans a 40° sector, then acquires the target at a range of about 6.5 n miles (12 km). For the terminal phase the Otomat drops to sea-skimming height. The Otomat system is capable of engaging two separate targets simultaneously in sea states up to Force 7.

Specifications

Length: 4.46 m (14.63 ft)
Diameter: 46 cm (18 in)
Wing span: 1.36 m (4.46 ft)
Weight:
with boosters: 770 kg (1,698 lb)
without boosters: 762 kg (1,680 lb)
Range: 86 n miles (160 km)
Guidance: Inertial and active radar homing

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy
Matra, France.

SURFACE-TO-AIR MISSILES (SAM)

Alenia Albatros SAM System

A quad launcher for the Aspide semi-active radar homing missile is mounted just aft of the main mast. Albatros is a modular system consisting of the Aspide missile, a guidance and launching subsystem and a missile handling subsystem which complements the gun fire-control system to produce an overlapping, layered, air defence against anti-aircraft and anti-ship missiles. Albatros may be used with one or two directors, the launcher being automatically slaved to one director during the operation. The MCU receives missile orders from the MSCU and missile status data from the launcher, selects the missile and initiates the launch sequence.

Targets are detected by the ship's primary search radars and allocated to the fire-control system, whose radar acquires the target and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews towards the target. The missile control system selects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds.

When the decision is made to engage the target the reversible pre-launch commands are issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode, in which two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch, the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at once may be controlled by one tracker, according to the manufacturer, who also claims that the system can engage horizontal targets at up to 15 km, vertical ones at 5 km and lateral ones at 8 km. A short reaction time gives the system the ability to destroy anti-ship missiles, even when detection is late.

Specifications
Length: 3.7 m (12.14 ft)
Diameter: 20.3 cm (8 in)
Wing span: 80 cm (31.5 in)
Weight: 220 kg (485 lb)
Speed: Mach 2.5
Range:
anti-surface: 7 n miles (13 km)
anti-air: 15-5,000 m (50-16,400 ft)
Warhead: 33 kg (72.7 lb)
Guidance: Semi-active radar

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

GUNS

OTOBREDA 76 mm (3 in)/62 Super Rapid
There is one 76 mm (3 in)/62 in 'A' position. The Super Rapid mounting is similar in design, dimensions and weight to the earlier Compact, but features upgraded hydraulic motors for the feed and hoist systems, rocker arms made from titanium, a redesigned feeder device and loading tray which move shorter distances for faster action. There is also a new digital console with plasma display for gun control.

Specifications
Traverse: 360° at 60°/s
Elevation: −15 to +85° at 35°/s
Weight (unloaded): 8 t
Muzzle velocity: 925 m/s (3,034 ft/s)
Rate of fire: 120 rds/min
Range: 8.5 n miles (15.75 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

INS-3 ESM/ECM system
INS-3 (Integrated Naval System) is an Elettronica ESM system, a 1-18 GHz radar warning system with a 1,500 emitter library, which was developed from the Elettronica RQN-3. INS-3 is used to trigger jamming and the Breda chaff launchers. The array characteristic of the INS-3 is mounted at the head of the short extension on the foremast. The ECM system is the Elettronica TQN-2 jammer (see below).

Manufacturer/Contractor
Elettronica SpA, Rome, Italy.

Elettronica TQN-2 jammer
The TQN-2 is built from a modular suite which can be expanded from a noise/deception jammer with a single antenna and transmitter to more complex configurations to achieve the most effective methods required.

Manufacturer/Contractor
Elettronica SpA, Rome, Italy.

DECOYS

OTOBREDA 105 mm SCLAR Mk 2
The OTOBREDA multipurpose naval rocket launcher system consists of two launchers for SNIA 105 mm countermeasure or assault rockets and an Alenia UCLAR control unit. Although designed as a multirole rocket launcher SCLAR is normally used to fire decoys. SCLAR Mk 2 uses an ESA 24 microprocessor. The launchers are mounted on each side of the ship and they can be trained and elevated by remote control. The control unit is linked to the ship's radar and a control panel in the ECM compartment provides the necessary operating signals. The data needed to stabilise the two launchers against pitch and roll is provided by the ship's gyrocompass.

Specifications
Mounting
Traverse: 300° at 60°/s
Elevation: −5 to +60° at 30°/s
Rate of fire: 1 rd/s (approx)

Rockets
Length: 1.85 m (SNIA 105 LR); 1.83 m (SNIA 105 MR)
Diameter: 105 mm
Weight: 27 kg (SNIA 105 LR); 29 kg (SNIA 105 MR)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy,

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Alenia SADOC 2/IPN 10
SADOC 2 *(Sistema Automatico Direzione delle Operazioni de Combattimento)* entered service aboard the frigate *Lupo* in September 1977. It is designed to produce an up-to-date picture of the tactical situation within the vicinity of both the ship and task group and has a mainframe architecture designed for processing and presenting data acquired by sensors. It can also be used for a number of other functions, including, threat evaluation and weapons control, ECM management, aircraft control, conducting ASW operations and data-link data bank management.

The system has two or three Central Processing Units (CPU) mini-computers, with one usually acting as an immediate backup in the event of system failure. These are Selenia (now Alenia) 32-bit CDG-3032, with a memory of 128 k. Within the consoles are Selenia (now Alenia) 16-bit NDC-160, with memory of 64 k. Both possess mass memory modules for handling programmes and large amounts of data and an interface with a 10 Mbit/s serial databus. The basic software of the latter is under the control of two TAVITAC operating systems; the disk operating system and a time-sharing executive.

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

RADARS

Set	RAN-12L/X	SPN-703 (3 RM 20)	RTN-10X
Company	Selenia	SMA	Selenia
Role	Air/surface search	Navigation	Fire control
Band	D/I	I/J	I/J
Beam	L: 6.6 × 16° X: 1.1 × 6	1.2 × 25°	—
Peak power	L: 0.3 kW X: 135/180 kW	20 kW	200 kW
Gain	L: 22 dB	27 dB X: 35 dB	—
Pulsewidth	L: 20 µs X: 1.5/0.15 µs	0.05/0.15/0.5/1.5 µs	1.5 µs
PRF	X: 450-550 pps	5,200/2,600/ 1,300/650 pps	450-550 pps
Scan rate	15/30 rpm	25 rpm	—
Typical ranges	45 n miles (82 km)		Missiles: 10.75 n miles (20 km) Aircraft: 21.5 n miles (40 km)

WEAPONS CONTROL

Alenia NA 21
There are two NA 21 systems in each corvette. NA 21 was developed from NA 10 which was designed for surface engagement, air engagements or shore bombardments and can control three guns of two calibres. NA 21 has a similar function and can control three guns of two different calibres, a surface-to-air missile system and can also designate targets for a surface-to-surface missile system. The console is similar to that of the NA 10 and features a data processing unit based upon Elsag ESA 24 micro-processors. The improved electronics permit the system to conduct a programmed low altitude search with the RTN 10 and, at the same time, to use the ship's search radar for surveillance, both being either panoramic or in sectors. The NA 21 is also capable of automatic target acquisition through its own radar or through the ship's command system and it can also designate targets for other weapon system directors. The RTN 10X associated with NA21 on these vessels is a conical-scan pulse radar which operates in the I-band and controls the twin 40 mm mountings in close-in weapon system mode. The director covers −23 to +83° and on the right-hand side is a CCTV camera with control unit. The maximum training speed is 110°/s while the maximum elevation speed is 90°/s. The below-decks equipment consists of a frequency changeable, highpower magnetron transmitter, a linear receiver and a servo amplifier. The RTN 10 employs different receiver signal and data processing techniques both for ECCM and for accurate tracking of targets at all altitudes. Target acquisition is initiated through the ship's tactical data handling or command system and the radar then switches to the acquisition phase with tracking beginning automatically upon detection of the target. The operational range is about 40 km against aircraft and >20 km against missiles.

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

SONAR

STN Atlas Elektronik ASO 84-41

A hull-mounted active search and attack sonar from the STN Atlas Elektronik's DSQS-21 series and intended primarily for operation against submarines below the thermal layer. It uses computer-aided detection techniques for classification and tracking. Information is presented on colour CRT displays to permit Doppler coding and discrimination of data.

Manufacturer/Contractor
STN Atlas Elektronik, Germany.

AVIATION

HELICOPTER

Specifications
Flight deck: (see 'Further Information.')
Hangar: There is a telescopic hangar, which was designed to accommodate an Agusta-Bell AB-212ASW helicopter.

Until an end-user is announced it is not known what type of helicopter will be used.

PROPULSION

Specifications
System: Diesel
Main machinery: 4 MTU 20V 956 TB92 diesels, 14.8 MW (20,120 hp)
Shafts: 4

FURTHER INFORMATION

PROGRAMME

As described in detail in the 'Overview' these two ships were ordered by Iraq in February 1981, formally handed over in 1986 and started trials with Iraqi crews in mid-1990. The invasion of Kuwait stopped any prospects of delivery.

Unlike the other four ships, however, these had actually been handed over to Iraq and they have remained flying the Iraqi flag and with a small Iraqi caretaker crew. In addition, some minor work was carried out on the two ships in 1995 at Iraq's expense, with payment being made by Iraq via Cuba.

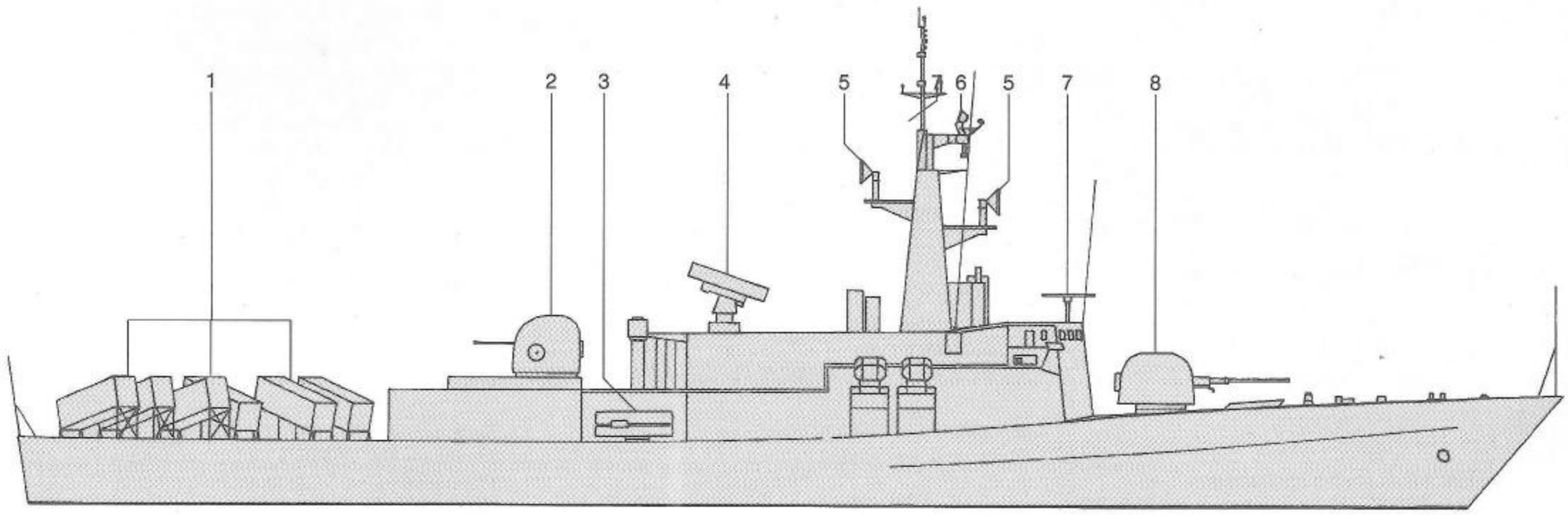
DESIGN

These ships have the same hull and propulsion system as the Ecuadorean ships. In the 'Esmeraldas' class, however, the flight deck is an isolated platform whereas in these Iraqi ships there is a continuous deck running from the superstructure to the stern. There is also a telescopic hangar, which was designed to accommodate an Agusta-Bell AB-212ASW helicopter.

FUTURE

The future of these ships is uncertain. Despite the Iraqi ownership it appears highly improbable that they will ever be delivered to that country and it was reported in late 1996 that Malaysia wishes to buy them both. If that occurs, presumably they will be given a preliminary refit similar to that for the other two corvettes.

MALAYSIAN CORVETTES (FINCANTIERI 60 m CORVETTES)



Fincantieri 60 m corvette (Malaysia) (Ian Sturton)
1 *OTOBREDA/Matra Teseo Mk 2 launcher for Otomat anti-ship missiles (three twin launchers)* **2** *OTOBREDA twin 40 mm/70 automatic gun* **3** *Triple ILAS-3 324 mm torpedo tubes* **4** *Alenia Albatros launcher for Aspide SAM* **5** *Alenia Orion RTN-10X* **6** *Alenia RAN-10S air/surface search* **7** *Navigation radar (type not known)* **8** *OTOBREDA 76 mm (3 in)/62 Super Rapid automatic gun*

GENERAL SPECIFICATIONS

Country of origin: Italy
Operator: Malaysia
Type: Fincantieri 60 m corvette

Class: -

Purchased: 2
Active: 0
Further purchase: 3 (see 'Further Information')

Displacement:
full load: 705 t

Dimensions
Length: 62.3 m (204.4 ft)
Beam: 9.3 m (30.5 ft)
Draught: 2.5 m (8 ft)

Speed: 37 kts
Range: 4,000 n miles at 18 kts

Complement: 47

SHIPS

-

Builder	Fincantieri, Breda, Mestre, Italy
Laid down	3 Jun 1982
Launched	5 Jul 1983
Completed (Iraq)	1987 (*Khalid Ibn Al Walid* (F 216))
Impounded by Italian Government	Aug 1990
Purchased by Malaysia	1996
Complete refurbishment	1996
Delivery	Feb 1997

-

Builder	Fincantieri, Breda, Mestre, Italy
Laid down	17 Sep 1982
Launched	2 Dec 1983
Completed (Iraq)	1988 (*Saad Ibn Abi Waccade* (F 218))
Impounded by Italian Government	Aug 1990
Purchased by Malaysia	1996
Complete refurbishment	1996
Delivery	Feb 1997

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Teseo Mk 2

There are three twin launchers for the Teseo Mk 2 system, using the Otomat missile. The Mk 2 version uses mid-course correction system to achieve longer ranges. All versions of the Otomat missile are housed in a launcher-container. The container weighs 1.61 tonnes and is inclined at an angle of 15° with the missile suspended from a ceiling launch rail. The target may be acquired by the ship's radar, by the radars of friendly ships or by helicopter radars. Data on the target's location are transmitted to the missile's autopilot and the turbojet is started. Once it has reached full power the boosters are ignited and the missile is launched. The missile can turn through an angle of ±200° so the warship does not have to be facing the target during the launch phase.

Once launched, the missile climbs to 150 m (492 ft) assisted by the boosters which burn for 4 seconds until it reaches cruising speed some 2.15 n miles (4 km) from the launch point when the boosters are jettisoned. The missile then descends to a cruising height of 15 to 20 m (50 to 66 ft) which is suitable for ensuring a good communications link with the mothership although still difficult for the target to observe. It continues towards the target with mid-course guidance correction until the radar seeker, which is azimuth only, is activated at a predetermined point and scans a 40° sector, then acquires the target at a range of about 6.5 n miles (12 km). For the terminal phase the Otomat drops to sea-skimming height. The Otomat system is capable of engaging two separate targets simultaneously in sea states up to Force 7.

Specifications

Length: 4.46 m (14.63 ft)
Diameter: 46 cm (18 in)
Wing span: 1.36 m (4.46 ft)
Weight: 762 kg (1,680 lb) (without boosters); 770 kg (1,698 lb) (with boosters)
Range: 86 n miles (160 km)
Guidance: Inertial and active radar homing

Manufacturers/Contractors

OTOBREDA, La Spezia, Italy.
Matra, France.

SURFACE-TO-AIR MISSILES (SAM)

Alenia Albatros SAM system

A quad launcher for the Aspide semi-active radar homing missile is mounted just aft of the main mast. Albatros is a modular system consisting of the Aspide missile, a guidance and launching subsystem, and a missile handling subsystem and complements the gun fire-control system to produce an overlapping, layered, air defence against both anti-aircraft and anti-ship missiles. Albatros may be used with one or two directors, the launcher being automatically slaved to one director during the operation. The MCU receives missile orders from the MSCU and missile status data from the launcher, selects the missile and initiates the launch sequence.

Targets are detected by the ship's primary search radars and allocated to the fire-control system, whose radar acquires the target and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews towards the target. The missile control system selects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds.

When the decision is made to engage the target the reversible pre-launch commands are issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode, in which two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch, the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at once may be

controlled by one tracker. A short reaction time gives the system the ability to destroy anti-ship missiles, even when detection is late.

Specifications
Length: 3.7 m (12.14 ft)
Diameter: 20.3 cm (8 in)
Wing span: 80 cm (31.5 in)
Weight: 220 kg (485 lb)
Speed: Mach 2.5
Range:
anti-surface: 7 n miles (13 km)
anti-air: 15-5,000 m (50-16,400 ft)
Warhead: 33 kg (72.7 lb)
Guidance: Semi-active radar

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

TUBES

324 mm ILAS-3 torpedo tubes
There are two triple torpedo tubes for A244 lightweight anti-submarine torpedoes. The B515/ILAS-3 consists of three 324 mm diameter torpedo tubes, two at the bottom of the installation and one on the top. The launcher is designed for installation on an open deck, usually with one installation on each side of the ship. They are manually loaded and trained but remotely operated from the combat information centre. Emergency local operation is possible on each tube.

Specifications
Length: 3.4 m (11.15 ft)
Height: 1.2 m (3.94 ft)
Width: 1.28 m (4.21 ft)
Weight: 1,050 kg (2,315 lb) (unloaded)

TORPEDOES

Whitehead A244/S lightweight torpedo
The A244/S is capable of active, passive or mixed modes for closing on its target. The head has a large search volume covered by multiple pre-formed beams following a number of self-adaptive search patterns. The seeker has an active acquisition range exceeding 2,100 m (2,296 yd) and is capable of operation in shallow water. The propulsion system uses a saltwater battery powering a DC counter-rotating motor which drives a two-bladed propeller shaft.

Specifications
Length: 2.75 m (9.0 ft)
Diameter: 324 mm (12.75 in)
Weight: 221 kg (487 lb)
Warhead: HBX-3 HE
Propulsion: Electric
Guidance: Sonar, self-adaptive programmed patterns

Manufacturer/Contractor
Whitehead, SpA, Italy.

GUNS

OTOBREDA 3 in (76 mm)/62 Super Rapid
There is one 76 mm (3 in)/62 in 'A' position. The Super Rapid mounting is similar in design, dimensions and weight to the earlier Compact, but features upgraded hydraulic motors for the feed and hoist systems, rocker arms made from titanium, a redesigned feeder device and loading tray which move shorter distances for faster action. There is also a new digital console with plasma display for gun control.

Specifications
Traverse: 360° at 60°/s
Elevation: −15 to +85° at 35°/s
Weight (unloaded): 8 t
Muzzle velocity: 925 m/s (3,034 ft/s)
Rate of fire: 120 rds/min
Range: 8.5 n miles (15.75 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm/70 (twin)
There is a single twin 40 mm mounting aft in 'Y' position. The 40 mm L/70 is an automatic cannon for air defence roles which may also be used to engage surface targets. The Compact twin 40 mm mounting is designed for use against high performance combat aircraft, against anti-ship missiles and for surface engagements. The mounting consists of two 40 mm guns which are 300 mm apart, a feeding system with magazine, a local control panel, a power supply rack, a converter and an air-water panel.

Specifications
Traverse: 360° at 90°/s
Elevation: −13 to +85° at 60°/s
Crew: 2
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (13,123 ft)
Rate of fire: 600 rds/min
Ammunition: 2.4 kg (5.3 lb) (HCHE, PFHE), 2.5 kg (5.51 lb) (HE-T)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

INS-3 ESM/ECM system
INS-3 (Integrated Naval System) is an Elettronica ESM system, essentially a 1-18 GHz radar warning system with a 1,500 emitter library, which was developed from the Elettronica RQN-3. INS-3 is used to trigger jamming and the OTOBREDA chaff launchers. The array characteristic of the INS-3 is mounted at the head of the short extension on the foremast. The ECM system is the Elettronica TQN-2 jammer (see below).

Manufacturer/Contractor
Elettronica SpA, Rome, Italy.

Elettronica TQN-2 jammer
The TQN-2 is built from a modular suite which can be expanded from a noise/deception jammer with a single antenna and transmitter to more complex configurations to achieve the most effective methods required.

Manufacturer/Contractor
Elettronica SpA, Rome, Italy.

DECOYS

OTOBREDA 105 mm SCLAR Mk 2
The OTOBREDA multipurpose naval rocket launcher system consists of two launchers for SNIA 105 mm countermeasure or assault rockets and an Alenia UCLAR control unit. Although designed as a multirole rocket launcher SCLAR is normally used to fire decoys. SCLAR Mk 2 uses an ESA 24 micro-processor. The launchers are mounted on each side of the ship and they can be trained and elevated by remote control. The control unit is linked to the ship's radar and a control panel in the ECM compartment to provide the necessary operating signals. The data needed to stabilise the two launchers against pitch and roll is provided by the ship's gyrocompass.

Specifications
Mounting
Traverse: 300° at 60°/s
Elevation: −5 to +60° at 30°/s
Rate of fire: 1 rd/s (approx)

Rockets
Length: 1.85 m (6.07 ft) (SNIA 105 LR); 1.83 m (6 ft) (SNIA 105 MR)
Diameter: 105 mm (4.1 in)
Weight: 27 kg (59.5 lb) (SNIA 105 LR); 29 kg (63.9 lb) (SNIA 105 MR)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Alenia SADOC 2/IPN 10
SADOC 2 *(Sistema Automatico Direzione delle Operazioni de Combattimento)* entered service aboard the frigate *Lupo* in September 1977. It is designed to produce an up-to-date picture of the tactical situation within the vicinity of both the ship and task group and has a mainframe architecture designed for processing and presenting data acquired by sensors. It can also be used for a number of other functions, including threat evaluation and weapons control, ECM management, aircraft control, conducting ASW operations and data-link data bank management.

The system has two or three Central Processing Units (CPU) mini-computers, with one usually acting as an immediate backup in the event of system failure. These are Selenia (now Alenia) 32-bit CDG-3032, with a memory of 128 k. Within the consoles are Selenia (now Alenia) 16-bit NDC-160, with memory of 64 k. Both possess mass memory modules for handling programmes and large amounts of data and an interface with a 10 Mbit/s serial databus. The basic software of the latter is under the control of two TAVITAC operating systems; the disk operating system and a time-sharing executive.

Signaal Link YM
The RMN Navy purchased the Signaal version of Link Y, which was developed in the UK by Ferranti as a digital link suitable for sale to non-NATO countries for naval and aircraft use. Different users have versions tailored to their own needs, the particular version being indicated by a single letter suffix; Link YE, for example, is exclusive to the Egyptian Navy, while Link YM is the RMN version.

Link Y generally uses a standard message format of two 24-bit words and a transmission speed of 300 to 1,200 bits/s.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

WEAPONS CONTROL

Alenia NA 21
There are two NA 21 systems in each corvette. NA 21 was developed from NA 10 which was designed for surface engagement, air engagements or shore bombardments and can control three guns of two calibres. NA 21 has a similar function and can control three guns of two different calibres, a surface-to-air missile system and can also designate targets for a surface-to-surface missile system. The console is similar to that of the NA 10 and features a data processing unit based upon Elsag ESA 24 micro-processors. The improved

electronics permit the system to conduct a programmed low-altitude search with the RTN 10 and, at the same time, to use the ship's search radar for surveillance, both being either panoramic or in sectors. The NA 21 is also capable of automatic target acquisition through its own radar or through the ship's command system and it can also designate targets for other weapon system directors. The RTN 10X associated with NA21 on these vessels is a conical-scan pulse radar which operates in the I-band and controls the twin 40 mm mountings in close-in weapon system mode. The director covers −23 to +83° and on the right-hand side is a CCTV camera with control unit. The maximum training speed is 110°/s while the maximum elevation speed is 90°/s. The below-decks equipment consists of a frequency changeable, highpower magnetron transmitter, a linear receiver and a servo amplifier. The RTN 10 employs different receiver signal and data processing techniques both for ECCM and for accurate tracking of targets at all altitudes. Target acquisition is initiated through the ship's tactical data handling or command system and the radar then switches to the acquisition phase with tracking beginning automatically upon detection of the target. The operational range is about 40 km against aircraft and >20 km against missiles.

RADARS

Set	RAN-12L/X	Type 1007	RTN-10X
Company	Selenia	Kelvin Hughes	Selenia
Role	Air/surface search	Navigation	Fire control
Band	D/I	I/J	I/J
Beam	L: 6.6 × 16° X: 1.1 × 6	1.0 × 18°	-
Peak power	L: 0.3 kW X:135/180 kW	25 kW	200 kW
Gain	L: 22 dB X: 35 dB	31 dB	-
Pulsewidth	L: 20 µs X: 1.5/0.15 µs	.08/0.3/0.8µs	1.5 µs
PRF	X: 450-550 pps	1,600/800/400 pps	450-550 pps
Scan rate	15/30 rpm	26 rpm	-
Typical ranges	45 n miles (82 km)		Missiles: 10.75 n miles (20 km) Aircraft: 21.5 n miles (40 km)

Manufacturer/Contractor
Alenia Elsag Sistemi Navali, Rome, Italy.

SONAR

STN Atlas Elektronik ASO 84-41
ASO 84-41 is a hull-mounted active search and attack sonar from the STN Atlas Elektronik's DSQS-21 series and is primarily intended for operation against submarines below the thermal layer. It uses computer-aided detection techniques for classification and tracking. Information is presented on colour CRT displays to permit Doppler coding and discrimination of data.

Manufacturer/Contractor
STN Atlas Elektronik, Germany.

PROPULSION

Specifications
System: Diesel
Main machinery: 4 MTU 20V 956 TB92 diesels, 14.8 MW (20,120 hp)
Shafts: 4

FURTHER INFORMATION

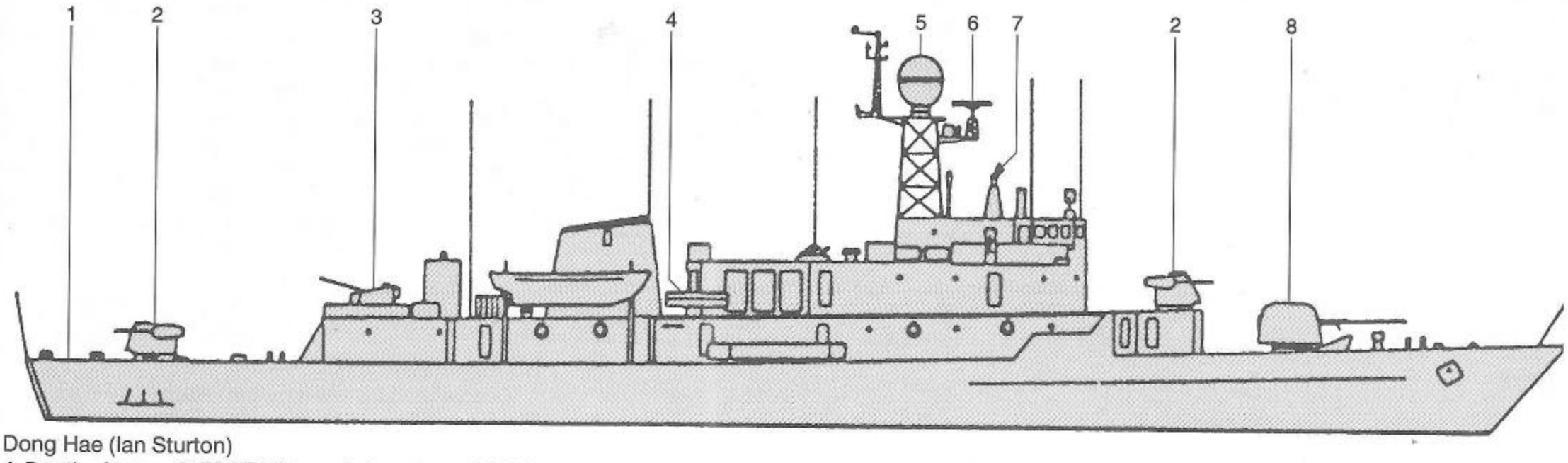
PROGRAMME

Originally built for the Iraqi Navy, these ships were sold to Malaysia in a contract signed on 26 October 1995. The ships are being refitted at Muggiano and the Royal Malaysian Navy crews will then undergo three months training in Italy.

MODERNISATION

During the pre-delivery refit, a Super Rapid 76 mm gun has been fitted, together with the Link YM datalink, a new navigation radar and GPS. In addition, the bridge wings are being extended to the after gun deck.

DONG HAE (HDC 800)



Dong Hae (Ian Sturton)
1 *Depth charges* **2** *ESCO 30 mm twin cannon* **3** *Bofors twin 40 mm/60 cannon* **4** *US Navy Mk 32 324 mm torpedo tubes* **5** *Signaal WM28 fire-control radar* **6** *Raytheon SPS-64 surface search radar* **7** *Signaal LIROD optical fire director* **8** *OTOBREDA 76 mm (3 in)/62 Compact automatic gun.*

GENERAL SPECIFICATIONS

Operator: South Korea
Type: HDC 800

Class: DONG HAE

Built: 4
Active: 4

Displacement:
normal: 800 t
full load: 1,076 t

Dimensions
Length: 78.1 m (256.2 ft)
Beam: 9.6 m (31.5 ft)
Draught: 2.6 m (8.5 ft)

Speed: 31 kts
Range: 4,000 n miles at 15 kts

Complement: 95 (10 officers)

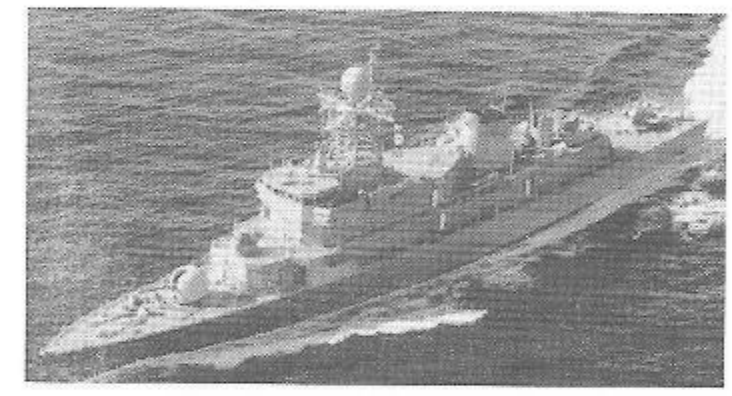
SHIPS

DONG HAE (751)
Builder Korea Shipbuilding, Pusan, Korea
Commissioned Aug 1982

SU WON (752)
Builder Korea Tacoma, Masan, Korea
Commissioned Oct 1983

KANG REUNG (753)
Builder Hyundai, Ulsan, Korea
Commissioned Nov 1983

AN YANG (755)
Builder Daewoo, Okpo, Korea
Commissioned Dec 1983



Su Won *(752) one of four 'Dong Hae' class corvettes built for the RoK Navy* (Korea Tacoma)

WEAPONS SYSTEMS

TUBES

324 mm Mk 32 tubes for Mk 46

Two triple tubes for Mk 46 lightweight torpedoes are mounted immediately forward of the stack, in a particularly high position.

TORPEDOES

Alliant Techsystems Mk 46 torpedo

The Mk 46 is an anti-submarine, active/passive homing torpedo with a range of 5.9 n miles (11 km) at 40 kts. It has a 44 kg warhead. The Mk 46 is a deep diving high-speed torpedo fitted with active/passive homing head and is intended mainly for use against submarines. After water entry it uses a helical search pattern and is capable of multiple re-attacks if required.

Specifications
Length: 2.59 m (8.49 ft)
Diameter: 324 mm
Weight: 231 kg (509.2 lb)
Warhead: 44 kg (97 lb) PBXN-103 HE
Speed: 40 kts
Range: 11,000 m (36,000 ft)

GUNS

OTOBREDA 76 mm (3 in)/62 Compact

The 76 mm/62 on the 'Dong Hae' class is located in the 'A' gun position. The Compact mounting features extensive aluminium fabrication of the gun platform, the trunnion supports and the trunk. The 76/62 Compact can fire 80 rounds without reloading and the rate of fire is adjustable from 10 to 85 rds/min. The system is remotely controlled. A reaction time of 2.8 seconds is quoted.

Specifications
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Weight (unloaded): 7.5 t
Muzzle velocity: 925 m/s (3,034 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.6 n miles (16 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ESCO 30 twin 30 mm mounting

There are two Emerlec 30 twin mounts: one is in 'B' position forward, the other right aft. The Emerlec 30 is a twin 30 mm weapon designed for air defence, surface engagement and anti-missile operations, using either local or remote-control. Ship's power supplies are used normally but there is an on-mount battery which will provide sufficient power to operate the guns and fire a full complement of ammunition in an emergency. Traditional hand-crank mechanisms provide further backup. There is an enclosed, environmentally controlled cabin for the operator and an integral below-deck magazine.

The Emerlec 30 employs the Oerlikon KCB positively locked, gas-operated cannon and the gunner sits in a cabin for local control operation using a daylight reflex, or an image-intensifier, sight, together with gyro-assisted line of sight stabilisation. The cabin is located between the barrels and forward of the elevating mass. Behind it, in a sealed compartment are the elevating and training drives together with flexible chutes to channel ammunition to the feeding mechanisms.

Ready ammunition is stored in an integral, below-deck, drum magazine with a capacity of 985 rounds for each barrel in a continuous disintegrating-link belt. These are transferred to the guns through separate chutes by means of electrically operated drives which automatically respond to the individual demand for ammunition supply.

Specifications
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,542 ft/s)
Traverse: 360° at 80°/s
Elevation: −15 to +80° at 80°/s
Crew: 1
Range: anti-ship (max): 3.25 n miles (6 km)
Rate of fire: 600 rds/min/barrel (nominal) or 140 rds/min/barrel (sustained)
Ammunition: 870 g (HEI/HEI-T, SAPHEI, TP/TP-T)

Manufacturer/Contractor
Electronics & Space Corporation (ESCO), St Louis, Missouri, USA.

Bofors 40 mm/70 (twin)

There is one twin Bofors 40 mm/70 mounting located aft, which can be used against air or surface targets. The Compact twin 40 mm mounting is designed for use against high-performance combat aircraft, against anti-ship missiles and for surface engagements. The

mounting consists of two 40 mm guns which are 300 mm apart, a feeding system with magazine, a local control panel, a power supply rack, a converter and an air-water panel.

Specifications

Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 600 rds/min
Ammunition: 2.4 kg (5.29 lb) (HCHE, PFHE), 2.5 kg (5.51 lb) (HE-T)
Traverse: Nominal 360° at 90°/s
Elevation: −13 to +85° at 60°/s
Crew: 2

DEPTH CHARGES

Total of 12.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

ESM/ECM

There is an intercept and jammer suite, believed to be of either Thorn EMI or NobelTech design.

DECOYS

MEL 9EW300 Protean

There are four MEL Protean chaff launchers, which consist of four magazines similar to those used in Dagaie with Lacroix munitions. Usually the magazines contain chaff munitions but one may be replaced by an infra-red (IR) munitions magazine. The Protean system uses Chemring munitions. Each chaff magazine has 36 — 40 mm grenades which each weigh 0.35 kg (0.77 lb) and have a 0.175 kg (0.38 lb) payload. They fire at an interval of 0.1 second per group and within 1 second begin to create a cloud with a 1,000 m² radar cross-section which is complete within up to 5 seconds at a height of 40 to 60 m (131 to 197 ft).

The control unit selects which groups of munitions will be launched and what combination of chaff/IR should be used. It is then used to fire the selected munitions and indicates what munitions are left in the launchers. In addition there is a course-to-steer indicator which recommends which is the most efficient evasive course the ship should take when factors such as wind strength and direction, threat bearing, ship speed and course are taken into consideration.

Manufacturers/Contractors

CelsiusTech, Sweden.
Thorn EMI, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Signaal Sensor Weapon Control and Command System (SEWACO) ZK

These ships are fitted with a specially designed version of the Signaal SEWACO system, designated SEWACO ZK (K = Korea). This system integrates the sensor, weapon and command subsystems around a common command and control (C^2) system, which presents raw and/or processed sensor data from search and fire-control radars together with IFF, sonar, electronic warfare and electro-optic systems to create a picture of the tactical situation. The data may also be used to designate targets to weapon systems and to assist in operations with auxiliary functions such as ASW helicopter direction and tactical navigation.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

WEAPONS CONTROL

Signaal Lightweight Radar Optronic Director (LIROD)

LIROD is a fire-control system based upon a K-band tracking radar and a TV camera. It is designed to control simultaneously two dual-purpose guns while tracking one air and one surface target. It may be used either as a stand-alone unit or to complement the WM28 fire-control system. The system reaction time from detection to the beginning of the engagement is about 4.5 seconds.

The radar can track fighter-size targets at ranges up to 9.7 n miles (18 km) and is capable of tracking targets with a maximum speed of 1,000 m/s (3,280 ft/s). In addition to the radar there is a militarised TV camera with CCIR standard video format. This can detect fighter-size targets at about 5.4 n miles (10 km) and large surface ships at about 10.8 n miles (20 km).

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADAR

Raytheon AN/SPS-64

One Raytheon AN/SPS-64 is carried for use as a surface search and navigation radar.

Specifications

Band: I/J
Max range: 64 n miles (118.5 km)
Beam: 1.25 × 20°
Peak power: 10/25/50 kW
Pulsewidth: 0.06/0.5/ 1 µs
PRF: 3,600/1,800/900 pps

Manufacturer/Contractor

Raytheon, USA.

Signaal WM28/61

The WM28/61 (the suffix '61' denotes that it uses the SMR-MU computer) is a weapon control system for light or medium-calibre guns and anti-ship missiles using semi-active guidance. It can engage either an air or a surface target with the gun and a surface target with the missile system. The radar can automatically track one air and one surface target simultaneously. For use with the missile, the air target tracking antenna is slaved to the surface target tracking programme and linked with a CW transmitter in order to illuminate the target. It can control a second light to medium-calibre gun for engaging an air and/or surface target. WM28/61 operates in the I/J-band and has a range of 25 n miles (46 km).

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

SONAR

Signaal PHS-32

PHS-32 is a hull-mounted, medium-frequency active search and attack sonar. Signal processing facilities include fast Fourier transformation of all preformed beam receiving channels. The system features automatic tracking of up to four targets and all data are presented on a single display.

Specifications

Frequencies: 3
Pulse lengths: 12.5, 25, 50,100 ms and 400 ms (CW or FM)
Detection range: Exceeding 10,000 yd (9.1 km)
Vertical beamwidth: 12 or 20°
Bearing accuracy: 1° RMS
Range accuracy: ±0.5-2%
Notch filtering: Selectable rejection bandwidth
Own Doppler correction: On all 60 channels

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 General Electric LM 2500 gas turbine, 20 MW (26,220 hp); 2 MTU 12V 956 TB92 diesels, 4.6 MW (6,260 hp)
Shafts: 2

FURTHER INFORMATION

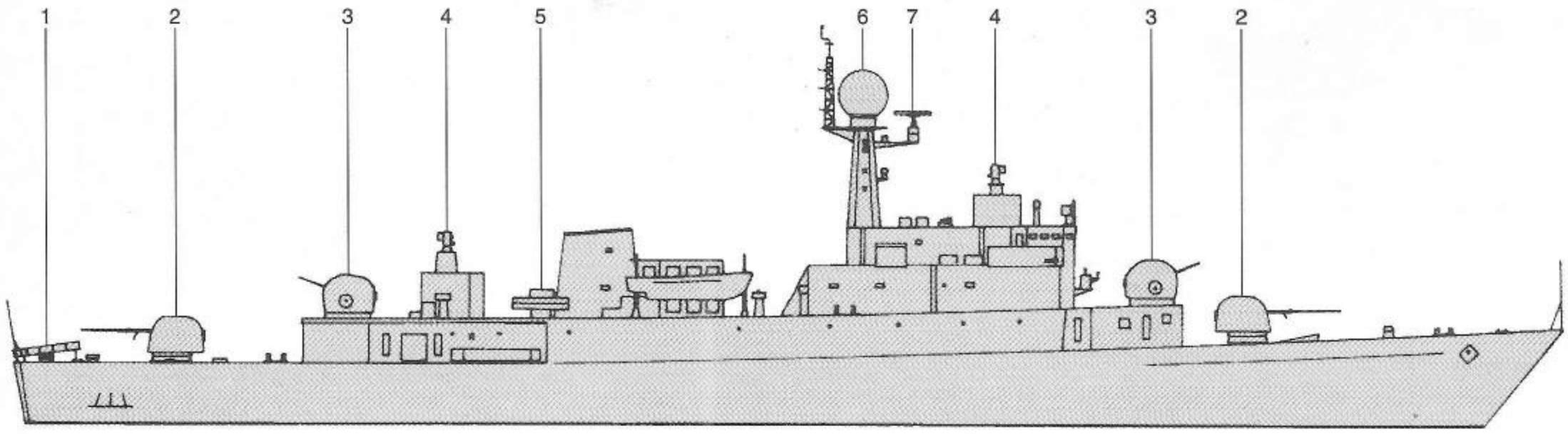
PROGRAMME

This was the South Korean Navy's first version of the corvette series, with four being ordered in 1980, one each from the four major warship building yards. They were commissioned in 1982-83, but production then switched to the larger and more capable 'Po Hang' class.

DESIGN

The design appears to have been based on that of the 'PC-1001' class of Coast Guard cutters. However, as frequently happens with such small hulls, too many weapons and sensors were crammed into the space available and production was discontinued in favour of the 'Po Hang' class.

PO HANG



An Dong (Ian Sturton)
1 *Depth charge racks* **2** *OTOBREDA 76 mm (3 in)/62 Compact automatic gun* **3** *OTOBREDA twin 40 mm/70* **4** *Marconi 1802 fire control* **5** *US Navy triple 324 mm Mk 32 torpedo tubes* **6** *GEC-Marconi 1810 surface search radar* **7** *Raytheon SPS-64(V) navigation radar*

GENERAL SPECIFICATIONS

Operator: South Korea

Class: PO HANG

Built: 23
Active: 23
Building: 2

Displacement:
full load: 1,220 t

Length: 88.3 m (289.7 ft)
Beam: 10 m (32.8 ft)
Draught: 2.9 m (9.5 ft)

Speed: 32 kts
Range: 4,000 n miles at 15 kts

Complement: 95 (10 officers)

SHIPS

PO HANG (756)		**AN DONG** (766)		**DAE CHON** (776)	
Builder	Korea SEC, Pusan, South Korea	**Builder**	Korea SEC, Pusan, South Korea	**Builder**	Korea Tacoma, Masan, South Korea
Commissioned	Dec 1984	**Commissioned**	Feb 1989	**Commissioned**	1990
KUN SAN (757)		**SUN CHON** (767)		**JIN HAE** (777)	
Builder	Korea Tacoma, Masan, South Korea	**Builder**	Korea Tacoma, Masan, South Korea	**Builder**	Korea SEC, Pusan, South Korea
Commissioned	Dec 1984	**Commissioned**	Jun 1989	**Commissioned**	1990
KYONG JU (758)		**YEE REE** (768)		**SOK CHO** (778)	
Builder	Hyundai, Ulsan, South Korea	**Builder**	Hyundai, Ulsan, South Korea	**Builder**	Korea Tacoma, Masan, South Korea
Commissioned	1986	**Commissioned**	Jun 1989	**Commissioned**	1991
MOK PO (759)		**WON JU** (769)		**YONG JU** (779)	
Builder	Daewoo, Okpo, South Korea	**Builder**	Daewoo, Okpo, South Korea	**Builder**	Hyundai, Ulsan, South Korea
Commissioned	1986	**Commissioned**	Aug 1989	**Commissioned**	1991
KIM CHON (761)		**JE CHON** (771)		**NAM WON** (781)	
Builder	Korea SEC, Pusan, South Korea	**Builder**	Korea Tacoma, Masan, South Korea	**Builder**	Daewoo, Okpo, South Korea
Commissioned	1987	**Commissioned**	Nov 1989	**Commissioned**	1991
CHUNG JU (762)		**CHON AN** (772)		**KWAN MYONG** (782)	
Builder	Korea Tacoma, Masan, South Korea	**Builder**	Korea SEC, Pusan, South Korea	**Builder**	Korea SEC, Pusan, South Korea
Commissioned	1987	**Commissioned**	Nov 1989	**Commissioned**	1991
JIN JU (763)		**SONG NAM** (773)		**SIN HUNG** (783)	
Builder	Hyundai, Ulsan, South Korea	**Builder**	Daewoo, Okpo, South Korea	**Builder**	Korea Tacoma, Masan, South Korea
Commissioned	1988	**Commissioned**	1990	**Commissioned**	1992
YO SU (765)		**BU CHON** (775)		- (785)	
Builder	Daewoo, Okpo, South Korea	**Builder**	Hyundai, Ulsan, South Korea	**Builder**	Daewoo, Okpo, South Korea
Commissioned	1988	**Commissioned**	1990	**Commissioned**	1996

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

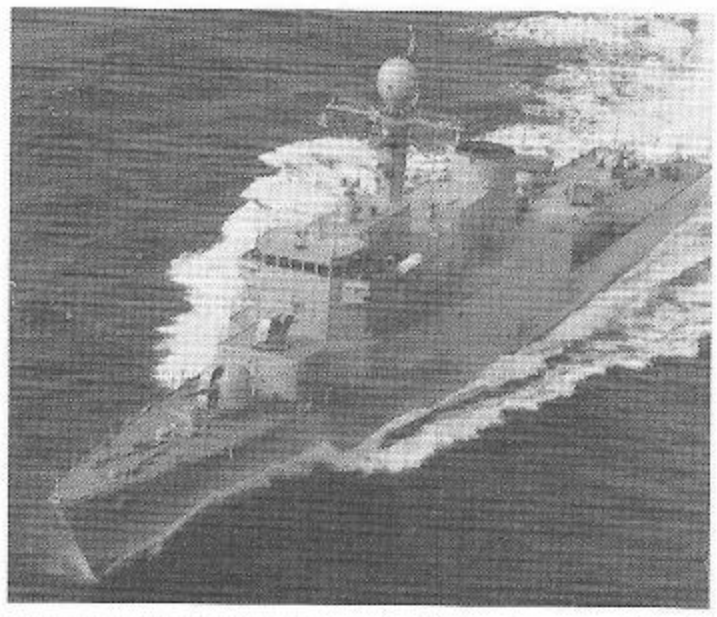
Aerospatiale Exocet MM 38 medium-range anti-ship missile

Po Hang (756) to *Mok Po* (759) only. The first four ships only mount two MM 38 Exocet in forward-facing, single launchers on the after superstructure, pointing outwards at an angle of about 30°. Targets are acquired by the ship's search radar and the operator then aligns the axial gyros in the target's direction and begins the initiation sequence. This involves turning on the thermal battery, releasing the mechanical safety locks, igniting the booster, and finally, breaking the umbilical cord; the total process takes some 60 seconds. Exocet has a 105° off-axis engagement envelope and can perform one 15° change of course during its flight.

The attack consists of three phases:

Cruise phase. The cruise phase starts as the missile clears the container and the missile, powered by the sustainer motor, flies towards the general location of the target at a height of about 100 m (328 ft) which is low enough to reduce the chance of detection but adequate for target acquisition. This phase can be as long as 22 km and ends when the seeker acquires the target. The seeker is a Dassault Electronique ADAC (*Auto Directeur Anti-Clutter*) active monopulse radar, working in the I-band (8-10 GHz), which has a typical range of 13 n miles (24 km) against FACs.

Approach phase. On detecting the target the missile



Kun San *(757), the second ship to be completed. These early ships in the class have the ESCO 30 mm twin ('B' and 'Y' positions) Exocet MM 38 launchers aft, and the Signaal WM 28 at the masthead* (Korea Tacoma)

descends to 9 to 15 m (30 to 50 ft).
Terminal phase. During this final phase the missile descends to 8 m (26 ft) (2 to 5 m (7 to 16 ft) in a calm sea) for a sea-skimming run in to the target.
A salvo may be fired in 12 to 20 seconds.

Specifications
(MM 38)
Length: 5.21 m (17 ft)
Diameter: 35 cm (13.8 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 2-22.5 nm (4-42 km)
Guidance: Inertial and active radar
Sustainer motor: SNPE Eole alloy-cased CDB; weight 151 kg (333 lb); max burn time 93 s.
Booster: 100 kg (220 lbs) SNPE Epervier boost motor; burn time of 2.4 s.
Warhead: Luchaire 165 kg (364 lb) fragmentation warhead
Fuzes: Delayed impact fuze and autopilot-controlled proximity fuze.

Manufacturer/Contractor
Aerospatiale Missiles, Paris, France.

TORPEDOES

324 mm Mk 32 torpedo launchers
Kim Chon (761) to *Sin Hung* (783). Two triple tubes for Mk 46 lightweight torpedoes are mounted immediately aft of the stack, in a particularly high position.

Alliant Techsystems Mk 46 torpedo
The Mk 46 is an anti-submarine, active/passive homing torpedo with a range of 5.9 n miles (11 km) at 40 kts. It has a 44 kg (97 lb) warhead. The Mk 46 is a deep diving high-speed torpedo fitted with active/passive homing head and is intended mainly for use against submarines. After water entry it uses a helical search pattern and is capable of multiple re-attacks if required.

Specifications
Length: 2.59 m (8.5 ft)
Diameter: 32 cm (12.75 in)
Weight: 231 kg (509 lb)
Warhead: 44 kg (97 lb) PBXN-103 HE
Speed: 40 kts
Range: 11,000 m (36,000 ft)

GUNS

OTOBREDA 76 mm (3 in)/62 Compact
Po Hang (756) to *Mok Po* (759) — one 76 mm (3 in) mounting.
Kim Chon (761) to *Sin Hung* (783) — two 76 mm (3 in) mounting.
The 76 mm/62 in the 'Po Hang' class is located either in the 'A' gun position (756 to 759) or in 'A' and 'Y' positions (761 to 783). The Compact mounting features extensive aluminium fabrication of the gun platform, the trunnion supports and the trunk. The 76/62 Compact can fire 80 rounds without reloading and the rate of fire is adjustable from 10 to 85 rds/min. The system is remotely controlled. A reaction time of 2.8 seconds is quoted.

Specifications
Elevation: −15 to +85° at 40°/s
Training speed: 70°/s
Weight (unloaded): 7.5 t
Muzzle velocity: 925 m/s (3,034 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.6 n miles (16 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ESCO 30 twin 30 mm mounting
Po Hang (756) to *Mok Po* (759) only. The first four ships have two twin ESCO (formerly Emerlec) 30 twin mounts: one in 'B' position forward, the other right aft. The ESCO 30 is a twin 30 mm weapon designed for air defence, surface engagement and anti-missile operations, using either local or remote-control. The ESCO 30 employs the Oerlikon KCB positively locked, gas-operated cannon and the gunner sits in a cabin for local control operation using a daylight reflex, or an image-intensifier, sight, together with gyro-assisted line of sight stabilisation. The cabin is located between the barrels and forward of the elevating mass. Behind it, in a sealed compartment are the elevating and training drives together with flexible chutes to channel ammunition to the feeding mechanisms. Ready ammunition is stored in an integral, below-deck, drum magazine with a capacity of 985 rounds for each barrel in a continuous disintegrating-link belt. These are transferred to the guns through separate chutes by means of electrically operated drives which automatically respond to the individual demand for ammunition supply.

Specifications
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,542 ft/s)
Traverse: 360° at 80°/s
Elevation: −15 to +80° at 80°/s
Crew: 1
Range (max): 3.25 n miles (6 km) (anti-ship)
Rate of fire: 600 rds/min/barrel
Ammunition: 870 g (19.2 lb) (HEI/HEI-T, SAPHEI, TP/TP-T)

Manufacturer/Contractor
Electronics & Space Corporation (ESCO), St Louis, Missouri, USA.

OTOBREDA 40 mm/70
Kim Chon (761) to *Sin Hung* (783). The fifth ship onwards have two twin OTOBREDA 40 mm L/70 enclosed mounts. The Compact twin 40 mm mounting is designed for use against high-performance combat aircraft, against anti-ship missiles and for surface engagements. The mounting consists of two 40 mm guns which are 300 mm apart, a feeding system with magazine, a local control panel, a power supply rack, a converter and an air-water panel.

Specifications
Calibre: 40 mm
Length of barrel: 2.8 m (9.2 ft)
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range: 3.25 n miles (6 km) for surface targets, and 4,000 m (13,120 ft) for air targets
Rate of fire: 600 rds/min
Ammunition: 2.4 kg (5.3 lb) (HCHE, PFHE), 2.5 kg (5.5 lb) (HE-T)
Traverse: Nominal 360° at 90°/s
Elevation: −13 to +85° at 60°/s
Crew: 2

DEPTH CHARGES

Kim Chon (761) to *Sin Hung* (783).
12 depth charges are carried.

ELECTRONIC WARFARE SYSTEMS

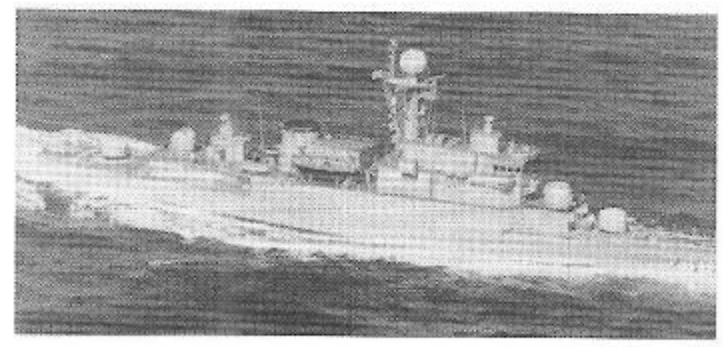
ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

There is an intercept and jammer suite, believed to be of either Thorn EMI or NobelTech design.

DECOYS

MEL 9EW300 Protean
There are four MEL Protean chaff launchers, which consist of four magazines similar to those used in Dagaie with Lacroix munitions. Usually the magazines contain chaff munitions but one may be replaced by an infra-red (IR) munitions magazine. The Protean system uses Chemring munitions.

Each chaff magazine has 36 × 40 mm grenades which each weigh 0.35 kg (0.77 lb)and have a 0.175 kg (0.38 lb) payload. They fire at an interval of 0.1 second per group and within 1 second begin to create a cloud with a 1,000 m² radar cross-section which is complete within up to 5 seconds at a height of 40 to 60 m (131 to 197 ft).



An Dong (Ships of the World)

The control unit selects which groups of munitions will be launched and what combination of chaff/IR should be used. It is then used to fire the selected munitions and indicates what munitions are left in the launchers. In addition there is a course-to-steer indicator which recommends the most efficient evasive course the ship should take when factors such as wind strength and direction, threat bearing, ship speed and course are taken into consideration.

Manufacturers/Contractors
CelsiusTech, Sweden.
Thorn EMI, UK.

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher
Some ships in the class are fitted with two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units (these are apparently in addition to, rather than in place of, the MEL Protean outfits.)

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Signaal Sensor Weapon Control and Command System (SEWACO) ZK

Po Hang (756) to *Mok Po* (759). The first four ships are fitted with the same specially designed version of the Signaal SEWACO system, designated SEWACO ZK (K = Korea) as the 'Dong Hae' class. This system integrates the sensor, weapon and command subsystems around a common command and control (C^2) system, which presents raw and/or processed sensor data from search and fire-control radars together with IFF, sonar, electronic warfare and electro-optic systems to create a picture of the tactical situation. The data may also be used to designate targets to weapon systems and to assist in operations with auxiliary functions such as ASW helicopter direction and tactical navigation.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Ferranti WSA 423

Kim Chon (761) to *Sin Hung* (783). In these ships a completely different system — the Ferranti WSA 423 — is fitted. The WSA 423 has a federated architecture to create a modular system based upon the 24-bit Ferranti FM1600E computer, which has an operating speed of 650 kops (thousand operations per second) and a memory of 1.2 million words, with one computer housed in each console. The system uses Coral 66 language software. In addition to the consoles the system consists of a tracker radar (with V.3342 or TVA2 television camera), a visual sight and an Nd:YAG laser rangefinder. The visual sight is usually the TDS to which the Ferranti Type 901 laser rangefinder may be added. Optional extras include range-only radar, surface-to-air missile direction and an ASW capability through rocket and torpedo control.

The WSA 423 command and weapon control system is based upon the WSA 422 but with added two-man command console from the CAAIS 450 system. It is designed to control two guns, (a 76 mm and 30/40 mm), and an anti-ship missile. The system may track up to 120 targets of which up to 100 may be automatic depending upon the software. It is compatible with Link Y and Link 14 as well as being capable of ECM direction and helicopter control.

Manufacturer/Contractor

GEC-Ferranti, UK.

WEAPONS CONTROL

Signaal LIROD

Po Hang (756) to *Yo Su* (765) only. These ships are fitted with the Signaal LIROD lightweight fire-control system, which is based on a K-band tracking radar and a TV camera. It is designed to simultaneously control two dual-purpose guns while tracking one air and one surface target. It may be used either as a stand-alone unit or to complement the WM28 fire-control system. The system reaction time from detection to the beginning of the engagement is about 4.5 seconds. The radar can track fighter-size targets at ranges up to 9.7 n miles (18 km) and is capable of tracking targets with a maximum speed of 1,000 m/s (3,280 ft/s). In addition to the radar there is a militarised TV camera with CCIR standard video format. This can detect fighter-size targets at about 5.4 n miles (10 km) and large surface ships at about 10.8 n miles (20 km).

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Radamec System 2400 electro-optic director

An Dong (766) onwards. System 2400 is a remotely operated director equipped with thermal imager, daylight TV camera and laser rangefinder. It is designed for multiweapon use and includes a dedicated console which has the Ferranti GP250 digital predictor, a 14 in (35.5 cm) raster scan display.

RADARS

Samsung/Marconi S-1810/Raytheon SPS-64

Ships carry either Samsung/Marconi S-1810 or Raytheon AN/SPS-64, but some ships carry both.

Signaal WM28 or Marconi 1802

Ships carry either Signaal WM28 or Samsung/Marconi ST-1802

Type	S-1810	AN/SPS-64	ST-1802	WM28
Company	Samsung/ GEC-Marconi	Raytheon	Samsung/ GEC-Marconi	Signaal
Role	Surface search	Navigation	Fire control	Fire control
Band	I	I/J	I/J	I/J
Beam	1.1 × $\cos^2$ 5-30°	1.25 × 20°	2.4°	Search: 1.5 × 4/7° Track: 2.4°
Peak power	50 kW	10/25/50 Kw	50 kW	200 kW
Gain	36 dB	-	37 dB	33.5 dB
Pulsewidth	Air search: 1 µs surface search: 0.2 µs	0.06/0.5/ 1 µs	0.67/0.3/1.0 µs	0.22/4.5 µs
PRF	2,000/4,000 pps	3,600/1,800/900 pps	Non-MTI:3,000 pps MTI:4,000 pps	3,600/1,800 pps
Scan rate	24 rpm		-	60 rpm
Typical range	Air: 24 nm (45 km) small vessels: 16 nm (30 km)	118.5 km	22 nm (40 km)	25 n miles (46 km)

SONARS

Signaal PHS-32 hull-mounted search and attack sonar system

Kim Chon (761) to *Sin Hung* (783). PHS-32 is a medium-range high-performance search and attack sonar with signal processing facilities for fast Fourier transformation processing of all preformed beam receiving channels. All data are presented on a single TV-type display, while operation has been much simplified by the use of light pen control. The system can track up to four targets automatically. A circular transducer permits all-round coverage in various modes of transmission such as: Omni, TRDT, MCC (wide vertical beam), LISTEN (passive with time/bearing recorder presentation). An audio beam is also available.

Specifications

Frequencies: 3
Pulse lengths: 12.5, 25, 50,100 ms and 400 ms (CW or FM)
Detection range: Exceeding 9,000 m (10,000 yd)
Vertical beamwidth: 12° or 20°
Bearing accuracy: 1°RMS
Range accuracy: ±0.5-2%
Notch filtering: Selectable rejection bandwidth
Own Doppler correction: On all 60 channels

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 General Electric LM-2500 gas turbine, 20 MW (26,820 hp); 2 MTU 12V 956 TB82 diesels, 4.6 MW (6,260 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

First laid down early 1983 by Korea SEC. At least one more of the class was scheduled for completion in 1995 but the status of further orders is uncertain.

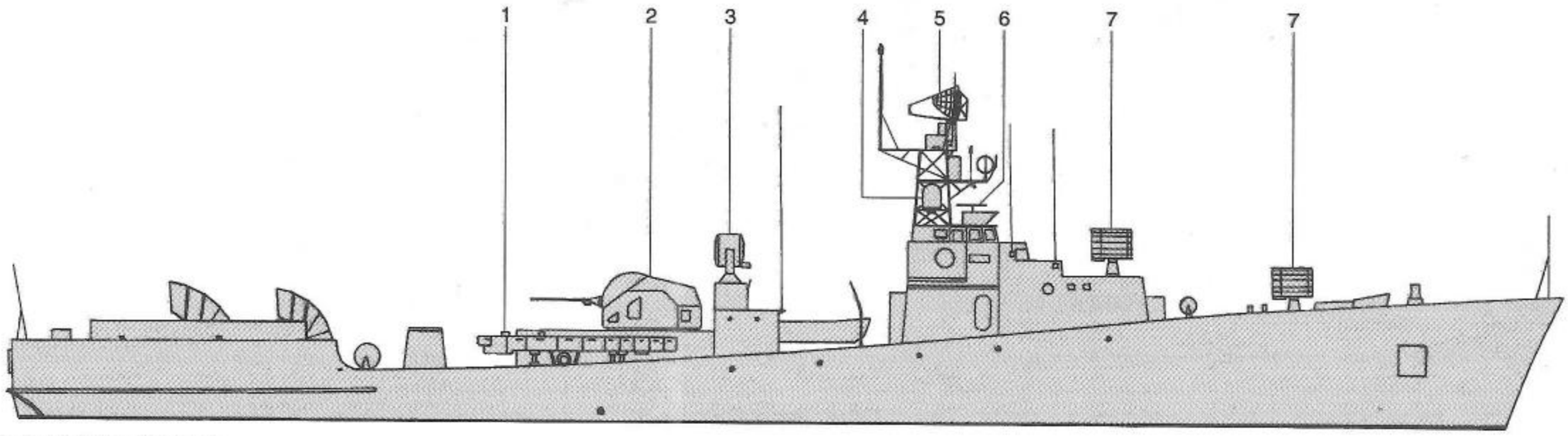
PENNANT NUMBERS

The attribution of pennant number to names is uncertain but names and shipbuilders are correct. It should be noted that no pennant numbers end with the figure '0'.

DESIGN

The first group (*Po Hang* (756) to *Mok Po* (759)) has no ASW sensors or weaponry and is clearly optimised for the anti-surface warfare role. The second group (*Kim Chon* (761) to *Sin Hung* (783) has only a relatively weak anti-surface capability (there are no missiles, for example) and is optimised for the ASW mission. The second group also has a much improved combat data system with Ferranti/Radamec/Marconi fire-control systems and radars, although this may be a result of new equipment coming on stream rather than a consequence of a change of role. Although this class has been in production since the early 1980s it appears that new ships are building, which may be air defence variants.

LETYASHTI (POTI)



Letyashti (Ian Sturton)
1 *406 mm (16 in) Russian Type 40 torpedo tubes (four)* **2** *ZIF-72 twin 57 mm/80 automatic guns* **3** *Muff Cob fire control* **4** *Watch Dog ESM* **5** *Strut Curve surface search radar* **6** *Don 2 navigation radar* **7** *RBU-6000 12-tube ASW rocket launcher*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Bulgaria
Type: Poti

Class: LETYASHTI

Acquired: 6
Active: 4

Displacement:
full load: 545 t

Dimensions
Length: 60 m (196.8 ft)
Beam: 8 m (26.2 ft)
Draught: 2 m (6.56 ft)

Speed: 38 kts
Range: 3,000 n miles at 18 kts, 500 n miles at 37 kts

Complement: 80

SHIPS

LETYASHTI (41)
Builder Zelenodolsk, Russia
Completed 1971-78

BDITELNI (42)
Builder Zelenodolsk, Russia
Completed 1971-78

BEZSTRASHNI (43)
Builder Zelenodolsk, Russia
Completed 1971-78

KHRABRI (44)
Builder Zelenodolsk, Russia
Completed 1971-78

WEAPONS SYSTEMS

TUBES

406 mm (16 in) torpedo tubes
There are four 16 in (406 mm) torpedo tubes. These are single, fixed tubes, but relatively close together in pairs on either side of the afterdeck.

TORPEDOES

Type E40-75A torpedoes

Specifications
Diameter: 406 mm
Length: 4.5 m (14.8 ft)
Warhead: 100 kg (220 lb)
Speed: 30 kts
Range: 7 n miles (13 km)
Homing: Active/passive homing

GUNS

57 mm/75 ZIF-72/AK 725
There is one twin ZIF-72/AK-725 mounting in 'Y' position on the quarterdeck. This weapon is an evolutionary development of the twin-barrel ZIF-31B, but it has clearly been designed for prolonged air defence engagements and for this reason has a slightly longer barrel (4.57 m) which is water-cooled. It may also be used against surface and coastal targets.

The mounting is operated by two men from the fire-control station associated with the 'Muff Cob' radar system. 'Muff Cob' has its antenna in a 1 m (3.28 ft) wide, weather-proof mounting suspended from a trunnion-yoke carried on a traversing mounting. The radar is supplemented by an electro-optic sensor. The height of the mounting is about 3 m (9.8 ft) and the H-band radar can probably tilt from −10 to +50° as with the gun mounting. It is likely that control of the mounting is conducted from the compartment which houses the radar display system.

Specifications
Length of barrel: 75 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Traverse: ±200°
Elevation: −10 to +85°
Range:
anti-surface: 3.25 n miles (6 km)
anti-air: 6,000 m (20,000 ft)
Rate of fire: 120 rds/min/barrel
Projectile weight: 6.61 kg (14.6 lb)
Power requirements: 220 or 380 V, three phase

ANTI-SUBMARINE MORTARS

RBU 6000
There are two 12-tubed, RBU-6000, trainable launchers on the foredeck. These weapons have automatic loading and a range of 6,000 m (19,680 ft) with a 31 kg (68 lb) warhead. The RBU-6000 is the most modern of Soviet-origin ASW rocket launchers and has the 12 tubes arranged in a circular fashion.

Specifications
Length: 1.8 m (5.9 ft)
Range: 6,000 m (19,680 ft)
Warhead: 31 kg (68 lb)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog
There are two Watch Dog radar-warning arrays.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar

The air search radar is the Russian MR-302 (NATO = Strut Curve) a medium-range, general purpose, F-band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m² aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Don-2

Don-2 is a standard Russian Navy I-band navigation/surface search radar.

Muff Cob

Muff Cob is the director for the 57 mm fire control system and is the large cylindrical radome atop the after deckhouse. The radome is supported by a trunnion yoke in a traversing mounting and is thus capable of both elevation and traverse. There is a device to the left of the radome (from the front), with a remotely controlled cover, which may be a TV camera. The F/G-band radar is named Muff Cob by NATO and Bars (Wildcat) by the Russian Navy.

IFF

Square Head and High Pole.

SONARS

There is a hull-mounted, high-frequency active search and attack sonar; type not known.

PROPULSION

Specifications
System: Combined diesel and gas turbine (CODAG)
Main machinery: 2 gas turbines 22.4 MW (30,000 hp); 2 Type M 503 A diesels, 3.91 MW (5,350 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These four Bulgarian ships are the only survivors of the once numerous 'Poti' class, of which 69 were built between 1961 and 1968. The Bulgarian Navy received three in December 1975, one in late 1986 and the last two in 1990. Of those six, two were deleted in 1993.

Khrabri *(44). The Bulgarian Navy is the last to operate ships of the once numerous Poti class*

DESIGN

The 'Poti' class an unusually high maximum speed of 38 knots. In part, this was achieved through the use of gas turbines, the Potis being first in the (then) Soviet Navy to be powered by these new devices. The gas turbines are mounted right aft, with each driving a propeller mounted in a long thrust tube. The gas turbines also drive compressors which drive air into the tubes, thus augmenting the thrust and increasing the top speed. As this idea has only been used in one other ship class (Mirka) it would seem that it has not proved particularly effective.

NAMES

Letyashti (41) = Flying
Bditelni (42) = Vigilant
Bezstrashni (43) = Fearless
Khrabri (44) = Gallant

DEPLOYMENT

All four are based at Atiya.

NANUCHKA

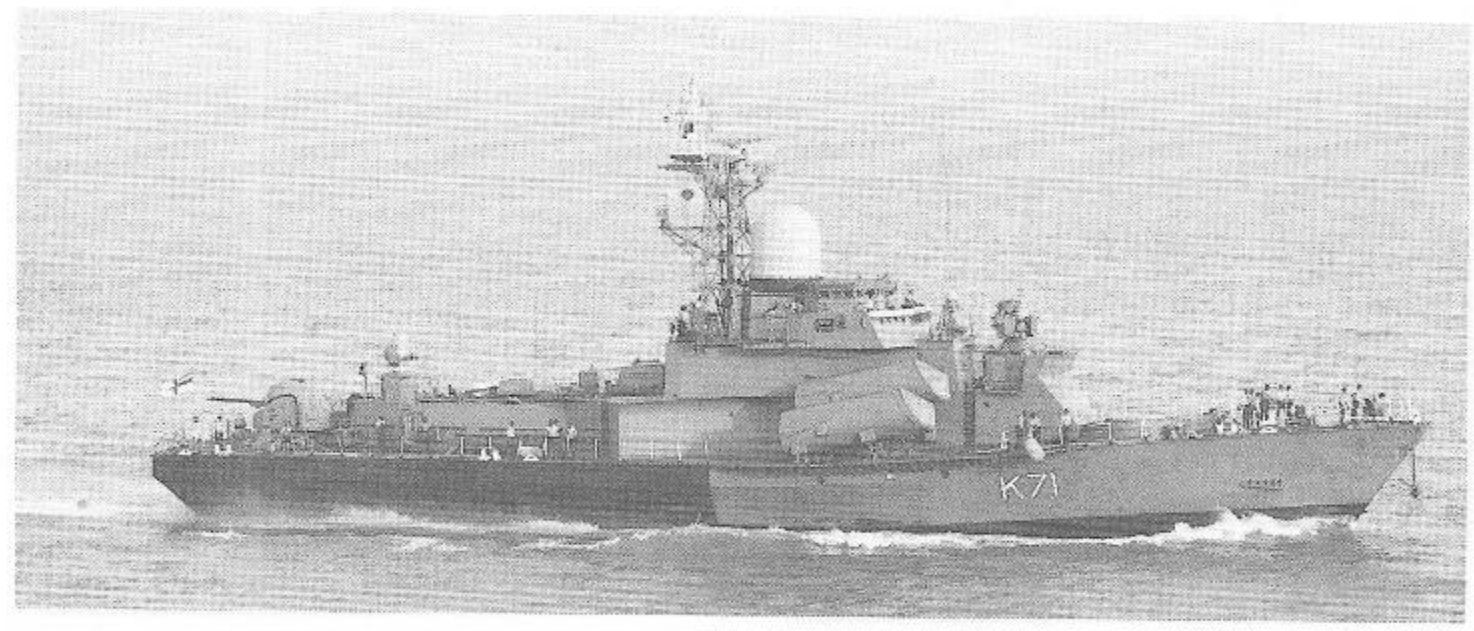
OVERVIEW

A total of 40 'Nanuchka' class corvettes, divided into four sub-types, was built for four navies between 1967 and 1981.

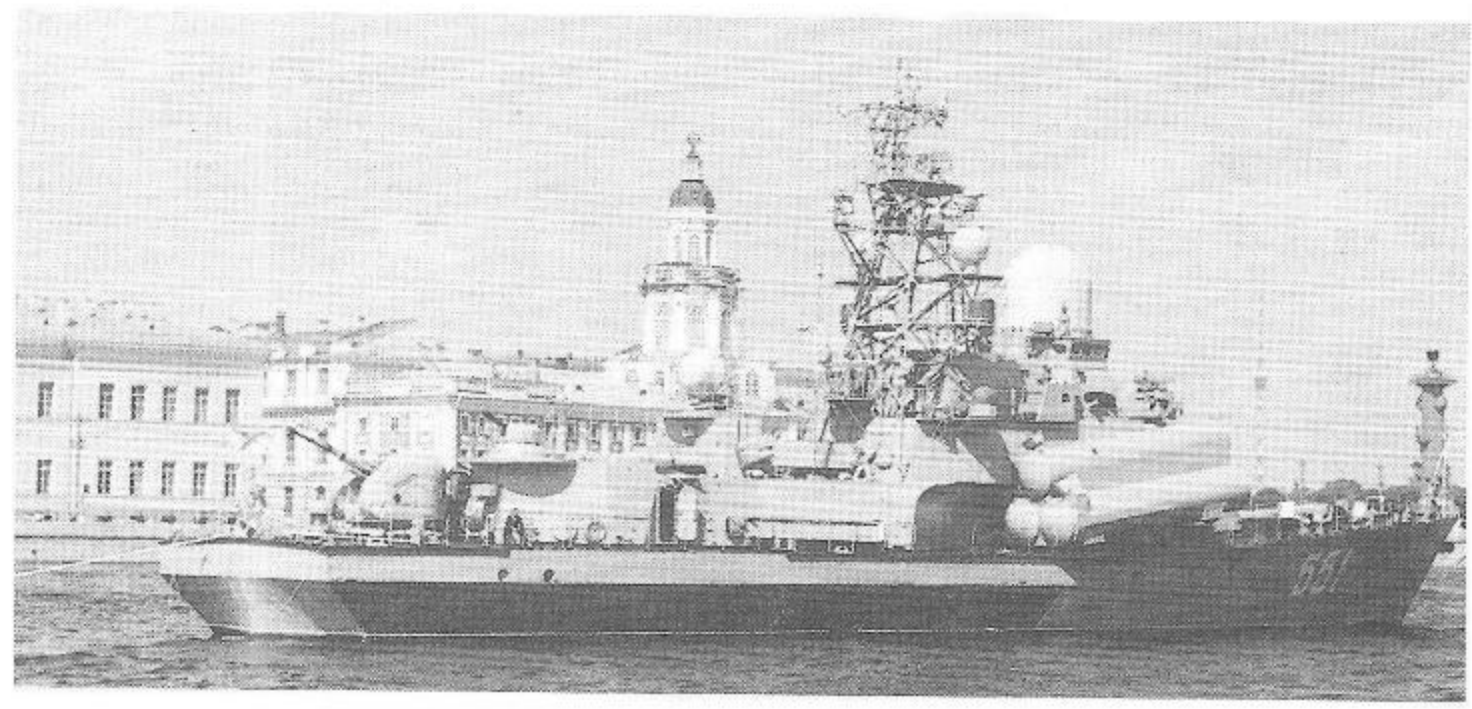
The four versions have the same hull, propulsion and performance, the differences lying in the weapons and sensor fit. This particularly applies to the export version, Nanuchka II, which was armed with SS-N-2c anti-ship missile rather than the higher performance SS-N-9. The other major difference was that Nanuchka III and the one-off Nanuchka IV were armed with a single 76 mm gun instead of the twin 57 mm in Nanuchka I and II.

	Nanuchka I	Nanuchka II	Nanuchka III	Nanuchka IV	Totals	In service January 1997
Russia	14		16	1	31	26
Algeria		3			3	0
India		3			3	3
Libya		4			4	1
Totals	14	10	16	1	41	30
In service January 1997	10	4	16	0		30

	Nanuchka I	Nanuchka II	Nanuchka III	Nanuchka IV
Project No	1234	1234E	1234.1	1234.2
Missiles **SSM** **SAM**	 6 × SS-N-9 1 × SA-N-4	 4 × SS-N-2c 1 × SS-N-4	 6 × SS-N-9 1 × SA-N-4	 12 × SS-CX-5
Guns	2 × 57 mm	2 × 57 mm	1 × 76 mm	1 × 76 mm 1 × 30 mm
Decoys	2 × PK-16	2 × PK-16	4 × PK-10	4 × PK-10
ESM	Bell Tap	Bell Tap	Foot Ball Half Hat A/B 4 × Half Cup	Foot Ball Half Hat A/B 4 × Half Cup
Data-links			2 × Bell Nest/ Light Bulb	2 × Bell Nest/ Light Bulb
Radar	Peel Pair	Square Tie	Plank Shave	Plank Shave
Weapon control	Muff Cob Pop Group	Muff Cob Pop Group	Bass Tilt Pop Group	Bass Tilt Pop Group

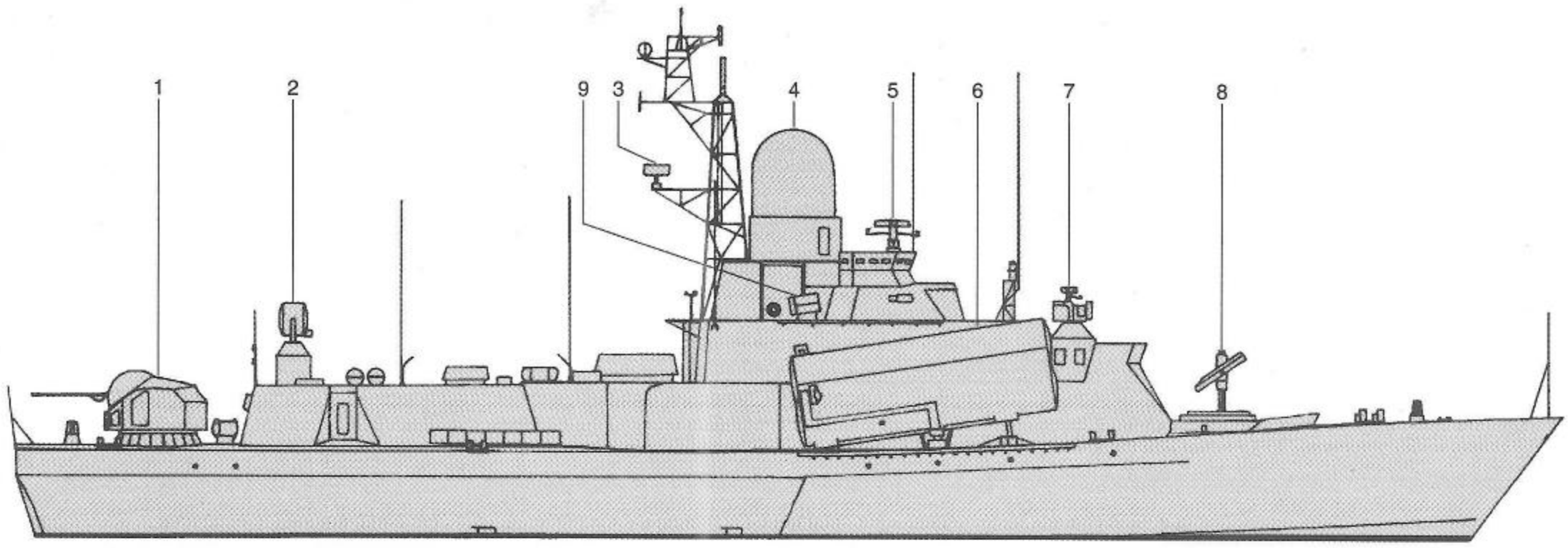


Nanuchka II. Note SS-N-2c missile launchers and twin 57 mm gun (H & L van Ginderen Collection)



Nanuchka III. This version has SS-N-9 missiles and a single 76 mm gun
(H & L van Ginderen Collection)

VIJAY DURG (NANUCHKA II)



Nanuchka II (Ian Sturton)
1 *Twin 57 mm/80 automatic guns* **2** *Muff Cob fire director radar (for 57 mm)* **3** *Square Head IFF* **4** *Band Stand air search/target indicator radar* **5** *Square Tie air/surface search radar* **6** *Two SS-N-4 Siren anti-ship missile launchers (six)* **7** *Pop Group fire control (for SA-N-4)* **8** *SA-N-4 Gecko twin-arm SAM launcher* **9** *PK-16 16 tube decoy launcher (two)*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: India
Type: Nanuchka II

Class: VIJAY DURG

Purchased: 3
Active: 3

Displacement:
full load: 660 t

Length: 59.3 m (194.5 ft)
Beam: 11.8 m (38.7 ft)
Draught: 2.6 m (8.5 ft)

Speed: 33 kts
Range: 2,500 n miles at 12 kts; 900 n miles at 31 kts

Complement: 42 (7 officers)

SHIPS

VIJAY DURG (K 71)		**SINDHU DURG** (K 72)		**HOS DURG** (K 73)	
Builder	St Petersburg, Russia	**Builder**	St Petersburg, Russia	**Builder**	St Petersburg, Russia
Commissioned	Apr 1976	**Commissioned**	Sep 1977	**Commissioned**	Apr 1978

WEAPONS SYSTEMS

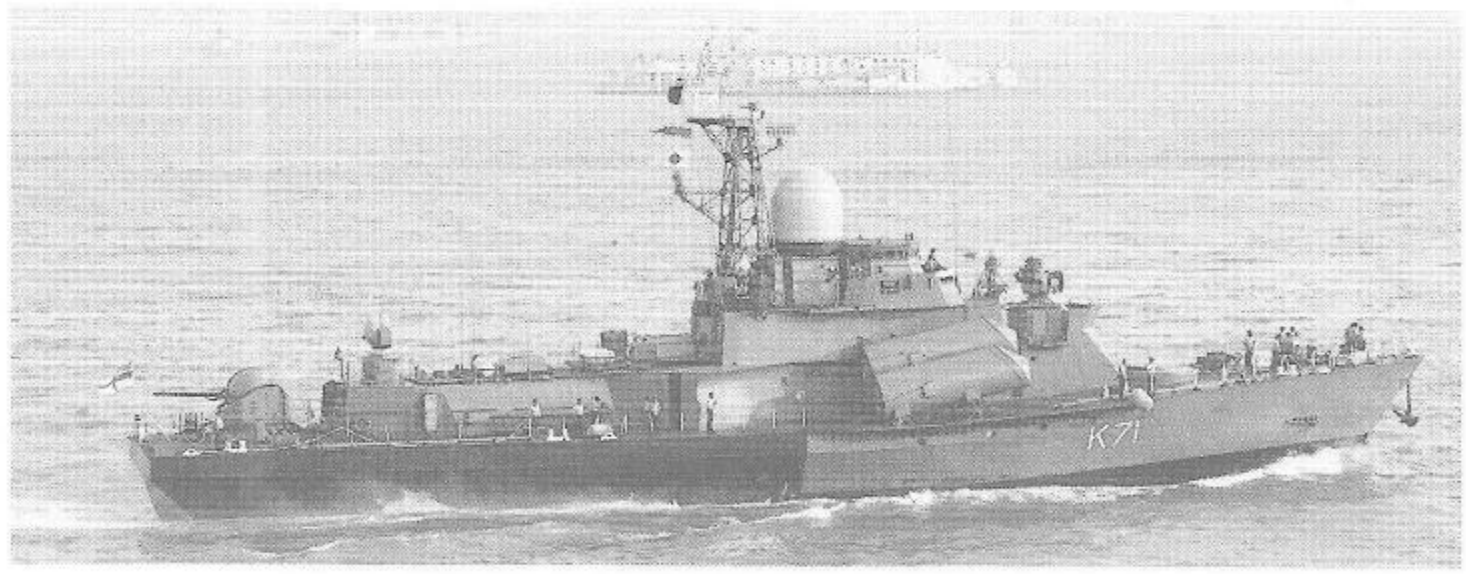
SURFACE-TO-SURFACE MISSILES (SSM)

P-21 Rubezh (SS-N-2c 'Styx') medium-range anti-ship missile

There are four P-21 (NATO = SS-N-2c 'Styx') missiles in individual, forward-facing launch bins, with two either side of the bridge structure. There are no reloads. The P-21 missile was introduced into service in 1967 and is essentially a P-15 (SS-N-2a) with an added infra-red seeker. This relatively large anti-ship missile is powered by a liquid-fuelled rocket motor, with a solid fuel booster attached.

Once the target is detected the ship must close with the aim of being within the optimum engagement distance, some 15 to 20 n miles (28 to 37 km). Then, since the missile launcher must face the target the ship must turn away and, while maintaining a speed of 15 kts or less, hold its course for 20 to 30 seconds before launching the first salvo of two missiles. These may be followed, a minute later, by another two.

Upon launch, the missile climbs at an angle of 45° to one of five preset altitudes (100, 150, 200, 250 or 350 m) (328, 492, 656, 820 or 1,148 ft), where the onboard radar searches for a target and the receiver is switched on for very short periods to receive signals from a designated range, the range gate being 1 km (0.54 n miles) on either side of the target. The radar locks only after eight returns have been received, at distances of 3.5 to 12 n miles (6.5 to 22 km), whereupon the seeker guidance system switches off the autopilot. A throw-off gyroscope takes the missile on target a few seconds before impact as it becomes too close for radar-generated homing signals. Russian Navy tacticians calculate that seven to eight missiles are required to destroy a cruiser-size target and four for a destroyer, making salvo firing a major feature of any tactical engagement scenario with SS-N-2c missiles to ensure destruction of the target.



Vijay Durg *(K 71). The Nanuchka II has four SS-N-2c anti-ship missiles but is otherwise very similar to the Russian Navy's Nanuchka I* (H & L van Ginderen Collection)

Specifications

(SS-N-2c)
Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.87 ft)
Speed: Mach 0.9
Weight (without booster): 2,500 kg (5,732 lb)
Warhead: 454 kg (1,000 lb) hollow-charge
Fuzes: Impact, proximity
Range: 3-46 n miles (5.5-85 km)
Guidance: Autopilot with active radar (supplemented in some with IR)

MS-2 seeker
Frequency: I-band (8-12 GHz) (four presets)
PRF: 300-500 pps (adjustable)
Altitude control: Barometric pressure device

Manufacturer/Contractor

Raduga, Moscow, Russia.

SURFACE-TO-AIR MISSILES

SA-N-4 'Gecko' (OSA-M) point defence system

There is one SA-N-4 launcher aft, with 20 missiles in a below-deck magazine. This system is known to NATO as SA-N-4 (reporting name = Gecko) but is known in

Russia as the Osa-M system, while the missile itself is designated 9M33. SA-N-4 has a distinctive loading and launching system in which the twin-rail launcher lies beneath a hinged flat cover plate, emerges to launch its missiles and then retracts in order to reload. This is likely to result in a low rate of fire which must be slowed even further by the need to close the magazine cover before firing. Underneath the launcher are four revolving drums each with five missiles while the electro-mechanical and hydraulic machinery is below that. On launch, the booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.4 km), following which, the sustainer burns for 15 seconds. SA-N-4 is controlled by the Pop Group system. There is a frequency-agile, monopulse radar with a parabolic rotating search antenna operating in H-band (6-8 GHz) and with a typical acquisition range of 16 n miles (30 km). There are two J-band (10-20 GHz) antennas, one of them for a pulse Doppler target-tracking element with a range of 10.75 n miles (20 km) and the smaller parabolic antenna being used to track the missile. Above the prime antennas is a smaller, circular one which emits an I-band (8-10 GHz) uplink capture beam which gathers the missile shortly after launch. The director also has a small, rectangular command uplink emitter.

Specifications
Range: 8 n miles (15 km)
Altitude: 91-3048 m (130-10,000 ft)
Speed: Mach 2.5
Warhead: 50 kg (110 lb)

GUNS

57 mm/80 (twin) ZIF-72/AK 725
The ZIF-72/AK 725 has been designed for prolonged air defence engagements and for this reason has a slightly longer barrel (4.57 m) which is water-cooled. It may also be used against surface and coastal targets. The mounting is operated by two men from the fire-control station associated with the 'Muff Cob' radar system. 'Muff Cob' has its antenna in a 1 m (3.28 ft) wide, weather-proof mounting suspended from a trunnion-yoke carried on a traversing mounting. The radar is supplemented by an electro-optic sensor. The height of the mounting is about 3 m (9.8 ft) and the H-band radar can probably tilt from −10 to +50° as with the gun mounting. It is likely that control of the mounting is conducted from the compartment which houses the radar display system.

Specifications
Length of barrel: 75 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Traverse: ±200°
Elevation: −10 to +85°
Range:
anti-surface: 3.25 n miles (6 km)
anti-air: 6,000 m (20,000 ft)
Rate of fire: 120 rds/min/barrel
Projectile weight: 6.61 kg (14. 6 lb)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Bell Tap
Bell Tap is a radar warning system.

DECOYS

PK-16
There are two PK-16 launchers on each ship. The munitions are all for seduction purposes. The SR-50 is a chaff round with a payload of 11 kg (24 lb). The SOM-50 is a heat-seeker/laser-guided missile seduction round with 7.3 kg (16 lb) payload while the SK.50 is a combined round with 9.1 kg (20 lb) of payload.

Manufacturer/Contractor
General Export for Defence, Moscow, Russia.

COMMAND AND CONTROL SYSTEMS

RADARS

Square Tie
Square Tie is an I-band air/surface search radar with a range of 40 n miles (74 km). It is mounted in the radome which is occupied by Band Stand in the Russian Navy's Nanuchka Is and IIIs.

Pop Group
Pop Group is the weapon control system for the SA-N-4 missile system, with the director sited on the roof of the forward deckhouse. The director includes an acquisition radar with a long, curved antenna on top of the cab and two target trackers. The latter two are of different size, but presumably the smaller one performs a similar function to the larger, but at higher frequencies, which would enable them to direct two different missiles against the same target. The system operates in the F/H/I-band.

Muff Cob
Muff Cob is the director for the 57 mm fire-control system and is the large cylindrical radome atop the after deckhouse. The radome is supported by a trunnion yoke in a traversing mounting and is thus capable of both elevation and traverse. There is a device to the left of the radome (from the front), with a remotely controlled cover, which may be a TV camera. The F/G-band radar is named Muff Cob by NATO and Bars (Wildcat) by the Russian Navy.

Don 2
Don 2 is a standard Russian Navy I-band navigation radar.

IFF
High Pole
Two Square Head.

PROPULSION

Specifications
System: Diesel

Main machinery: 6 M 504 diesels, 19.2 MW (26,122 hp)
Shafts: 3

FURTHER INFORMATION

PROGRAMME

These three ships were built at Leningrad (St Petersburg) and transferred from the (then) USSR in the late 1970s.

DESIGN

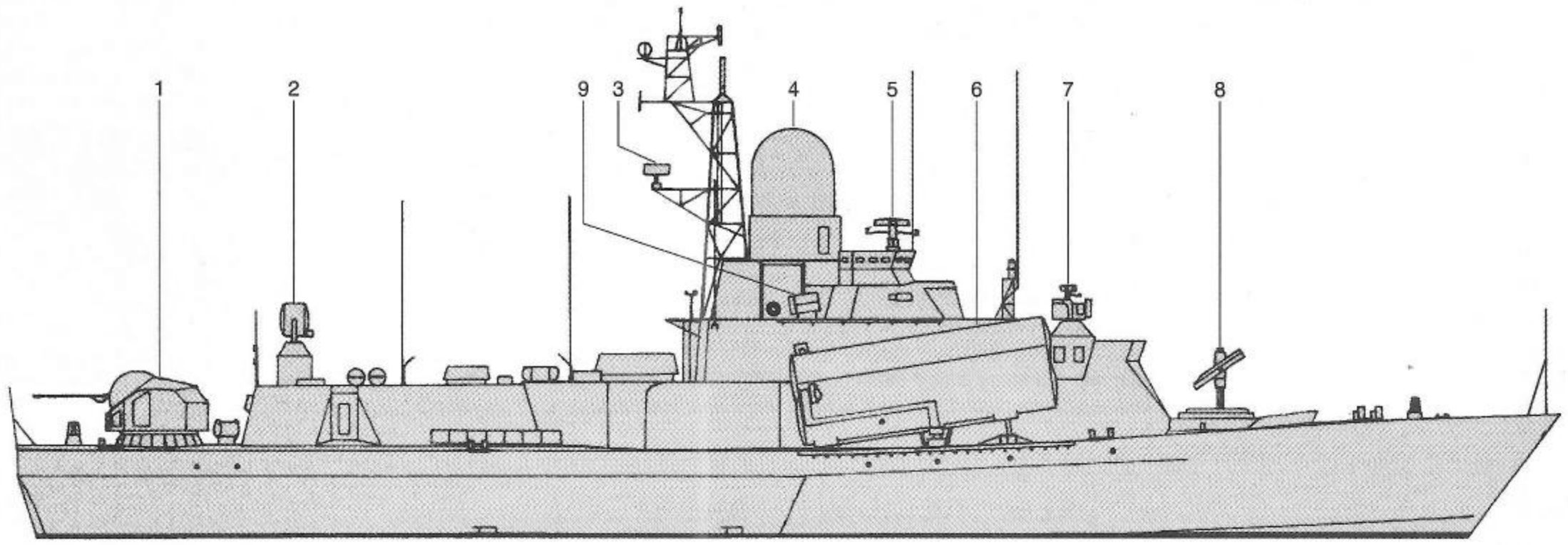
The ships are very similar to the Russian Navy's Nanuchka I, except that the SS-N-9 missile is replaced by the SS-N-2c. The launch bins for this older missile are considerably larger than those for the SS-N-9 so only four can be carried instead of six. Also, the radome is mounted lower than in the Russian ships due to the absence of the Fish Bowl datalink which is not required for the SS-N-2.

DEPLOYMENT

All are based at Bombay and all are currently active.

Indian Navy 'Nanuchka II' class corvette, Vijay Durg *(K 71)*

TARIQ IBN ZIYAD (NANUCHKA II)



Nanuchka II (Ian Sturton)
1 *Twin 57 mm/80 automatic guns* **2** *Muff Cob fire-director radar (for 57 mm)* **3** *Square Head IFF* **4** *Band Stand air search/target indicator radar* **5** *Square Tie air/surface search radar* **6** *Two SS-N-4 Siren anti-ship missile launchers (six)* **7** *Pop Group fire control (for SA-N-4)* **8** *SA-N-4 Gecko twin-arm SAM launcher* **9** *PK-16 16 tube decoy launcher (two)*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Libya
Type: Nanuchka II (Type 1234E)

Class: TARIQ IBN ZIYAD

Purchased: 4
Active: 3

Displacement:
full load: 660

Length: 59.3 m (194.5 ft)
Beam: 11.8 m (38.7 ft)
Draught: 2.6 m (8.5 ft)

Speed: 33 kts
Range: 2,500 n miles at 12 kts; 900 n miles at 31 kts

Complement: 42 (7 officers)

SHIPS

TARIQ IBN ZIYAD (416)
Builder St Petersburg, Russia
In service Oct 1981

EAN AL GAZALA (417)
Builder St Petersburg, Russia
In service 1983

EAN ZARA (418)
Builder St Petersburg, Russia
In service 1983

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

P-21 Rubezh (SS-N-2c 'Styx') medium-range anti-ship missile

There are four P-21 (NATO = SS-N-2c 'Styx') missiles in individual, forward-facing launch bins, with two either side of the bridge structure. There are no reloads. The P-21 missile was introduced into service in 1967 and is essentially a P-15 (SS-N-2a) with an added infra-red seeker. This relatively large anti-ship missile is powered by a liquid-fuelled rocket motor, with a solid fuel booster attached.

Once the target is detected the ship must close with the aim of being within the optimum engagement distance, some 15 to 20 n miles (28 to 37 km). Then, since the missile launcher must face the target the ship must turn away and, while maintaining a speed of 15 kts or less, hold its course for 20 to 30 seconds before launching the first salvo of two missiles. These may be followed, a minute later, by another two.

Libyan corvette, Tariq ibn Ziyad *(416) was so severely damaged by US aircraft in 1986 that it had to be sent to Russia for repair. Note camouflage paint* (H & L van Ginderen Collection)

Upon launch, the missile climbs at an angle of 45° to one of five preset altitudes (100, 150, 200, 250 or 350 m) (328, 492, 656, 820, or 1,148 ft), where the onboard radar searches for a target and the receiver is switched on for very short periods to receive signals from a designated range, the range gate being 1 km (0.54 n miles) on either side of the target. The radar locks only after eight returns have been received, at distances of 3.5 to 12 n miles (6.5 to 22 km), whereupon the seeker guidance system switches off the autopilot. A throw-off gyroscope takes the missile on target a few seconds before impact as it becomes too close for radar-generated homing signals. Russian Navy tacticians calculate that seven to eight missiles are required to destroy a cruiser-size target and four for a destroyer, making salvo firing a major feature of any tactical engagement scenario with SS-N-2c missiles to ensure destruction of the target.

Specifications

(SS-N-2c)
Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.87 ft)
Speed: Mach 0.9
Weight (without booster): 2,500 kg (5,732 lb)
Warhead: 454 kg (1,000 lb) hollow-charge
Fuzes: Impact, proximity
Range: 3-46 n miles (5.5-85 km)

Guidance: Autopilot with active radar (supplemented in some with IR)

MS-2 seeker
Frequency: I-band (8-12 GHz) (four presets)
PRF: 300-500 pps (adjustable)
Altitude control: Barometric pressure device

Manufacturer/Contractor

Raduga, Moscow, Russia.

SURFACE-TO-AIR MISSILES (SAM)

SA-N-4 'Gecko' (OSA-M) point defence system

There is one SA-N-4 launcher aft, with 20 missiles in a below-deck magazine. This system is known to NATO as SA-N-4 (reporting name = Gecko) but is known in Russia as the Osa-M system, while the missile itself is designated 9M33. SA-N-4 has a distinctive loading and launching system in which the twin-rail launcher lies beneath a hinged flat cover plate, emerges to launch its missiles and then retracts in order to reload. This is likely to result in a low rate of fire which must be slowed even further by the need to close the magazine cover before firing. Underneath the launcher are four revolving drums each with five missiles while the electro-mechanical and hydraulic machinery is below that. On launch, the booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.4 km), following which, the sustainer burns for 15

seconds. SA-N-4 is controlled by the Pop Group system. There is a frequency-agile, monopulse radar with a parabolic rotating search antenna operating in H-band (6-8 GHz) and with a typical acquisition range of 16 n miles (30 km). There are two J-band (10-20 GHz) antennas, one of them for a pulse Doppler target-tracking element with a range of 10.75 n miles (20 km) and the smaller parabolic antenna being used to track the missile. Above the prime antennas is a smaller, circular one which emits an I-band (8-10 GHz) uplink capture beam which gathers the missile shortly after launch. The director also has a small, rectangular command uplink emitter.

Specifications
Range: 8 n miles (15 km)
Altitude: 91-3048 m (130-10,000 ft)
Speed: Mach 2.5
Warhead: 50 kg (110 lb)

GUNS

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The ZIF-72/AK 725 has been designed for prolonged air defence engagements and for this reason has a slightly longer barrel (4.57 m) which is water-cooled. It may also be used against surface and coastal targets. The mounting is operated by two men from the fire-control station associated with the 'Muff Cob' radar system. 'Muff Cob' has its antenna in a 1 m (3.28 ft) wide, weather-proof mounting suspended from a trunnion-yoke carried on a traversing mounting. The radar is supplemented by an electro-optic sensor. The height of the mounting is about 3 m (9.8 ft) and the H-band radar can probably tilt from −10 to +50° as with the gun mounting. It is likely that control of the mounting is conducted from the compartment which houses the radar display system.

Specifications
Length of barrel: 75 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Traverse: ±200°
Elevation: −10 to +85°
Range:
anti-surface: 3.25 n miles (6 km)
anti-air: 6,000 m (20,000 ft)
Rate of fire: 120 rds/min/barrel
Projectile weight: 6.61 kg (14.6 lb)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Bell Tap
Bell Tap is a radar warning (ESM) system.

DECOYS

PK-16
There are two PK-16 launchers on each ship. The munitions are all for seduction purposes. The SR-50 is a chaff round with a payload of 11 kg (24 lb). The SOM-50 is a heat-seeker/laser-guided missile seduction round with 7.3 kg (16 lb) payload while the SK.50 is a combined round with 9.1 kg (20 lb) of payload.

Manufacturer/Contractor
General Export for Defence, Moscow, Russia.

COMMAND AND CONTROL SYSTEMS

RADARS

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Don 2
Don 2 is a standard Russian Navy I-band navigation radar.

IFF
High Pole
Two Square Head.

PROPULSION

Specifications
System: Diesel
Main machinery: 6 M 504 diesels, 19.2 MW (26,122 hp)
Shafts: 3

FURTHER INFORMATION

PROGRAMME

The Libyan Navy received four Nanuchka IIs from the (then) USSR, the first in October 1981, followed by the second in February 1983, the third in February 1984, and the fourth in September 1985.

DESIGN

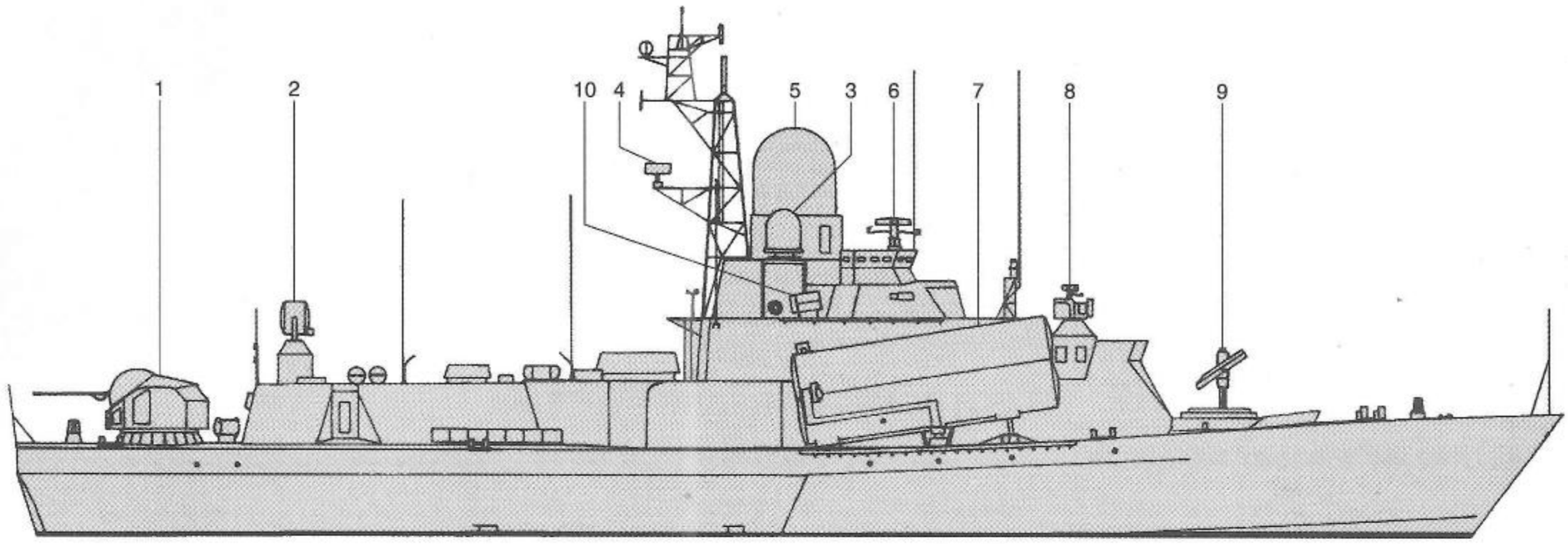
These are virtually identical with the Nanuchka IIs supplied to India but are instantly recognisable by their camouflage paint schemes, which were applied in 1991.

DEPLOYMENT

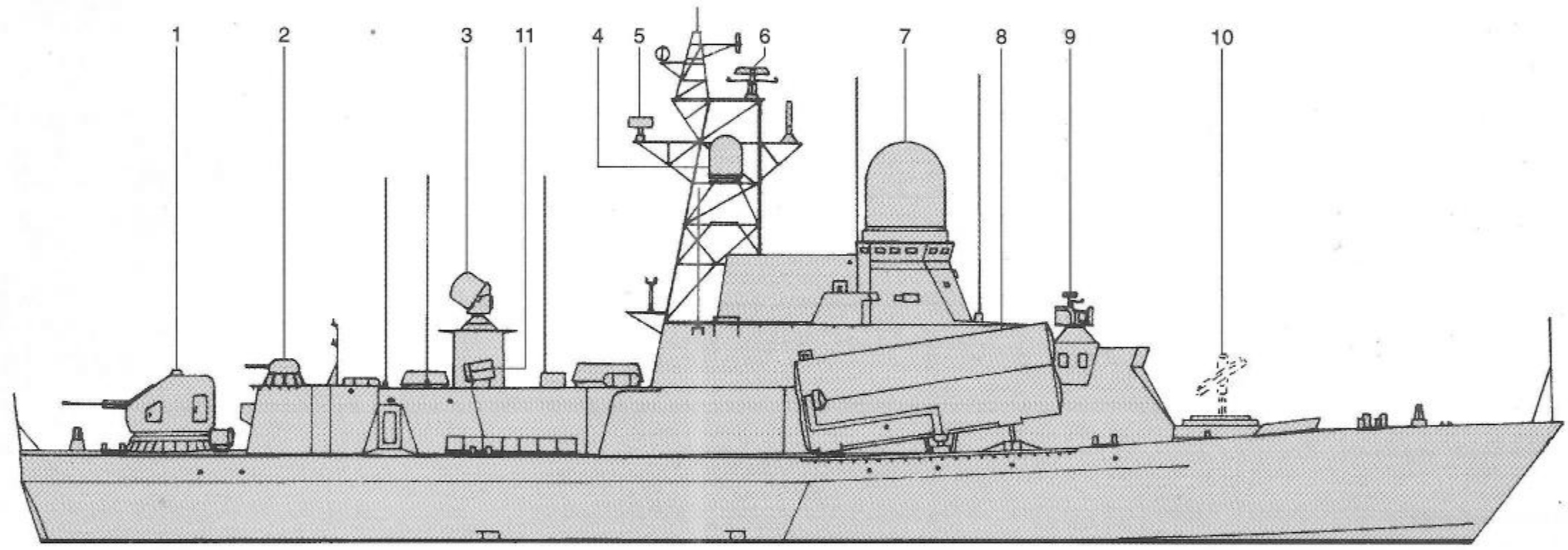
Two of these ships were attacked by aircraft of the Sixth Fleet, during the US/Libyan confrontation in 1986, following the imposition of an embargo by President Reagan. One Libyan ship, *Ean Zaquit* (419), was sunk on 24 March 1986, and a second, *Ean Mara* (416), was severely damaged on the following day. *Ean Mara* was subsequently sent to St Petersburg for repairs and returned to Libya in early 1991 having been renamed *Tariq Ibn Ziyad.*

All are still seaworthy but it appears that the Libyan Navy only maintains one in a fully operational condition.

NANUCHKA
I, III AND IV



Nanuchka I (Ian Sturton)
1 *Twin 57 mm/80 automatic gun* **2** *Muff Cob fire-director radar (for 57 mm)* **3** *Fish Bowl datalink* **4** *Square Head IFF* **5** *Band Stand air search/target indicator radar* **6** *Peel Pair air/surface search radar* **7** *Triple SS-N-9 Siren anti-ship missile launchers (six)* **8** *Pop Group fire control (for SA-N-4)* **9** *SA-N-4 Gecko twin-arm SAM launcher* **10** *PK-16 16 tube decoy launcher (two)*



Nanuchka III (Ian Sturton)
1 *AK-176M 76 mm (3 in)/60 automatic gun* **2** *AK-630 30 mm CIWS* **3** *Bass Tilt fire-control radar (76 mm and 30 mm guns)* **4** *Light Bulb datalink* **5** *Square Head IFF* **6** *Peel Pair air/surface search* **7** *Band Stand (datalink)* **8** *Triple SS-N-9 Siren anti-ship missile launchers (six)* **9** *Pop Group fire control* **10** *SA-N-4 twin-arm launchers for SAM* **11** *PK-10 ten-tube decoy launcher*

GENERAL SPECIFICATIONS

Operator: Russia
Type: 1234
National designation: *maly raketny korabl* (small missile ship).

Class: NANUCHKA

Built: Nanuchka I — 14; Nanuchka III — 16; Nanuchka IV — 1

Active: Nanuchka I — 10; Nanuchka III — 16; Nanuchka IV — 1

Displacement:
full load: 660 t

Length: 59.3 m (194.5 ft)
Beam: 11.8 m (38.7 ft)
Draught: 2.6 m (8.5 ft)

Speed: 33 kts
Range: 2,500 n miles at 12 kts; 900 n miles at 31 kts

Complement: 42 (7 officers)

SHIPS

Nanuchka I: SKVAL, STORM, TAIFUN, ZYKLON, METL, ZARNITSA, GROM, VOLNA, VICHR BORA
Builder: St Petersburg, Vladivostok, Russia

Nanuchka III: METEOR, TUCHA, PRILIV, URAGAN, PASSAT, PRIBOY, ZARYA, SMERCH, MIRAS, SHTYL, VETER, MOROZ, INEZ, RASSVET, RAZLIV, OTLIV AJSBERG, ZYB
Builder: St Petersburg, Vladivostok, Russia

Nanuchka IV: NAKAT
Builder: St Petersburg, Vladivostok, Russia

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Chelomey SS-N-9 Siren

Nanuchka I and Nanuchka III only. These ships have two massive triple launchers for SS-N-9 sea-skimming, anti-ship missile. The Russian 4K85 missile (NATO = SS-N-9 'Siren') is believed to be similar to the SS-N-7 'Starbright,' but longer, with a J-band (10 GHz) active radar seeker in the nose. The warheads are either 200 kT nuclear (now removed under international agreement) or 513 kg (1,131 lb) high explosive, which may be the same hollow-charge type as in the SS-N-2 'Styx' missile. The launch tubes are angled at approximately 8°, with doors at both ends which open during launching.

In the 'Nanuchka' class the fire-control system is associated with 'Band Stand,' a D/F-band (1-4 GHz) radar data link housed in a prominent radome. Little is known about this system except that it has a high data rate. The fire-control system is likely to receive offboard data through Bell Nest or Light Bulb datalinks which may also be used in providing mid-course guidance. Offboard data may be provided both by other ships and by Ka-25 Hormone C or Ka 27 Helix B helicopters which could perform over-the-horizon targeting, although Nanuchkas do not carry their own helicopters.

Specifications
Length: 8.84 m (29 ft)
Diameter: 76 cm (30 in)
Weight: 3,300 kg (7,275 lb)
Range: 60 n miles (110 km)
Speed: Mach 0.9
Guidance: Autopilot with active radar (possibly complemented by IR)

SS-CX-5

Nanuchka IV only. The sole Nanuchka IV is the trials ship for the SS-CX-5 missile. This is an improved and smaller version of SS-N-9 with a range of 162 n miles (300 km).

SURFACE-TO-AIR MISSILES (SAM)

SA-N-4 'GECKO' (OSA-M) point defence system

Nanuchka I/III/IV. There is one SA-N-4 launcher on the foredeck, with 20 missile in a below-deck magazine. This system is known to NATO as SA-N-4 (reporting name = Gecko) but is known in Russia as the Osa-M system, while the missile itself is designated 9M33.

SA-N-4 has a distinctive loading and launching system in which the twin-rail launcher normally lies beneath a hinged flat cover plate, emerges to launch its missiles, and then must retract in order to reload. This is likely to result in a low rate of fire which must be slowed even further by the need to close the magazine cover before firing. Underneath the launcher are four revolving drums each with five missiles while the electro-mechanical and hydraulic machinery is below that. On launch, the booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.4 km), following which, the sustainer burns for 15 seconds. SA-N-4 is controlled by the Pop Group system. There is a frequency-agile, monopulse radar with a parabolic rotating search antenna operating in H-band (6-8 GHz) and with a typical acquisition range of 16 n miles (30 km). There are two J-band (10-20 GHz) antennas, one of them for a pulse Doppler target-tracking element with a range of 10.75 n miles (20 km) and the smaller parabolic antenna being used to track the missile. Above the prime antennas is a smaller, circular one which emits an I-band (8-10 GHz) uplink capture beam which gathers the missile shortly after launch. The director also has a small, rectangular command uplink emitter.

Specifications:
Range: 8 n miles (15 km)
Altitude: 91-3,048 m (130-10,000 ft)
Speed: Mach 2.5
Warhead: 50 kg (110 lb)

GUNS

57 mm/75 ZIF-72/AK 725

Nanuchka I only. There is one ZIF-72/AK 725 in 'Y' position on the quarterdeck. This weapon is an evolutionary development of the twin-barrel ZIF-31B, but it has clearly been designed for prolonged air defence engagements and for this reason has a slightly longer barrel (4.57 m) which is water-cooled. It may also be used against surface and coastal targets. The mounting is operated by two men from the fire-control station associated with the 'Muff Cob' radar system. 'Muff Cob' has its antenna in a 1 m (3.28 ft) wide, weatherproof mounting suspended from a trunnion-yoke carried on a traversing mounting. The radar is supplemented by an electro-optic sensor. The height of the mounting is about 3 m (9.8 ft) and the H-band radar can probably tilt from −10 to +50° as with the gun mounting. It is likely that control of the mounting is conducted from the compartment which houses the radar display system.

Specifications
Length of barrel: 75 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Traverse: ±200°
Elevation: −10 to +85°
Range:
anti-surface: 3.25 n miles (6 km)
anti-air: 6,000 m (20,000 ft)
Rate of fire: 120 rds/min/barrel
Projectile weight: 6.61 kg (14.6 lb)
Power requirements: 220 or 380 V, three phase

76 mm (3 in)/60 AK-176M

Nanuchka III and IV only. In Nanuchka III and IV there is one AK-176M 76 mm L/59 gun mounted in 'Y' position in place of the twin 57 mm mounting in the earlier ships. The AK-176M is designed for air defence, surface engagement and shore bombardment roles and is a four-man mounting which may be operated from the weapon control centre or from a local control station. The barrel is cooled externally by taking seawater from the ship's fire main through a jacket which lies around the liner.

The AK-176M is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'. This radar is also associated with the AK-630 and the two appear to form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the *Kondensor* sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day/night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight. Some vessels appear to have the mounting in a stand-alone configuration supported by other fire-control radars.

Specifications
Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,214 ft/s)
Traverse: 360° at 35°/s
Elevation: −7 to +85°at 30°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 120 rds/min

30 mm/65 AK-630

Nanuchka III and IV only. In Nanuchka III and IV there is a single AK-630 CIWS at the after end of the superstructure. This weapon has five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AO-18 weapon is a water-cooled, six-barrelled, Gatling-principle weapon with fixed breech-block and revolving barrels. The weapons is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but unlike the US weapon AK-630 features a separate radar director.

Specifications
Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,920 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (4,374 yd)
electro-optic fire control: 5,000 m (5,468 yd)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
Weight
UOF-84 HE-I: 384 g (13.5 oz)
UOR-84 HE-T: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Nanuchka I.

Nanuchka Is are fitted with the Bell Tap ESM system.

Nanuchka III/IV

The later ships have a different fit, with Foot Ball and Half Hat A and B (IIIs). They also have four Half Cup laser warners.

DECOYS

PK-16 or PK-10

Nanuchka III and IV. Two per ship on Nanuchka III. PK-10 is a Russian naval decoy system about which details were first revealed in 1993. The system consists of KT-216 launchers, a control console and three munitions. The launcher has ten 120 mm barrels fixed at an angle of about 45°. The launcher appears to be turnable. The control console is a relatively simple design with simple controls capable of controlling up to four launchers.

The munitions are all for seduction purposes. The SR-50 is a chaff round with a payload of 11 kg (24 lb). The SOM-50 is a heat-seeker/laser-guided missile seduction round with 7.3 kg (16 lb) payload while the SK.50 is a combined round with 9.1 kg (20 lb) of payload.

Manufacturer/Contractor
General Export for Defence, Moscow, Russia.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Bell Nest/Light Bulb
Later Nanuchka IIIs only. The later Nanuchka IIIs have either two Bell Nest or Light Bulb datalink systems.

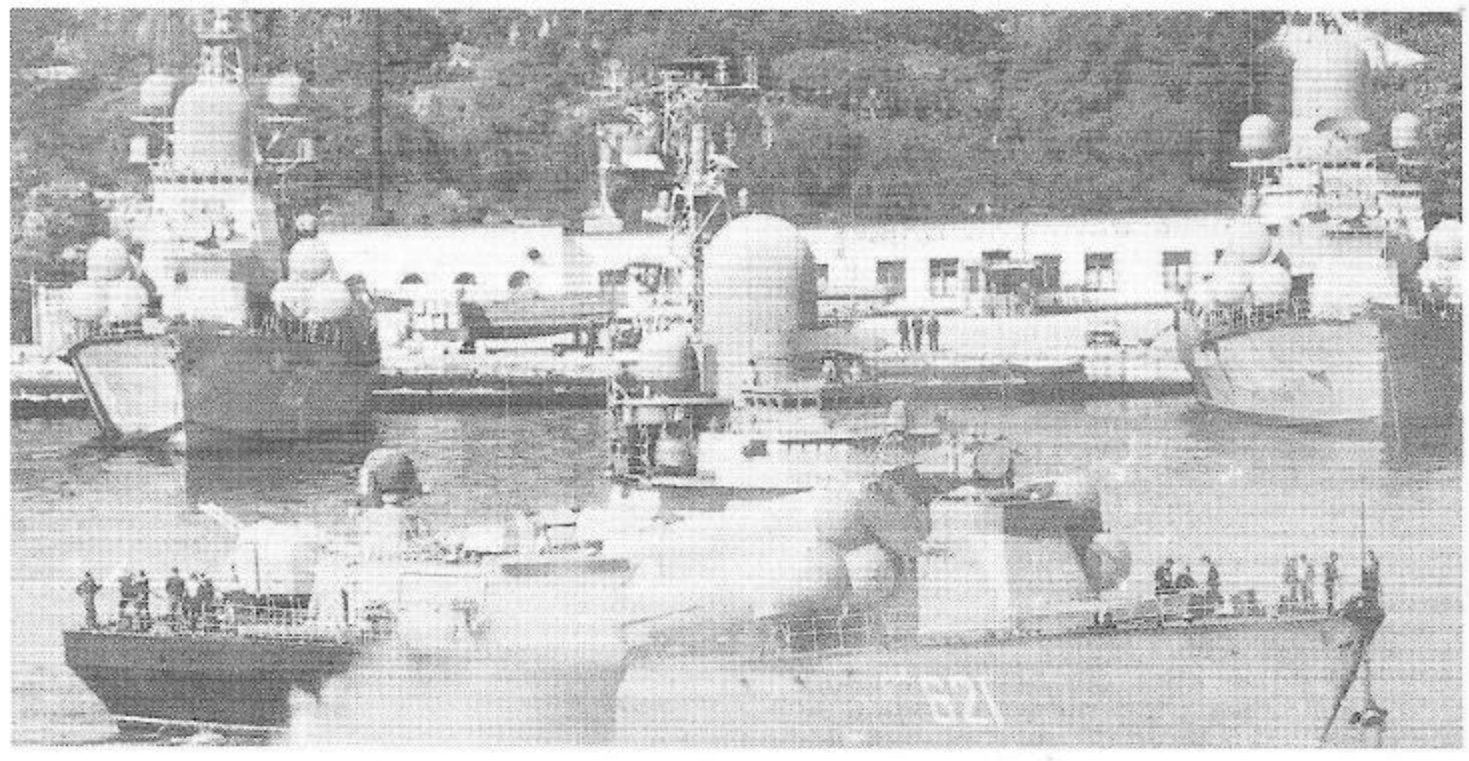
Band Stand
Band Stand is a D/E/F-band radar which is part of the fire control system for the SS-N-25 missile system, although there my be some connection with the ship's overall air surveillance, as well. The Light Bulb datalinks may well be part of the same system, providing the links between the ship and the missile.

RADARS

Peel Pair
Nanuchka I and early Nanuchka III. These ships are fitted with the Peel Pair I-band air/surface search radar. This antenna is mounted on the bridge roof and consists of two identical antennas (possibly Don-series) mounted back to back.

Plank Shave
Later Nanuchka III. The later Nanuchka IIIs are fitted with a Plank Shave antenna. This I-band set has usually been associated with targeting for the SS-N-2c missile, but it appears in this case to be used in a general air/surface search role.

Muff Cob
Nanuchka I only. Muff Cob is the director for the 57 mm fire-control system and is the large cylindrical radome atop the after deckhouse. The radome is supported by a trunnion yoke in a traversing mounting and is thus capable of both elevation and traverse. There is a device to the left of the radome (from the front), with a remotely controlled cover, which may be a TV camera. The F/G- band radar is named Muff Cob by NATO and Bars (Wildcat) by the Russian Navy.



A trio of Nanuchkas. Number 621 is a Nanuchka I, with crewmen providing the scale. The two ships still moored are a Nanuchka III (left) (note radomes on the mast) and a second Nanuchka I (right) (H & L van Ginderen Collection)

Bass Tilt
Nanuchka III only. Bass Tilt is an H/I-band fire-control radar which entered service in the mid-1970s and is part of the fire-control system for the ADG-630 CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (4 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.5 ft) high and 1.45 m (4.7 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

Pop Group
All versions. Pop Group is the weapon control system for the SA-N-4 missile system, with the director sited on the roof of the forward deckhouse. The director includes an acquisition radar with a long, curved antenna on top of the cab and two target trackers. The latter two are of different size, but presumably the smaller one performs a similar function to the larger, but at higher frequencies, which would enable them to direct two different missiles against the same target. The system operates in the F/H/I-band.

Nayada
All versions. Nayada is a standard Russian I-band navigation radar.

IFF
High Pole. Square Head. Spar Stump. Salt Pot A and B.

PROPULSION

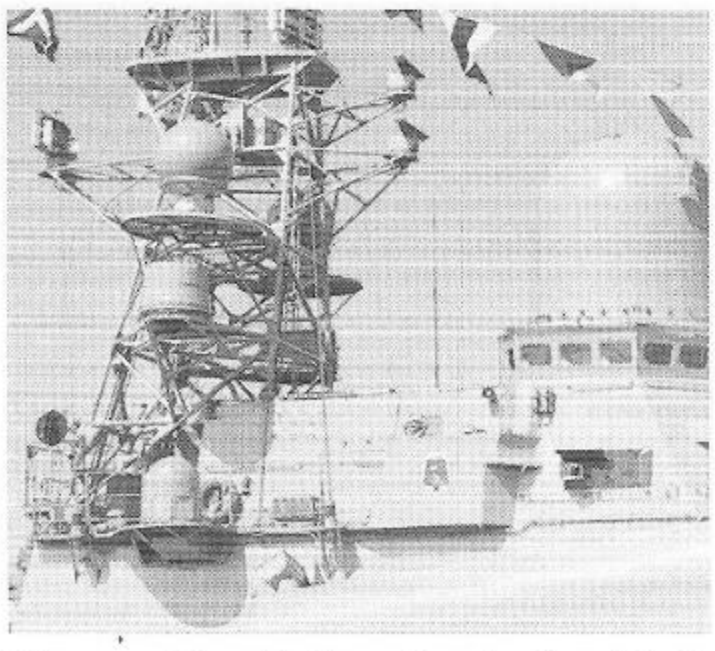
Specifications
System: Diesel

Main machinery: 6 M504 diesels, 19.2 MW (26,122 hp)
Shafts: 3

FURTHER INFORMATION

PROGRAMME

Construction of the Nanuchka Is started in 1969 at the Petrovsky yard in (then) Leningrad. Construction of the Nanuchka III, which was first observed by the West in 1978 and the one-off Nanuchka IV trial ship took place in the Pacific. Nanuchka IV was completed in 1987 as a trials ship.



Close-up of the midship section of a Nanuchka III. On the masthead platform is a Square Head IFF antenna, with a second, covering the aft sector, below and behind the platform. On the side of the mast (from top to bottom) are Light Bulb (datalink), Half Hat (radar intercept/ESM) and Wine Glass (jammer). The two rotating antennas on the front side of the mast are Nayada navigation radars. The large radome on the bridge roof is Band Stand

DEPLOYMENT

The 'Nanuchka' class is intended for deployment in coastal waters, but in the 1980s there were regular deployments to the Mediterranean, North Sea and the Pacific, where the type was seen operating in groups of two or three.

Current deployment (early 1997) is nine in the Northern Fleet, nine in the Baltic, five in the Black Sea and the remaining six in the Pacific.

FUTURE

Many of the Nanuchkas are lying alongside or at anchor and are non-operational, scrapping of Nanuchka Is has already started.

A successor class to this useful small warship is in the design stage, but whether it will enter production is another matter.

Nanuchka III. Note that the bridge house has been moved further forward and that the Band Stand radome is now on the bridge roof. Note also the unusual circular antenna at the masthead (H & L van Ginderen Collection)

PAUK

OVERVIEW

The 'Pauk' class corvettes were built between 1977 and 1982 and are essentially an anti-submarine version of the 'Tarantul' class hull. Thus, the superstructure is lighter and there are no SS-N-2c missiles, but instead there are two sonars and an ASW armament consisting of four 406 mm torpedo tubes, two RBU-1200 rocket launchers and two depth-charge racks.

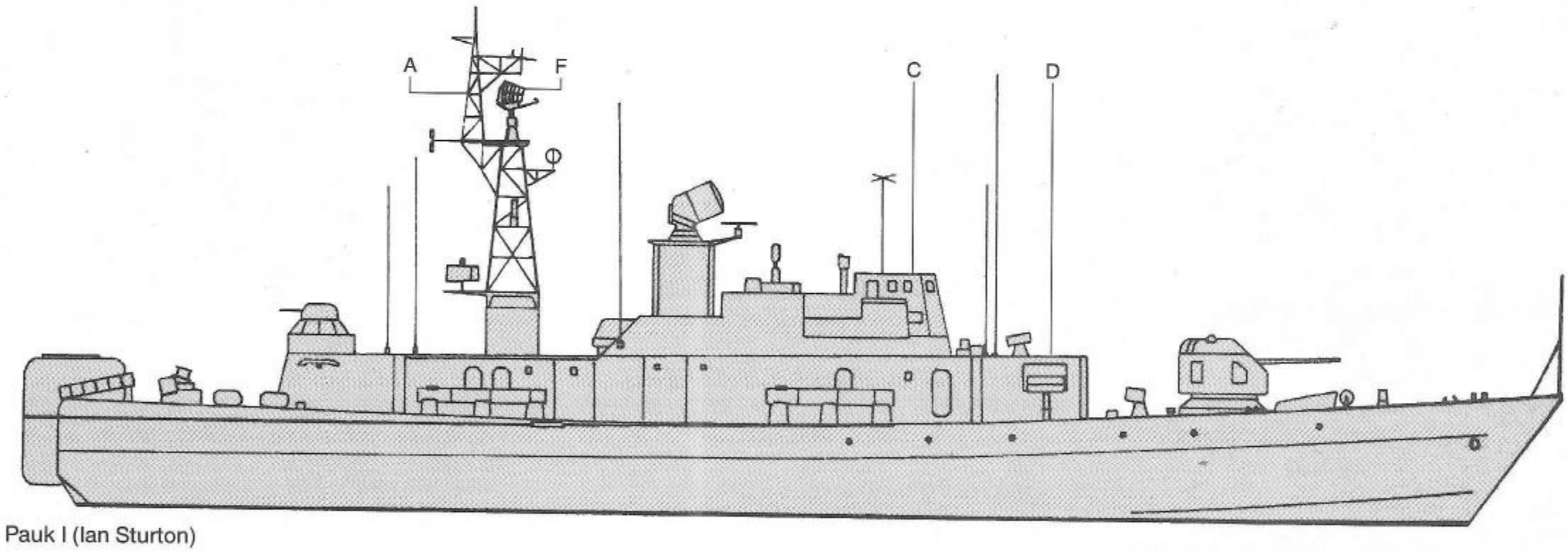
Following the usual Soviet policy of the 1970s and 1980s, there was one version (Pauk I) for Soviet forces and a second version for export (Pauk II). This made it clear that there were certain weapons (for example, 406 mm torpedoes) and items of electronic equipment (such as sonars and radars) which were not allowed out of Russian hands. In addition, and again following standard practice, one of the export versions was retained by the Soviet Navy for use in training foreign crews. A number of 'Pauk' class ships were also supplied to the KGB Maritime Border Guard.

A total of 52 'Pauk' class was delivered:

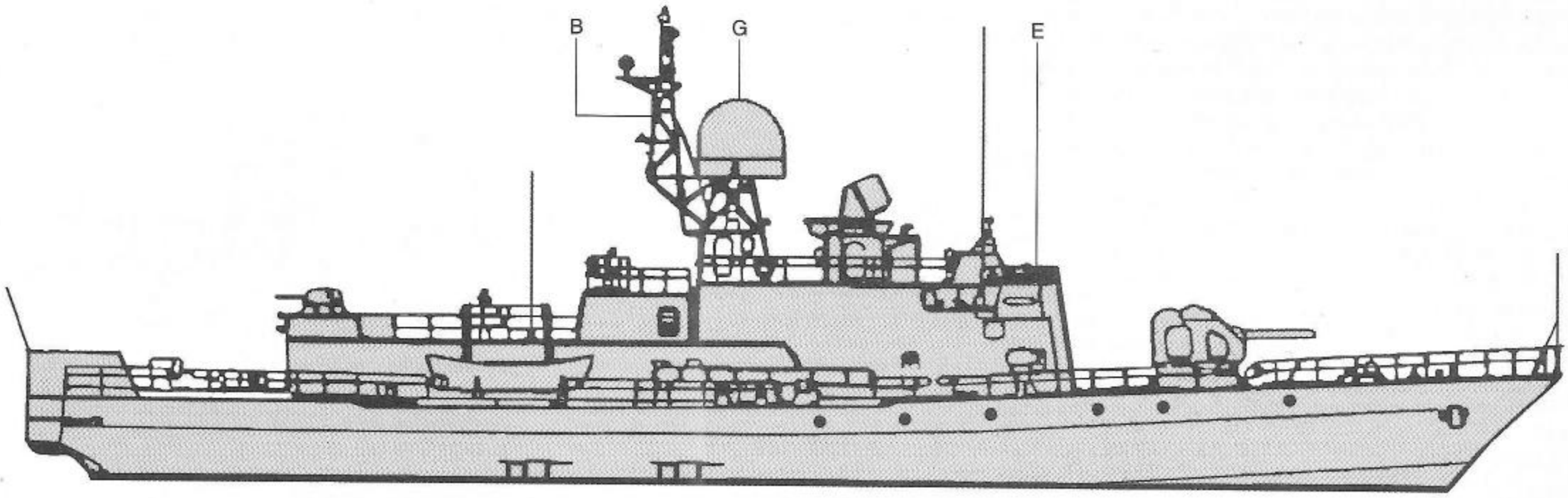
'Pauk I'
- Russian Navy: 31
- KGB Maritime Border Guard: 15
- Bulgaria: 2 (these were former Russian Navy ships)

'Pauk II'
- Cuba: 1
- India: 4
- Russia: 1

One of the three original Pauk I ASW corvettes with the low bridge. Note the large mainmast and the container for the MGK-345 sonar on the stern (MoD Bonn)



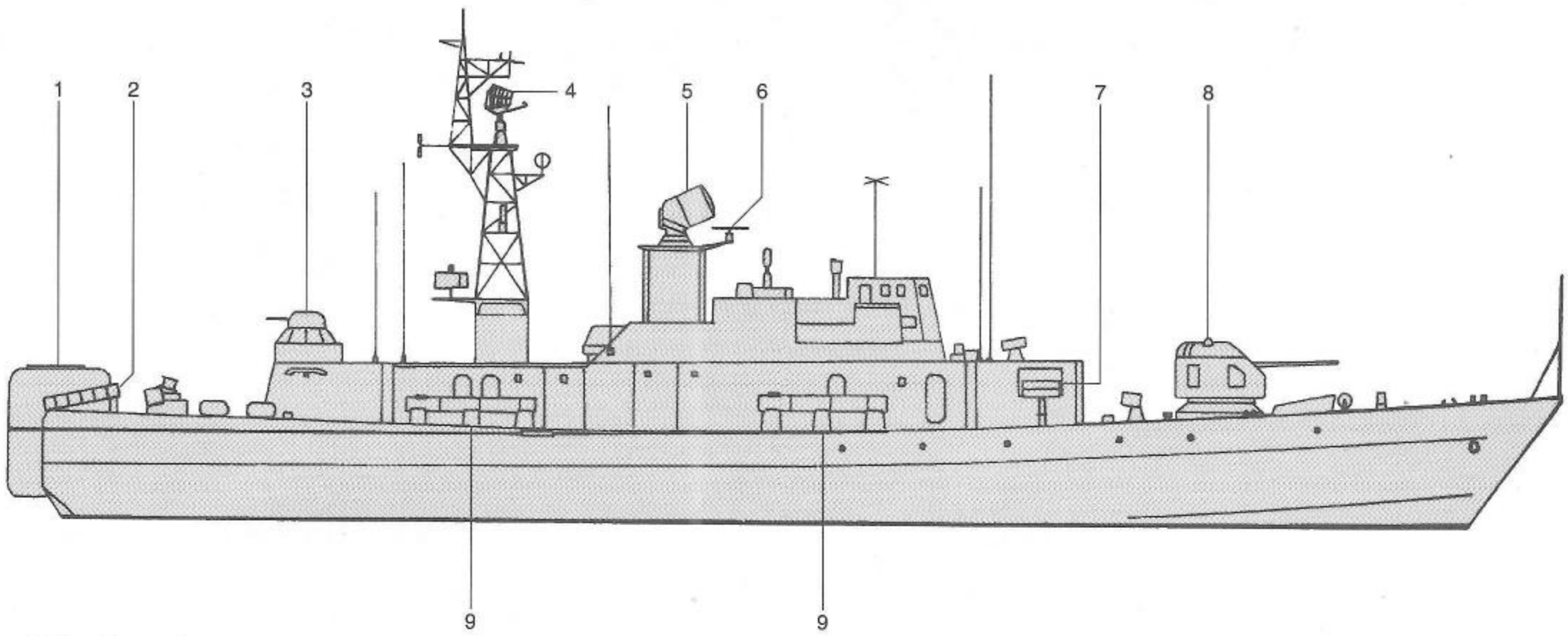
Pauk I (Ian Sturton)



Pauk II

Main differences between Pauk I (top) and Pauk II (bottom). **Mainmast:** *In Pauk I mainmast is aft (A). In Pauk II mainmast (B) is much lower and further forward occupying position taken by Bass Tilt in Pauk I.* **Bridge:** *In Pauk I bridge (C) is amidships with a flat-roofed deckhouse forward (D). In Pauk II bridge has been brought forward to front-edge of deckhouse (E).* **Sensors:** *Pauk I has Strut Curve, Pauk II has Cross Dome/Positive E (G).* **Tubes:** *Pauk I has 400 mm tubes (H); Pauk II has 533 mm tubes*

RESHITELNI (PAUK I) (TYPE 1241P)



Pauk I (Ian Sturton)
1 *MGK-345 sonar system* **2** *Depth charge rack (two racks, each six depth charges)* **3** *AK-360M six-barrelled 30 mm CIWS* **4** *Peel Cone air/surface search radar* **5** *Bass Tilt fire-control director for AK-176M/630 weapons* **6** *Navigation radar (Kivach, Pechora or SRN 207)* **7** *RBU 1200 ASW rocket launcher* **8** *AK-176M 76 mm (3 in)/60 gun* **9** *400 mm (15.75 in) torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Bulgaria
Type: Pauk I (Type 1241P)

Class: RESHITELNI

Acquired: 2
Active: 2

Displacement:
full load: 440 t

Dimensions
Length: 59.5 m (195.2 ft)
Beam: 10.2 m (33.5 ft)
Draught: 3.3 m (10.8 ft)

Speed: 32 kts
Range: 2,200 n miles at 18 kts

SHIPS

RESHITELNI 13		**BODRI** 14	
Builder	Yaroslavl, Russia	**Builder**	Yaroslavl, Russia
Commissioned (Russian Navy)	1977-82	**Commissioned (Russian Navy)**	1977-82
Transferred (Bulgaria)	Sep 1989	**Transferred (Bulgaria)**	Dec 1990

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 Grail

There are two quad launchers per ship. The Strela 2 (9M32M) missiles in the SA-N-5 missile system are housed in glass fibre launcher-containers. When the operator acquires the target he/she activates the thermal battery and when the seeker has acquired the target an audio signal is received. The operator then takes the first pressure on the trigger to activate the missile gyros which are warmed up in four to six seconds. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then takes the full pressure on the trigger to launch the missile. The booster burns for 0.05 seconds to eject the missile from the launch tube at a speed of 28 m/s (92 ft/s) and to spin it; then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead.

Specifications
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 18-4,500 m (60-15,000 ft)

Manufacturer/Contractor
Fakel, Russia.

TUBES

406 mm (16 in) torpedo tubes

There are four 16 in (406 mm) torpedo tubes. These are fixed mounts, two on each side of the ship, and widely separated. (Note that the 'real' export version, the Type 1241PE has 533 mm (21 in) torpedo tubes.

TORPEDOES

Type E40-75A torpedoes.

Specifications
Diameter: 406 mm
Length: 4.5 m (14.8 ft)
Warhead: 100 kg (220 lb)
Speed: 30 kts
Range: 7 n miles (13 km)

GUNS

AK 176M 76 mm (3 in)/60

There is one AK-176M 76 mm gun mounted on the foredeck. The AK-176M is designed for air defence, surface engagement and shore bombardment roles and is a four-man mounting which may be operated from the weapon control centre or from a local control station. The barrel is cooled externally by taking sea-water from the ship's fire main through a jacket which lies around the liner.

The AK-176M is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'. This radar is also associated with the AK-630 and the two form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the *Kondensor* sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day/night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight.

Specifications
Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,214 ft/s)
Traverse: 360° at 35°/s
Elevation: −7 to +85° at 30°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 120 rds/min

30 mm/65 AK-630

There is a single, six-barrelled AK-630 CIWS at the forward end of the superstructure. This weapon has five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AO-18 gun is a water-cooled, six-barrelled, Gatling-principle weapon with fixed breech block and

Reshitelni, *a Pauk I of the Bulgarian Navy. This ship was transferred from Russian Navy stocks and is thus a standard Russian variant, with Strut Curve radar, 400 mm torpedo tubes and a prominent mainmast* (C D Yaylali)

revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but, unlike the US weapon, AK-630 features a separate radar director.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,920 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (4,374 yd)
electro-optic fire control: 5,000 m (5,468 yd)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
UOF-84 HE-I: weight: 384 g (13.5 oz)
UOR-84 HE-T: weight: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

ANTI-SUBMARINE MORTARS

RBU 1200

There are two RBU 1200 mountings, one on either side of the deckhouse forward of the bridge. RBU 1200 is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm, is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (75 lb) warhead and a range of about 0.8 n miles.

Specifications

Calibre: 250 mm
Length: 1.4 m (4.6 ft)
Range: 1,400 m (1,530 yd)
Warhead: 34 kg (75 lb)

DEPTH CHARGES

Two racks, each with six depth charges.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Brick Plug

There are three Brick Plug arrays.

DECOYS

PK-16

These ships have two PK-16, the Russian Navy's standard decoy system, with 16 tubes. The system consists of launchers, a control console and three types of munition. The launcher appears to be turnable, while the control console appears to be a relatively simple design with simple controls capable of controlling up to four launchers. The munitions are all for seduction purposes. The SR-50 is a chaff round with a payload of 11 kg (24 lb). The SOM-50 is a heat-seeker/laser-guided missile seduction round with 7.3 kg (16 lb) payload while the SK.50 is a combined round with 9.1 kg (20 lb) of payload.

COMMAND AND CONTROL SYSTEMS

RADARS

Peel Cone

Peel Cone is the air/surface search on the ships intended for the Russian Navy.

Spin Trough

Spin Trough is an I-band surface search and navigation radar.

Bass Tilt

Bass Tilt is an H/I-band fire-control radar which entered service in the mid-1970s and is part of the fire-control system for the ADG-630 CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (4 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.5 ft) high and 1.45 m (4.7 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

SONAR

MGK-345 sonar system

The sonar system, designated MGK-345 is composed of two elements. There is a keel-mounted transducer in a dome and a VDS (NATO designation Foal Tail) which can operate at depths up to 200 m (656 ft). The system has a claimed range of 6.5 n miles (12 km).

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Type M521-TM5 diesels each 6,250 kW (8,600 hp)
Shafts: 2
Ship's services: 1—100 kW diesel-generator set, 2—200 kW alternators

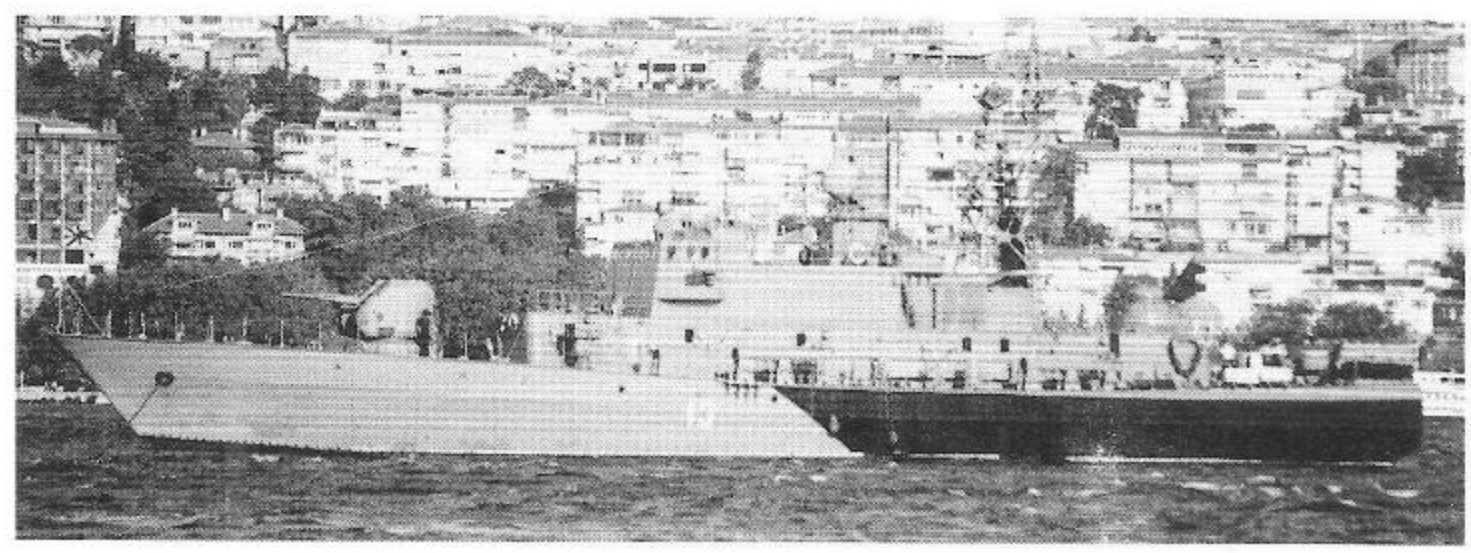
FURTHER INFORMATION

PROGRAMME

Reshitelni transferred from the Russian Navy in September 1989, followed by *Bodri* in December 1990. It should be noted that since these were transferred from Russian stocks they are the standard Russian 'Pauk I' class (Type 1241P) and not the export Pauk II (Type 1241PE) version.

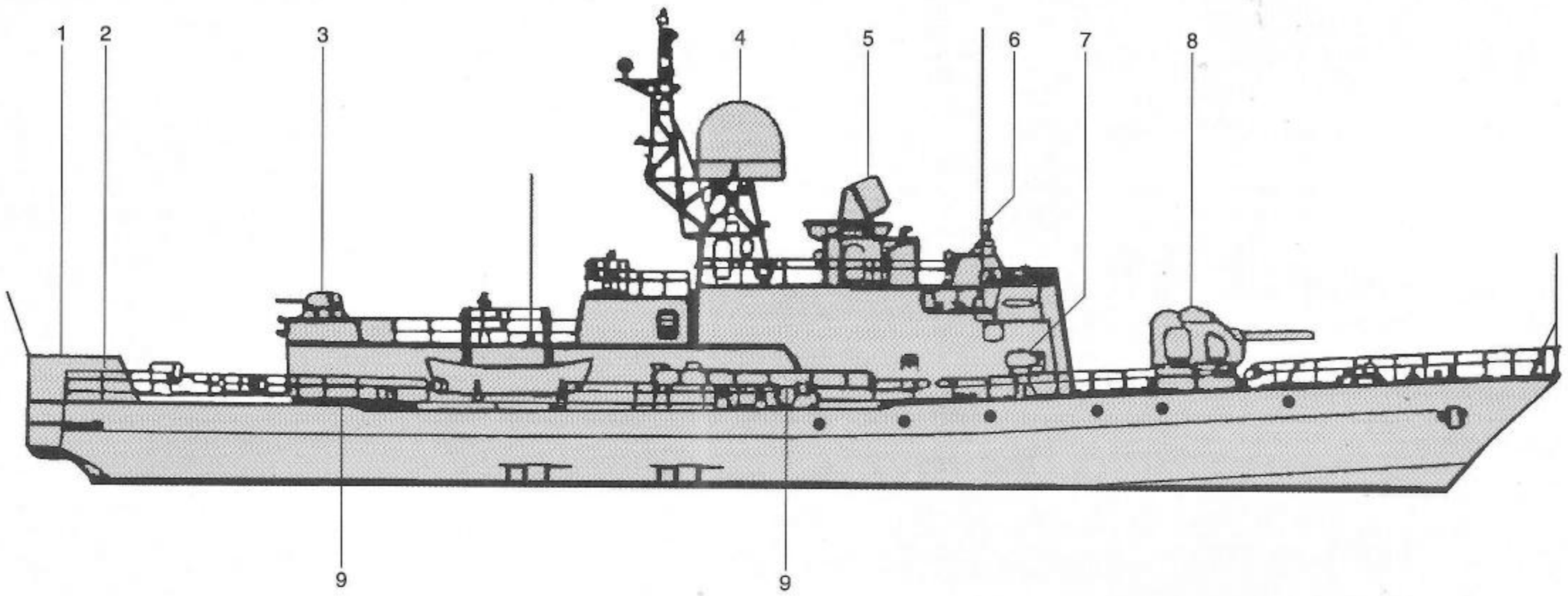
DEPLOYMENT

Both ships are based at Varma. *Reshitelni* played a prominent role in the NATO Partnership for Peace (PfP) exercise in the Black Sea in 1995.



Pauk I

321 (PAUK II) (TYPE 1241PE)



Pauk II
1 *MGK-345 sonar system* **2** *Depth charge racks* **3** *AK-630 30 mm close-in weapons system* **4** *Cross Dome/Positive E air/surface search radar* **5** *Bass Tilt fire-control radar* **6** *Hood Wink electro-optic director* **7** *RBU 1200 ASW rocket launcher* **8** *AK-176M (76 mm (3 in)/60 automatic gun* **9** *533 mm (21 in) torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Cuba
Type: Pauk II (Type 1241PE)

Class: 321

Acquired: 1
Active: 1

Displacement:
full load: 440 t

Dimensions
Length: 57.6 m (189 ft)
Beam: 10.2 m (33.5 ft)
Draught: 3.4 m (11.2 ft)

Speed: 32 kts
Range: 2,400 n miles at 14 kts

Complement: 32

SHIPS

321
Builder Yaroslavl, Russia
Transferred May 1990

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 Grail

There are two quad launchers per ship. The Strela 2 (9M32M) missiles in the SA-N-5 missile system are housed in fibre glass launcher-containers. When the operator acquires the target he/she activates the thermal battery and when the seeker has acquired the target an audio signal is received. The operator then takes the first pressure on the trigger to activate the missile gyros which are warmed up in four to six seconds. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then takes the full pressure on the trigger to launch the missile. The booster burns for 0.05 seconds to eject the missile from the launch tube at a speed of 28 m/s (92 ft/s) and to spin it; then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out. The missile homes on the 'hottest' part of the target and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead.

Specifications
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 18-4,500 m (60-15,000 ft)

Manufacturer/Contractor
Fakel, Russia.

TUBES

21 in (533 mm) tubes for SET-65E torpedo

There are four single 533 mm (21 in) torpedo tubes, two on each side of the ship. The individual tubes are widely separated from each other.

TORPEDOES

SET-65E 533 mm (21 in) torpedo

The Cuban Pauk is armed with Russian-supplied SET-65E torpedoes.

Specifications
Diameter: 533 mm (21 in)
Length: 7.8 m (25.6 ft)
Weight: n/k
Range: 10.75 n miles (20 km)
Max speed: 35 kts
Warhead: 372 kg (820 lb)

GUNS

AK 176M 76 mm (3 in)/60

There is one AK-176M 76 mm gun mounted on the foredeck. The AK-176M is designed for air defence, surface engagement and shore bombardment roles and is a four-man mounting which may be operated from the weapon control centre or from a local control station. The barrel is cooled externally by taking sea-water from the ship's fire main through a jacket which lies around the liner.

The AK-176M is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'. This radar is also associated with the AK-630 and the two form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the *Kondensor* sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day/night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight.

Specifications
Calibre: 76 mm
Lenght of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,214 ft/s)
Traverse: 360° at 35°/s
Elevation: −7 to +85° at 30°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 120 rds/min

30 mm/65 AK-630

There is a single, six-barrelled AK-630 CIWS at the forward end of the superstructure. This weapon has five roles, engaging anti-ship missiles, aircraft, small

surface vessels, drifting mines and unprotected targets ashore. The AO-18 gun is a water-cooled, Gatling-principle weapon with fixed breech-block and revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but, unlike the US weapon, AK-630 features a separate radar director.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,920 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (4,374 yd)
electro-optic fire control: 5,000 m (5,468 yd)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
UOF-84 HE-I: weight: 384 g (13.5 oz)
UOR-84 HE-T: weight: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

ANTI-SUBMARINE MORTARS

RBU 1200

There are two RBU 1200 mountings, one on either side of the deckhouse forward of the bridge. RBU 1200 is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm, is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (75 lb) warhead and a range of about 0.8 n miles.

Specifications

Calibre: 250 mm
Length: 1.4 m (4.6 ft)
Range: 1,400 m (1,530 yd)
Warhead: 34 kg (75 lb)

DEPTH CHARGES

Two racks, each with six depth charges.

ELECTRONIC WARFARE SYSTEMS

DECOYS

PK-16

These ships have two PK-16 chaff launchers. These are the Russian Navy's standard decoy systems, with 16 tubes. The system consists of launchers, a control console and three types of munition. The launcher appears to be turnable, while the control console appears to be a relatively simple design with simple controls capable of controlling up to four launchers. The munitions are all for seduction purposes. The SR-50 is a chaff round with a payload of 11 kg (24 lb). The SOM-50 is a heat-seeker/laser-guided missile seduction round with 7.3 kg (16 lb) payload while the SK.50 is a combined round with 9.1 kg (20 lb) of payload.

COMMAND AND CONTROL SYSTEMS

RADARS

Cross Dome/Positive E

Cross Dome/Positive E is fitted to these export ships (it is also fitted in the export versions of other ships). It is an E/F-band air/surface search radar.

Pechora

Pechora is installed in this ship as the surface search/navigation radar. It operates in the I-band.

Bass Tilt

Bass Tilt is an H/I-band fire-control radar which entered service in the mid-1970s and is part of the fire-control system for the ADG-630 CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (4 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.56 ft) high and 1.45 m (4.8 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

SONAR

MGK-345 sonar system

The sonar system, designated MGK-345 is composed of two elements. There is a keel-mounted transducer in a dome and a VDS (NATO designation Foal Tail) which can operate at depths up to 200 m (656 ft). The system has a claimed range of 6.5 n miles (12 km).

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Type M521-TM5 diesels each 6,250 kW (8,600 hp)
Shafts: 2
Ship's services: 1—100 kW diesel generator set, 2—200 kW alternators

FURTHER INFORMATION

PROGRAMME

This is the last known warship to have been transferred from Russia to the Cuban Navy, having been delivered in May 1990. An export version of the 'Pauk' class, it was built at the Yaroslavl Shipyard and is virtually identical to the ships delivered to India.

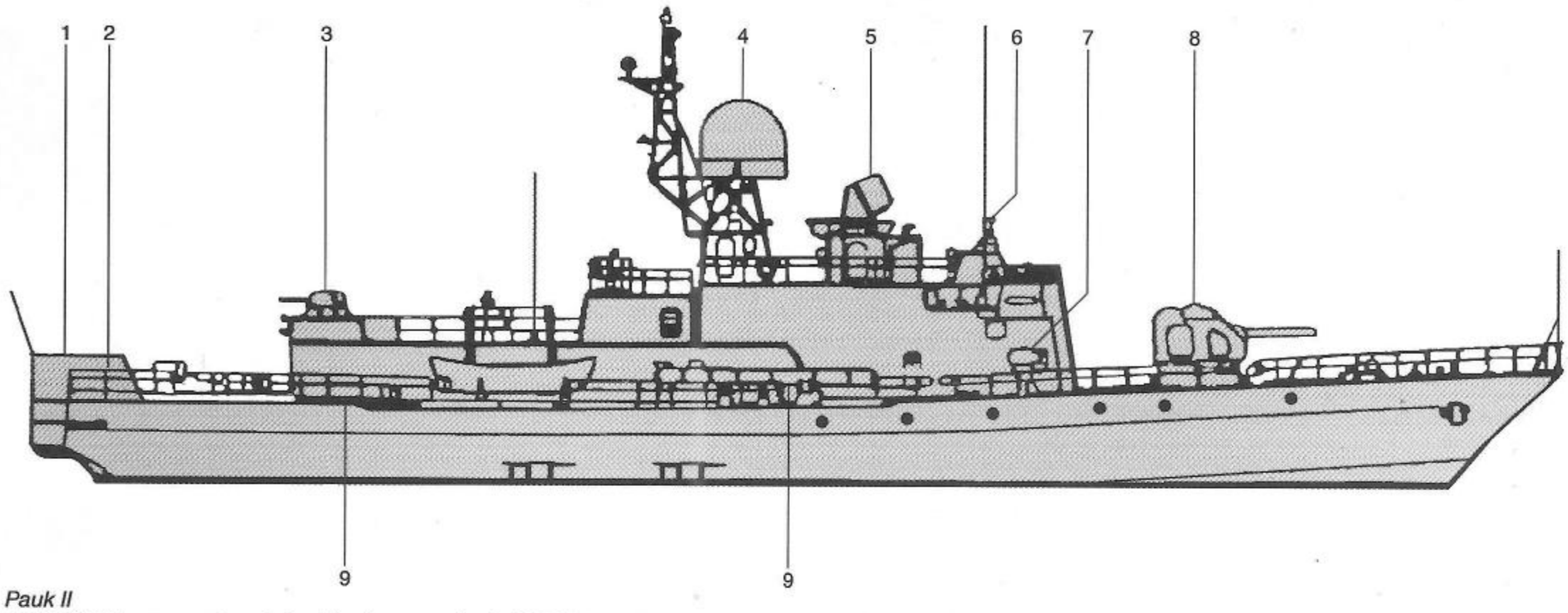
STRUCTURE

Pauk II has a longer superstructure than the Pauk I and new electronics with an air search radome (Cross Dome/Positive E) similar to the 'Parchim II' class. It does not, however, have the large lattice mainmast, which is a major feature of Pauk I.

DEPLOYMENT

This ship was seen at sea in 1995.

ABHAY (PAUK II) (TYPE 1241PE)



Pauk II
1 *MGK-345 sonar system* **2** *Depth charge racks* **3** *AK-630 30 mm close-in weapons system* **4** *Cross Dome/Positive E air/surface search radar* **5** *Bass Tilt fire-control radar* **6** *Hood Wink electro-optic director* **7** *RBU 1200 ASW rocket launcher* **8** *AK-176M (76 mm (3 in)/60 automatic gun* **9** *533 mm (21 in) torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: India
Type: Pauk II (Type 1241PE)

Class: ABHAY

Purchased: 4
Active: 4

Displacement:
full load: 440 t

Dimensions
Length: 59.5 m (195.2 ft)
Beam: 10.2 m (33.5 ft)
Draught: 3.3 m (10.8 ft)

Speed: 32 kts
Range: 2,400 n miles at 14 kts

Complement: 32 (6 officers)

SHIPS

ABHAY (P 33)
Builder Volodarski, Rybinsk, Russia
Commissioned Mar 1989

AJAY (P 34)
Builder Volodarski, Rybinsk, Russia
Commissioned 24 Jan 1990

AKSHAY (P 35)
Builder Volodarski, Rybinsk, Russia
Commissioned Dec 1990

AGRAY (P 36)
Builder Volodarski, Rybinsk, Russia
Commissioned Feb 1991

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 Grail

There are two quad launchers per ship. The Strela 2 (9M32M) missiles in the SA-N-5 missile system are housed in glass fibre launcher-containers. When the operator acquires the target he/she activates the thermal battery and when the seeker has acquired the target an audio signal is received. The operator then takes the first pressure on the trigger to activate the missile gyros which are warmed up in four to six seconds. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then takes the full pressure on the trigger to launch the missile. The booster burns for 0.05 seconds to eject the missile from the launch tube at a speed of 28 m/s (92 ft/s) and to spin it; then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead.

Specifications

Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 18-4,500 m (60-15,000 ft)

Manufacturer/Contractor

Fakel, Russia.

TUBES

21 in (533 mm) tubes for SET-65E torpedo

There are four single 533 mm (21 in) torpedo tubes, two on each side of the ship. The individual tubes are widely separated from each other.

TORPEDOES

SET-65E 533 mm (21 in) torpedo

The Indian Pauks are armed with Russian-supplied SET-65E torpedoes.

Specifications

Diameter: 533 mm (21 in)
Length: 7.8 m (25.6 ft)
Weight: n/k
Range: 10.75 n miles (20 km)
Max speed: 35 kts
Warhead: 372 kg (820 lb)

GUNS

AK 176M 76 mm (3 in)/60

There is one AK-176M 76 mm gun mounted on the foredeck. The AK-176M is designed for air defence, surface engagement and shore bombardment roles and is a four-man mounting which may be operated from the weapon control centre or from a local control station. The barrel is cooled externally by taking seawater from the ship's fire main through a jacket which lies around the liner.

The AK-176M is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'. This radar is also associated with the AK-630 and the two form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the *Kondensor* sight which is installed as a back-up in the event of the failure of 'Bass Tilt'. It is a day/night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight.

Specifications

Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,214 ft/s)
Traverse: 360° at 35°/s
Elevation: −7 to +85° at 30°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 120 rds/min

30 mm/65 AK-630

There is a single, six-barrelled AK-630 CIWS at the forward end of the superstructure. This weapon has five roles, engaging anti-ship missiles, aircraft, small

surface vessels, drifting mines and unprotected targets ashore. The AO-18 gun is a water-cooled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but, unlike the US weapon, AK-630 features a separate radar director.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,920 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (4,374 yd)
electro-optic fire control: 5,000 m (5,468 yd)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
UOF-84 HE-I: weight: 384 g (13.5 oz)
UOR-84 HE-T: weight: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

ANTI-SUBMARINE MORTARS

RBU 1200

There are two RBU 1200 mountings, one on either side of the deckhouse forward of the bridge. RBU 1200 is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm, is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (75 lb) warhead and a range of about 0.8 n miles.

Specifications

Calibre: 250 mm
Length: 1.4 m (4.6 ft)
Range: 1,400 m (1,530 yd)
Warhead: 34 kg (75 lb)

DEPTH CHARGES

Two racks, each with six depth charges.

ELECTRONIC WARFARE SYSTEMS

DECOYS

PK-16

These ships have two PK-16 chaff launchers. These are the Russian Navy's standard decoy systems, with 16 tubes. The system consists of launchers, a control console and three types of munition. The launcher appears to be turnable, while the control console is a relatively simple design with simple controls capable of controlling up to four launchers. The munitions are all for seduction purposes. The SR-50 is a chaff round with a payload of 11 kg (24 lb). The SOM-50 is a heat-seeker/laser-guided missile seduction round with 7.3 kg (16 lb) payload while the SK.50 is a combined round with 9.1 kg (20 lb) of payload.

COMMAND AND CONTROL SYSTEMS

RADARS

Cross Dome/Positive E

Cross Dome/Positive E is fitted to these export ships (it is also fitted in the export versions of other ships). It is an E/F-band air/surface search radar.

Pechora

Pechora is installed in this ship as the surface search/navigation radar. It operates in the I-band.

Bass Tilt

Bass Tilt is an H/I-band fire-control radar which entered service in the mid-1970s and is part of the fire-control system for the ADG-630 CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (4 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.56 ft) high and 1.45 m (4.8 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

SONAR

MGK-345 sonar system

The sonar system, designated MGK-345 is composed of two elements. There is a keel-mounted transducer in a dome and a VDS (NATO designation Foal Tail) which can operate at depths up to 200 m (656 ft). The system has a claimed range of 6.5 n miles (12 km).

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Type M521-TM5 diesels each 6,250 kW (8,600 hp)
Shafts: 2
Ship's services: 1—100 kW diesel-generator set, 2—200 kW alternators

FURTHER INFORMATION

PROGRAMME

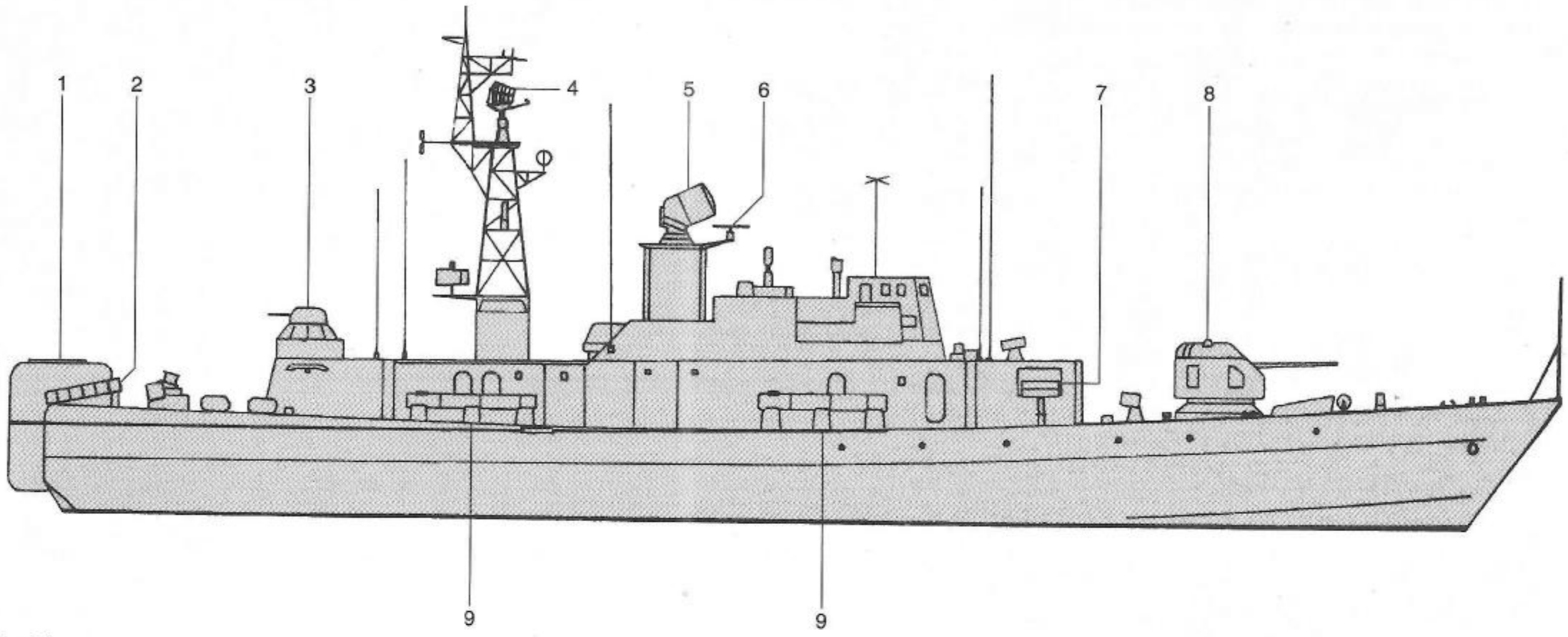
This is the Type 1241PE (Pauk II), built in Russia for export. The original order was placed in late 1983 but completion of the first ship was delayed by lack of funds and the order for the remaining ships was not reinstated until 1987. A fifth of class was cancelled. The names associated with former coastal patrol craft.

DESIGN

As with the one ship supplied to Cuba, this is the export model of the Pauk. It has a longer superstructure than the Pauk I, larger torpedo tubes and new electronics.

Abhay *(P 33) name ship of a class of four Russian Pauk II (Type 1241PE) operated by the Indian Navy* (Central Design Bureau, Almaz)

PAUK I, PAUK II



Pauk I
1 *MGK-345 sonar system* **2** *Depth charge rack (two racks, each six depth charges)* **3** *AK-360M six-barrelled 30 mm CIWS* **4** *Peel Cone air/surface search radar* **5** *Bass Tilt fire-control director for AK-176M/630 weapons* **6** *Navigation radar (Kivach, Pechora or SRN 207)* **7** *RBU 1200 ASW rocket launcher* **8** *AK-176M 76 mm (3 in)/60 gun* **9** *400 mm (15.75 in) torpedo tubes*

GENERAL SPECIFICATIONS

Operator: Russia
Type: Pauk I – Type 1241P; Pauk II – Type 1241PE
National designation: *Maly protivolodochny korabl* (small anti-submarine ship)

Class: PAUK I, PAUK II

Built: 46
Active: Pauk I – 32; Pauk II – 2

Displacement:
standard: 444 t
full load: 495 t

Dimensions
Length: 57.6 m (189 ft)
Beam: 10.2 m (33.5 ft)
Draught: 3.3 m (10.8 ft)

Speed: 28 kts
Range: 3,000 n miles at 12 kts

Endurance: 10 days

Complement: 41 (5 officers)

SHIPS

Pauk I	46 ships (Navy – 31; Border Guard – 15)	**Pauk II**	1 ship
Builder	Yaroslavl, Vladivostok, Russia	**Builder**	Yaroslavl, Vladivostok, Russia
Commissioned	1977-1979	**Commissioned**	1979

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 Grail

There are two quad launchers per ship. The Strela 2 (9M32M) missiles in the SA-N-5 missile system are housed in glass fibre launcher-containers. When the operator acquires the target he/she activates the thermal battery and when the seeker has acquired the target an audio signal is received. The operator then takes the first pressure on the trigger to activate the missile gyros which are warmed up in four to six seconds. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then takes the full pressure on the trigger to launch the missile. The booster burns for 0.05 seconds to eject the missile from the launch tube at a speed of 28 m/s (92 ft/s) and to spin it; then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead.

Specifications
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 2.6 n miles (4.8 km)
Altitude: 18-4,500 m (60-15,000 ft)

Manufacturer/Contractor
Fakel, Russia.

TUBES

406 mm (16 in) torpedo tubes

Pauk I only. There are four 406 mm (16 in) torpedo tubes. These are fixed mounts, two on each side of the ship, and widely separated.

533 mm (21 in) torpedo tubes

Pauk II only. There are four 533 mm (21 in) torpedo tubes. Russian system designation is TR-236-02.

GUNS

AK 176M 76 mm (3 in)/60

There is one AK-176M 76 mm gun mounted on the foredeck. The AK-176M is designed for air defence, surface engagement and shore bombardment roles and is a four-man mounting which may be operated from the weapon control centre or from a local control station. The barrel is cooled externally by taking sea-water from the ship's fire main through a jacket which lies around the liner.

The AK-176M is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'; Russian designation is Vimpel-VME. This radar is also associated with the AK-630 and the two form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the Kondensor sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day/night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight.

Normal ammunition load is 152 shells, with storage for a further 102, if required.

Specifications
Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,214 ft/s)
Traverse: 360° at 35°/s
Elevation: −7 to +85° at 30°/s
Ammunition (total): 16 kg (35.2 lb)
Rate of fire: 120 rds/min
Range: 8.5 n miles (15.7 km)

30 mm/65 AK-630

There is a single, six-barrelled AK-630 CIWS at the after end of the superstructure. This weapon has five roles,

Pauk I *firing an RBU 1200 ASW rocket*

engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AO-18 gun is a water-cooled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but, unlike the US weapon, AK-630 features a separate radar director.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,920 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
Radar fire control: 4,000 m (4,374 yd)
Electro-optic fire control: 5,000 m (5,468 yd)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
UOF-84 HE-I: weight: 384 g (13.5 oz)
UOR-84 HE-T: weight: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

ANTI-SUBMARINE MORTARS

RBU 1200

There are two RBU 1200 mountings, one on either side of the deckhouse forward of the bridge. RBU 1200 is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 253.5 mm, is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (75 lb) warhead and a range of about 0.8 n miles; 30 are carried.

Specifications

Calibre: 250 mm
Length: 1.4 m (4.6 ft)
Range: 1,400 m (1,530 yd)
Warhead: 34 kg (75 lb)

DEPTH CHARGES

Two racks, each with six depth charges.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Brick Plug/Half Hat

All ships have three Brick Plug and two Half Hat radar warning antennas.

DECOYS

PK-16 or PK-10

These ships have either two PK-16 or four PK-10. These are the Russian Navy's standard decoy systems, with either 10 or 16 tubes. The system consists of launchers, a control console and three types of munition. The launcher appears to be turnable, while the control console appears to be a relatively simple design with simple controls capable of controlling up to four launchers. The munitions are all for seduction purposes. The SR-50 is a chaff round with a payload of 11 kg (24 lb). The SOM-50 is a heat-seeker/laser-guided missile seduction round with 7.3 kg (16 lb) payload while the SK.50 is a combined round with 9.1 kg (20 lb) of payload.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Hood Wink

There is one Hood Wink electro-optic director.

RADARS

Peel Cone

Pauk I only. Peel Cone is the air/surface search on the ships intended for the Russian Navy.

Cross Dome/Positive E

Pauk II only. Cross Dome/Positive E is fitted to the Pauk IIs intended for export (it is also fitted in the export versions of other ships). It is an E/F-band air/surface search radar. Range against a 5 m² aircraft is 45 km and three targets can be tracked simultaneously.

Kivach/Pechora/SRN 207

One of these three models is installed in each ship as the surface search/navigation radar. All operate in the I-band.

Bass Tilt

Bass Tilt is an H/I-band fire-control radar which entered service in the mid-1970s and is part of the fire-control system for the AK-630 CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (4 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.56 ft) high and 1.45 m (4.8 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

SONAR

MGK-345 sonar system

The sonar system, designated MGK-345 is composed of two elements. There is a keel-mounted transducer in a dome and a VDS (NATO designation Foal Tail) which can operate at depths up to 200 m (656 ft). The system has a claimed range of 6.5 n miles (12 km).

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Type M521-TM5 diesels each 6,250 kW (8,600 hp)
Shafts: 2
Ship's services: 1—100 kW diesel-generator set, 2—200 kW alternators

FURTHER INFORMATION

PROGRAMME

The first of class was laid down in 1977 and completed in 1979 and the Pauk was then in series production at Yaroslavl in the Black Sea and at Vladivostok until 1988 when the 'Svetlyak' class took over. Overall numbers of Pauk I are increased by two Pauk IIs, reported to be wearing Russian colours, perhaps while sales are still expected. An improved version was reported to be building at Kharbarovsk in 1995.

DESIGN

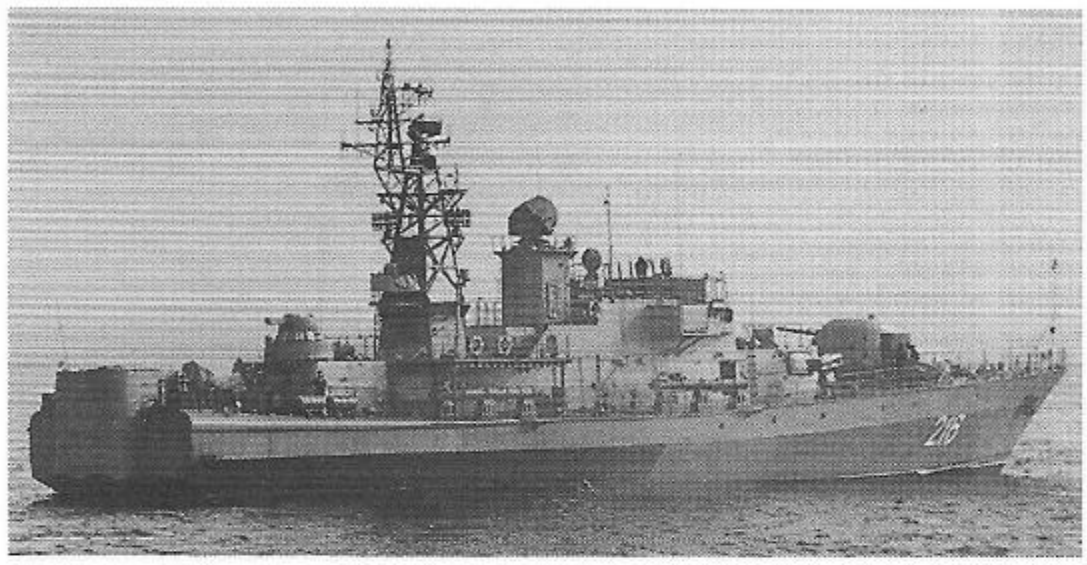
This is an ASW version of the 'Tarantul' class, having the same hull form, but with a 1.8 m (5.9 ft) extension housing for dipping sonar. The first three had a low bridge, but from the fourth hull onwards this was raised by half a deck level. A modified version (Pauk II) with a longer superstructure, two twin 533 mm torpedo tubes and a radome similar to the 'Parchim' class has been built for export with one ship retained by the Russian Navy for training foreign crews.

OPERATIONAL

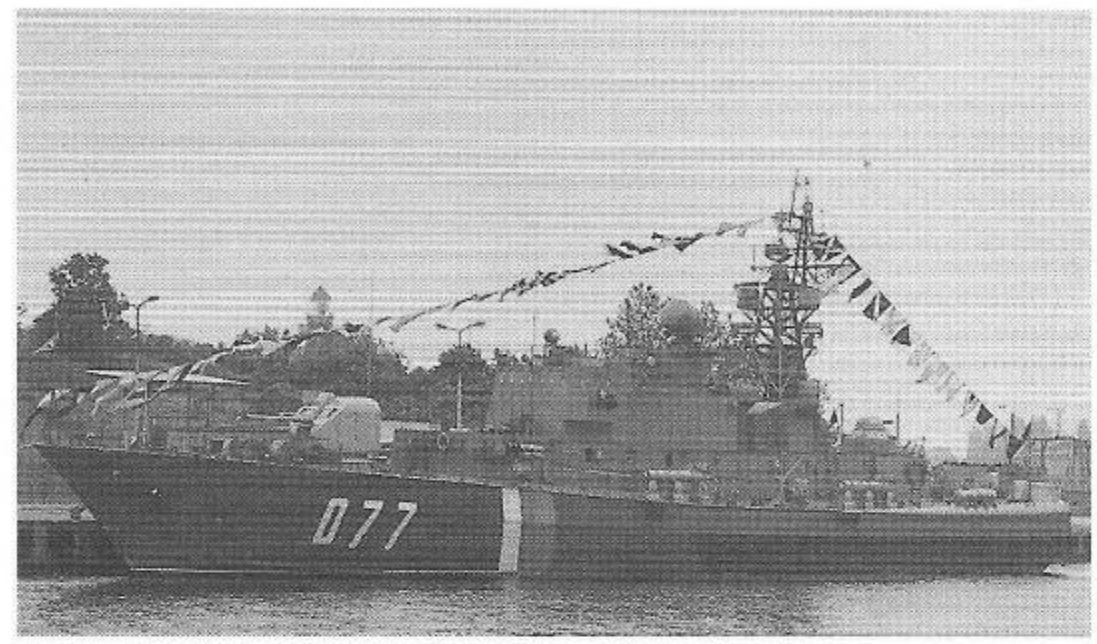
15 of these ships are operated by the Border Guard.

SALES

One Pauk I was sold to Bulgaria in September 1989 followed by a second in December 1990.



Pauk I *of the Russian Navy showing the large container at the stern for the MGK-345 sonar, which can be lowered to a depth of 200 m (656 ft)* (MoD Bonn)



Pauk I *operated by the Russian Boarder Guard* (J Cislak)

TARANTUL

OVERVIEW

The Tarantul (known in Russia as Project 1241 'Sea Lightning') has its origins in a 1970 Soviet Navy requirement for a new missile-carrying corvette *(Raketny Kater).* The ship was designed by E Yuhnin and his team at the 'Almaz' Design Bureau and emerged in 1978, armed with the SS-N-2 (NATO = Styx). It has achieved considerable success with some 76 having been constructed by the end of 1996.

The ship has a steel hull, with the deck and superstructure fabricated from an aluminium-magnesium alloy. The standard hull is 56.1 m (184.0 ft) long, with a 10.2 m (33.46 ft) beam. Displacements are: standard 385 tonnes; full load 455 tonnes. The basic weapons system in the early versions is the 'Termit' anti-ship missile (NATO = SS-N-2c 'Styx'; Russia = P-21/P-22). The role of these ships is anti-surface warfare and they do not have any sonar or anti-submarine weapons. Standard artillery weapon is the AK-176M , with a firing rate of 120-130 rounds per minute and a range of 8.1 n miles (15 km). The 'Vympel' (MR-123) system provides fire control for the AK-176M as well as for the twin AK-630 30 mm CIWS, thus ensuring that they operate in conjunction with each other.

The propulsion system in the 'Tarantul I and II' classes is COGAG, with two high-powered gas turbines for boost and two lower-powered gas turbines for cruise. One of the early Tarantul IIs was, however, used to test a CODAG system, which retained a top speed of 41 knots, but increased range to 2,400 n miles (4,440 km) and this system was then adopted for Tarantul III.

Tarantul III also switched to the SS-N-22 missile (Russia = 3M80) which has a considerably greater range than SS-N-2 and is also much faster. It is claimed that it requires 1 to 2 SS-N-22 missiles to destroy a frigate/destroyer-sized warship, and 1 to 5 for a 20,000 tonne cargo ship. This means that each Tarantul III can destroy a minimum of two targets.

Tarantul I (Type 1241RE)

Tarantul I is the export version, which, following normal Soviet Navy practice, lacks certain weapons and sensors which it was not prepared to release to foreign navies, such as the Band Stand fire-control system and the associated Light Bulb datalink. The Soviet Navy, also following normal practice, was allocated two ships for use in training foreign crews, which appear to be still operating in the Baltic. Tarantul Is for most export customers are constructed in Russia, but India has set up its own production and at one time intended to produce no less than 27. That number has, however, been drastically cut-back as a result of grave difficulties in obtaining weaponry, sensors and equipment from Russia.

Tarantul II (Type 1241M)

Tarantul II was the first production version for the Soviet Navy. This is armed with a different version of SS-N-2 with various guidance features not releasable to foreign navies. One Tarantul II was, however, sold to Bulgaria, while another has been converted to the prototype Type 1241.7.

Tarantul III (Type 12411)

This is the major production version for the Soviet/Russian Navy and is armed with four SS-N-22 missiles.

Type 1241.7

In the early 1990s the Almaz Design Bureau released brochures at various international exhibitions, advertising three new versions of the ship. The first, designated Project 1241.7 (there is no known NATO designation), has a new main radar and the CADS-N-1 'Kashtan' close in weapons system, with combined guns and missiles. One of the Russian Navy's Tarantul IIs has been converted to this standard, presumably for trials and as a sales demonstrator.

Project 1241.8

A second new version, Project 1241.8, also has a new radar, as well as four quadruple launchers for the new SS-N-25 missile.

Project 12421

Project 12421 is an export version of the Tarantul III, indicating that SS-N-22, has been released for foreign use, although the ship does not have Band Stand or Light Bulb.

Summary

Production of the 'Tarantul' class to date is:

Type 1241M (Tarantul II)

- **Russian Navy.** 18, of which one was later passed to Bulgaria and one has been converted to the prototype Type 1241.7.

Type 1241RE (Tarantul I)

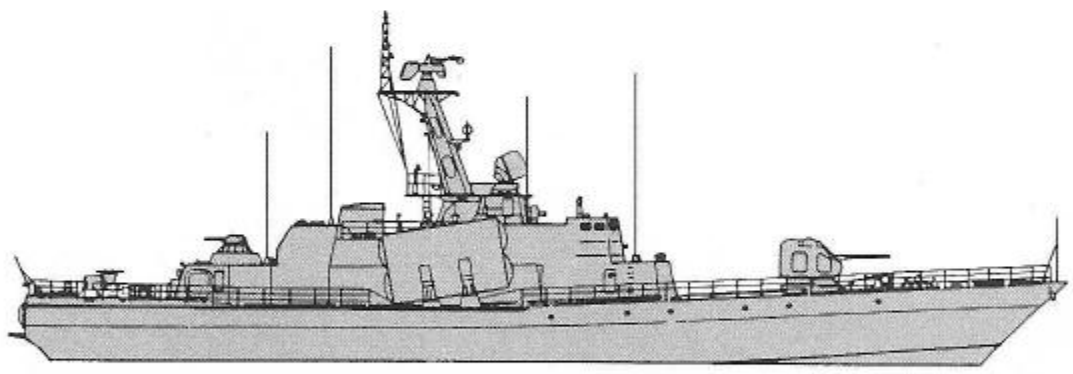
- **Germany (former DDR).** Five. Four were scrapped by Germany on reunification and one was passed to the USA for trials.
- **India.** 12. Of these, five were built in Russia and seven in India.
- **Poland.** Four.
- **Romania.** Three.
- **Vietnam.** Two.
- **Yemen.** Two.
- **Russia.** Three were allocated to the Russian Navy for training foreign crews.

Type 1241MR (Tarantul III)

- **Russia.** 27, plus two building.

Type 1241.7 (Tarantul IV)

- **Russia.** One, converted from Type 1241M (Tarantul II).
- **Vietnam.** Two new Tarantuls were supplied to Vietnam in 1996. It is not yet known which model is involved.



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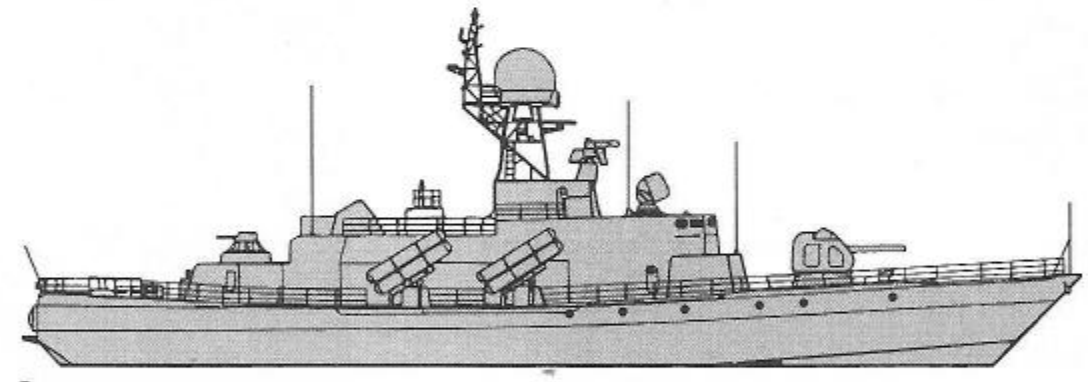

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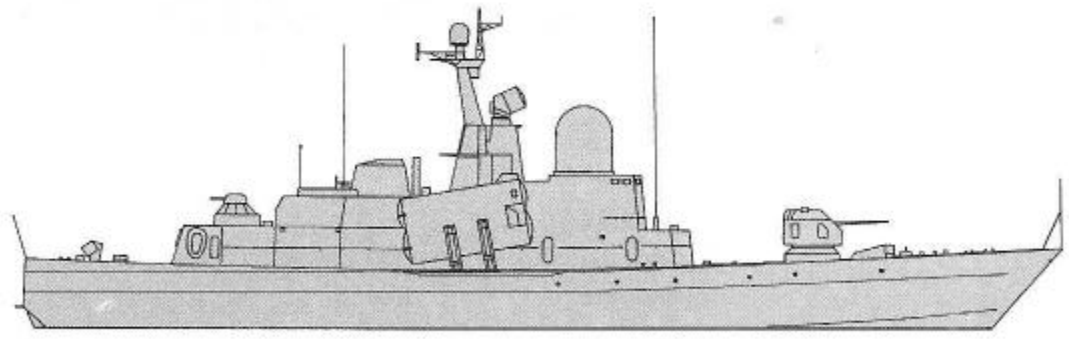

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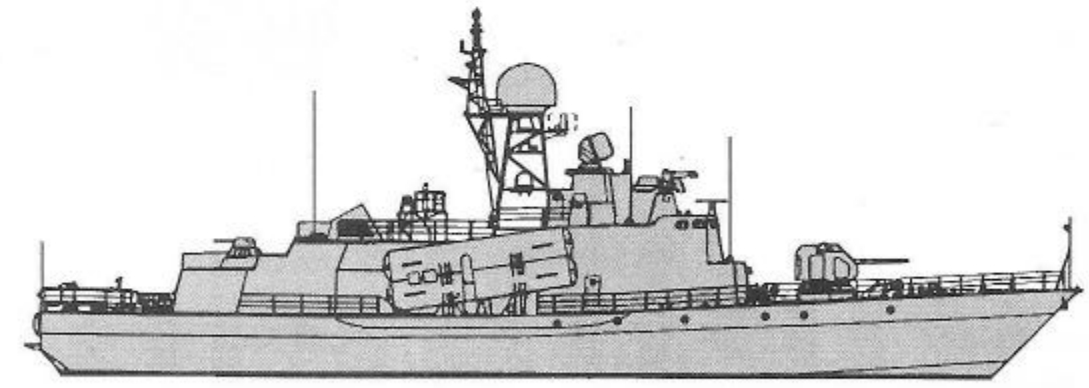
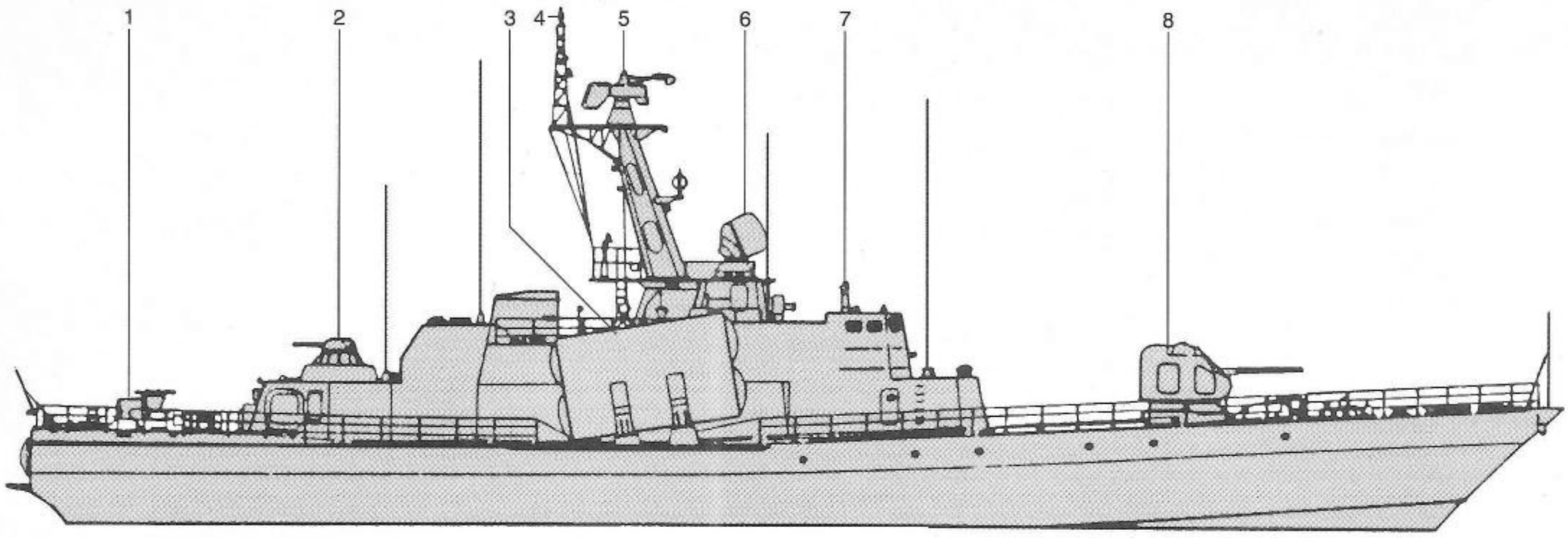


4

Four versions of the Tarantul. The first version **1** *was the Type 1241RE which was for export, and as with other classes, lacks the sophisticated weapons, sensors and electronics reserved for the Russian Navy. Thus, Type 1241M,* **2** *the Russian version, has Band Stand and additional ESM and ECM. Type 12418* **3** *is a development of the type 12411 (Tarantul III) (not shown), is intended for export, and has four quadruple launchers for SS-N-25 and Positive-E radar. Type 12421 is an export version of Type 12411 (Tarantul III) with SS-N-22 missiles, but without the Band Stand radar*

VEER (TARANTUL I) (TYPE 1241RE)



Veer *(Type 1241RE)* (Ian Sturton)
1 *PK-16, 16-tube decoy launcher* **2** *AK-630 30 mm, seven-barrel CIWS* **3** *SS-N-2c anti-ship missile launchers* **4** *Square Head IFF* **5** *Plank Shave (Harpun-E) surface search/targeting radar* **6** *Bass Tilt fire director* **7** *Pechora navigation radar* **8** *AK-176M 76 mm (3 in)/60 automatic gun*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: India
Type: Tarantul I (1241RE)

Class: VEER

Purchased: 5
Built: 5

Active: 10
Building: 2

SHIPS

VEER (K 40)
Builder Volodarski, Rybinsk, Russia
Commissioned 12 May 1987

NIRBHIK (K 41)
Builder Volodarski, Rybinsk, Russia
Commissioned 3 Feb 1988

NIPAT (K 42)
Builder Volodarski, Rybinsk, Russia
Commissioned 15 Jan 1989

NISHANK (K 43)
Builder Volodarski, Rybinsk, Russia
Commissioned 12 Sep 1989

NIRGHAT (K 44)
Builder Volodarski, Rybinsk, Russia
Commissioned 4 Jun 1990

VIBHUTI (K 45)
Builder Mazagon Dock, Bombay, India
Laid down May 1988
Launched 28 Apr 1990
Commissioned 3 Jun 1991

VIPUL (K 46)
Builder Mazagon Dock, Bombay, India
Laid down Jul 1988
Launched 3 Jan 1991
Commissioned 16 Mar 1992

VINASH (K 47)
Builder Goa Shipyard, Goa, India
Laid down Jun 1990
Launched 24 Jan 1992
Commissioned 20 Nov 1993

Nashak *(K 83) and* Vidyut *(K 48) alongside. Note differences in engine uptakes* (H & L van Ginderen Collection)

VIDYUT (K 48)
Builder Goa Shipyard, Goa, India
Laid down Jun 1992
Launched Sep 1993
Commissioned 16 Jan 1995

NASHAK (K 83)
Builder Mazagon Dock, Bombay, India
Laid down Aug 1992
Launched 12 Nov 1993
Commissioned Jan 1996

PRAHAR (-)
Builder Goa Shipyard, Goa, India
Laid down Jan 1994
Launched 26 Aug 1995
Commissioned Feb 1997

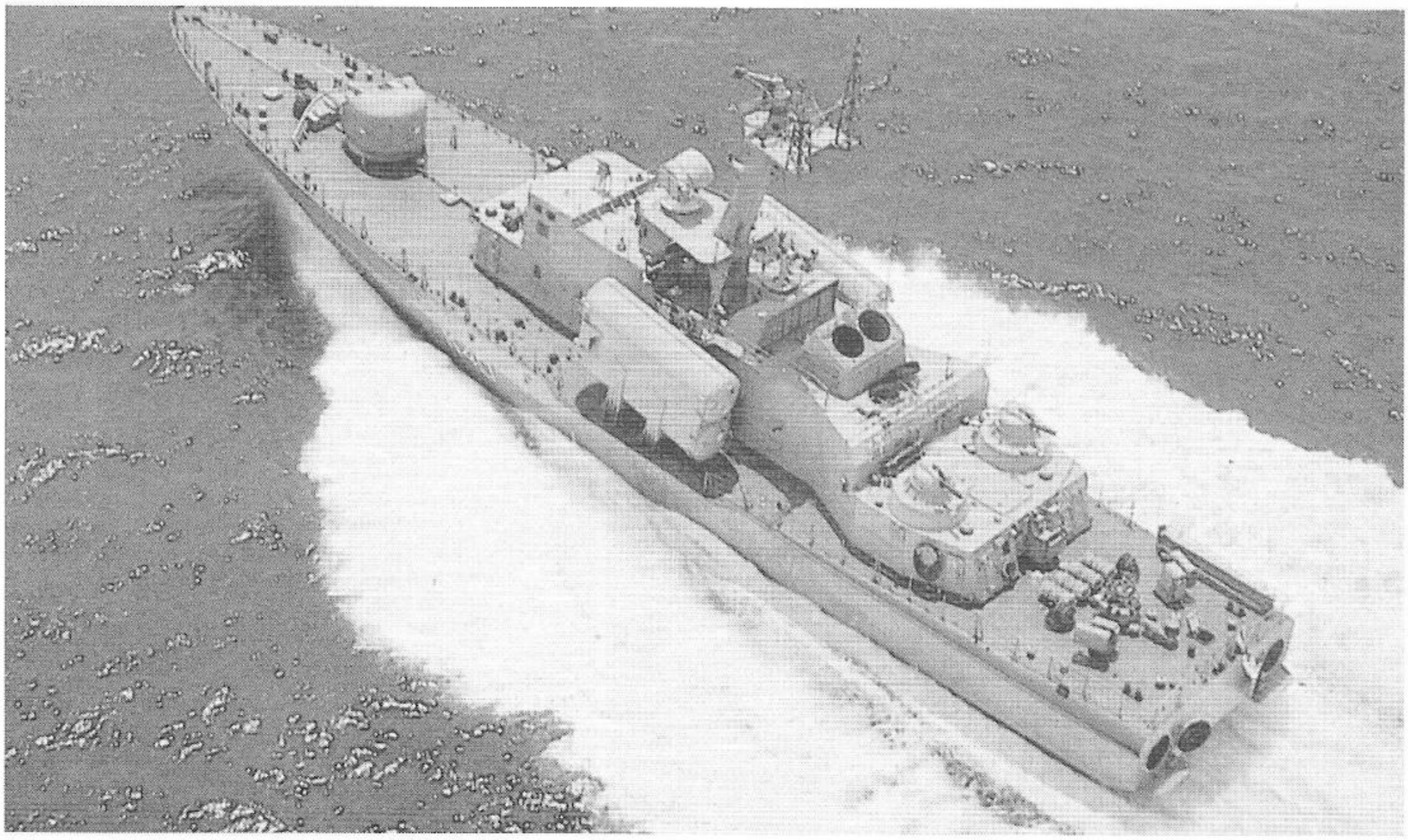
- (-)
Builder Mazagon Dock, Bombay, India
Laid down Jun 1995
Launched Feb 1997
Commissioned Mar 1999

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

P-22 Rubezh (SS-N-2c 'Styx') medium-range anti-ship missile

The 'Tarantul' class is armed with four SS-N-2c 'Styx' missiles with two vertical pairs of missile launch tubes in the waist, either side of the superstructure. There are no reloads. This relatively large anti-ship missile is powered by a liquid-fuelled rocket motor, with a solid fuel booster attached. Once the target is detected the ship must close, with the aim of being within the optimum engagement distance, some 15 to 20 n miles (28 to 37 km). Once ready to launch, the ship must face the target, maintain a speed of 15 kts or less and hold its course for 20 to 30 seconds before launching the first salvo of two missiles. These may be followed, a minute later, by the second pair. Upon launch the missile climbs at an angle of 45° to one of five preset altitudes (100, 150, 200, 250 or 350 m) (328, 492, 656, 820 or 1,148 ft), where the onboard radar searches for a target and the receiver is switched on for very short periods to receive signals from a designated range, the range gate being 0.54 n miles (1 km) on either side of the target.



Veer (K 40), lead-ship of the Indian Navy's class of Tarantul I (Type 1241RE) missile corvettes. The layout of the weapons is clearly shown: 76 mm gun forward; SS-N-2c anti-ship missile launchers in the waist and two AK-630 CIWS aft. Note also the two PK-16 decoy launchers on the quarterdeck and the open jet exhaust covers (Almaz)

The radar locks only after eight returns have been received, at distances of 3.5 to 12 n miles (6.5 to 22 km), whereupon the seeker guidance system switches off the autopilot. A throw-off gyroscope takes the missile on target a few seconds before impact as it becomes too close for radar-generated homing signals. Russian Navy tacticians calculate that seven to eight missiles are required to destroy a cruiser-size target and four for a destroyer, making salvo firing a major feature of any tactical engagement scenario with SS-N-2 missiles to ensure destruction of the target.

Specifications
(SS-N-2c)
Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.87 ft)
Speed: Mach 0.9
Weight (without booster): 2,600 kg (5,732 lb)
Warhead: 454 kg (1,000 lb) hollow-charge
Fuzes: Impact, proximity
Range: 3-54 n miles (5.5-100 km)
Guidance: Autopilot with active radar (supplemented in some with IR)

MS-2 seeker
Frequency: I-band (8-12 GHz) (four presets)
PRF: 300-500 pps (adjustable)
Altitude control: Barometric pressure device

Manufacturer/Contractor
Raduga, Moscow, Russia.

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 'GRAIL' (Strela-2M)
There is one, four-missile launcher for the SA-N-5 short-range SAM system. SA-N-5 is the NATO designation for the Russian Strela-2M (Strela = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired, the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and partially pulls the trigger to activate the missile gyros, which take some four to six seconds to warm up. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spinning it up. Then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has better fragmentation uniformity.

Specifications
(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 18-4,500 m (60-15,000 ft)
Guidance: IR homing

Manufacturer/Contractor
Fakel, Russia.

GUNS

AK-176M 76 mm (3 in)/60
There is one single 76 mm (3 in) gun on the foredeck which is intended for air defence, surface engagement and shore bombardment roles. The AK-176M is a four-man mounting which may be operated from the weapon control centre or from a local control station. The AK-176M is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'. This radar is also associated with the AK-630 and the two may form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the *Kondensor* sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day/night sight which may be used to engage both surface and air targets. In the event of a power failure the WD-221 optical sight can be used.

Specifications
Calibre: 76 mm
Length of barrel: 59 calibres
Traverse: 360° at 35°/s
Elevation: −3 to +85° at 30°/s
Range:
anti-surface: 3.75 n miles (7 km)
anti-air: 10,000 m (32,800 ft)
Ammunition weight (total): 16 kg (35.3 lb)
Ammunition carried: 252 rounds (ready use); 150 rounds (magazine)
Rate of fire: 120-130 rds/min

30 mm/65 AK-630 close in weapons system
There are two 30 mm Gatling-type AK-630s mounted side by side on the roof of the after deckhouse. These have five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AO-18 weapon is a water-cooled, six-barrelled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but unlike the US weapon AK-630 features a separate radar director, Bass Tilt.

Specifications
Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,919 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (13,000 ft)
electro-optic fire control: 5,000 m (16,400 ft)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
Weight:
UOF-84 HE-I: 384 g (13.5 oz)
UOR-84 HE-T: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Bass Tilt fire-control radar

Bass Tilt is an H/I-band fire-control radar which entered service in the mid-1970s and is part of the fire-control system for the AK-630 CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (4 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m high (6.56 ft) and 1.45 m (4.7 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

Hood Wink

One Hood Wink electro-optic director is fitted in the bridge roof.

RADARS

Plank Shave

Plank Shave (Russian name — Harpun) is mounted atop a small tower on the bridge roof. This is an I-band set used for surface search and targeting and is frequently found in ships armed with SS-N-2 missiles.

Bass Tilt

Bass Tilt is an H/I-band fire-control radar (see 'Weapons Control').

Pechora

Pechora is an I-band navigation radar.

IFF

Salt Pot, Square Head A.

PROPULSION

Veer (K 40) to Nirghat (K 44)

Specifications

System: Combined gas turbine or gas turbine (COGOG)

Main machinery: 2 Nikolayev Type DR 77 gas turbines, 11.77 MW (16,016 hp); 2 Nikolayev Type DR 76 gas turbines with reversible gearboxes, 3.67 MW (4,993 hp).

Shafts: 2

Vibhuti (K 45) onwards

Specifications

System: Combined diesel or gas turbine (CODOG)

Main machinery: 1 General Electric LM 2500 gas turbine; 17.38 MW (23,300 hp); 2 MTU 12V 538 TB92 diesels, 3.76 MW (5,110 hp)

Shafts: 2

FURTHER INFORMATION

PROGRAMME

The 'Veer (Tarantul)' class is intended to replace the Russian-supplied 'Osa' class missile boats in the Indian Navy. The first five of these ships are standard Russian 'Tarantul I' class built for export, while the remainder are being built in India. At one time it was anticipated that 30 (possibly more) would be built at no less than three shipyards — indicating a high degree of satisfaction with the type — but supply problems in Russia have led to a substantial downsizing of the order.

DESIGN

Like other export versions of the 'Tarantul' class, the Indian Tarantul Is do not have the Band Stand radar and Light Bulb datalink. Instead, Plank Shave is used for both surface search and targeting.

The later Indian-built ships are known to have CODOG propulsion, using a combination of a US (General Electric) gas turbine and two German (MTU) diesels. It is, however, possible that the earlier Indian-built ships may be powered by the same COGOG arrangement using Russian-supplied gas turbines, as the Russian-built ships.

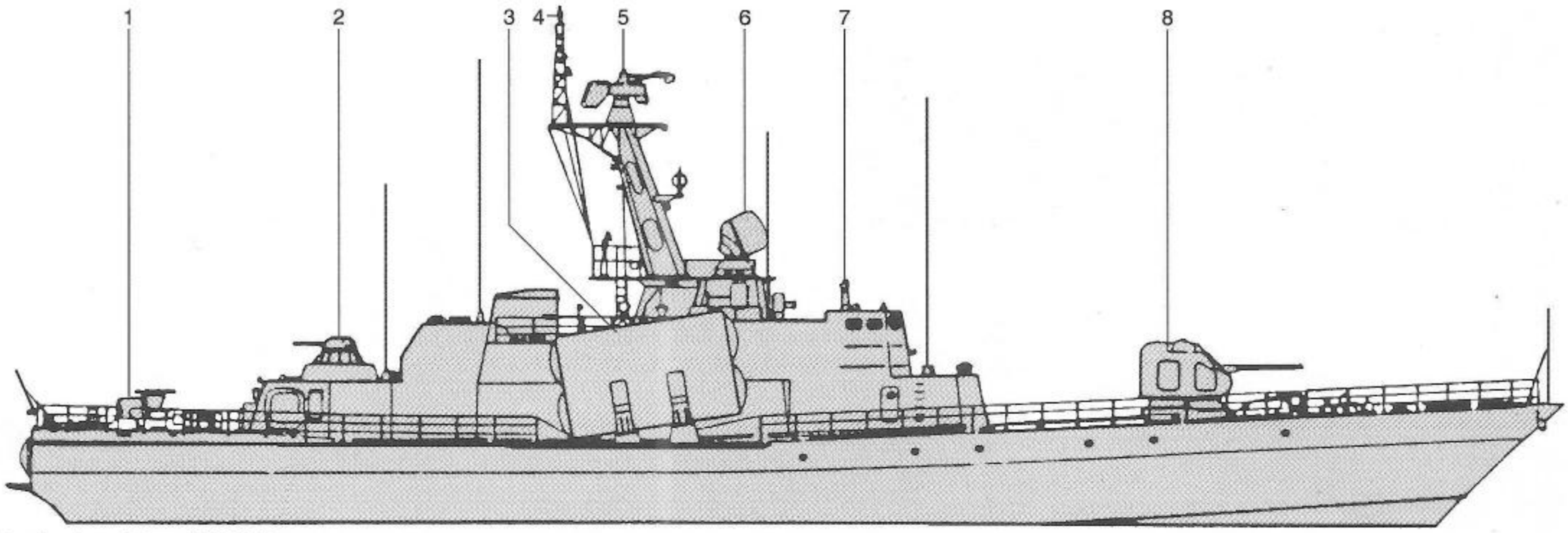
There have been reports that the SS-N-2 missiles may be replaced by SS-N-25 in the last pair being built in India.

OPERATIONAL

All the Indian-built Tarantuls currently form the 22nd Squadron.

Vinash *(K 47)* (Goa Shipyard)

GORNIK (TARANTUL I)



Metalowiecz *(Type 1241RE)*
1 *PK-16, 16-tube decoy launcher* **2** *SS-N-2c anti-ship missile launchers (four in total)* **4** *Square Head IFF* **5** *Plank Shave (Harpun-E) surface search/targeting radar* **6** *Bass Tilt fire director* **7** *Peczora-1 navigation radar* **8** *AK-176M 76 mm (3 in)/60 automatic gun*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Poland
Type: Tarantul I (Type 1241RE)

Class: GORNIK

Purchased: 4
Active: 4

Displacement:
standard: 385 t
full load: 420 t

Length: 56.90 m (186.7 ft)(oa); 56.1 m (184 ft) (wl)
Beam: 10.20 m (33.46 ft)
Draught: 2.5 m (8.2 ft)

Speed: 43 kts
Range: 2,200 n miles at 18 kts

Complement: 46 (6 officers)

SHIPS

GORNIK (434)
Builder River Shipyard 341, Rybinsk, Russia
Commissioned 28 Dec 1983

HUTNIK (435)
Builder River Shipyard 341, Rybinsk, Russia
Commissioned 31 Mar 1984

METALOWIECZ (436)
Builder River Shipyard 341, Rybinsk, Russia
Commissioned 13 Feb 1988

ROLNIK (437)
Builder River Shipyard 341, Rybinsk, Russia
Commissioned 4 Feb 1989

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

P-22 Rubezh (SS-N-2c 'Styx') medium-range anti-ship missile

There are two twin launchers for SS-N-2c 'Styx', which is designated KT-138E (P-21/P-22) in Polish service. These launchers are in two vertical pairs of missile launch tubes in the waist, either side of the superstructure. There are no reloads. This relatively large anti-ship missile is powered by a liquid-fuelled rocket motor, with a solid fuel booster attached. Once the target is detected the ship must close, with the aim of being within the optimum engagement distance, some 15 to 20 n miles (28 to 37 km). Once ready to launch, the ship must face the target, maintain a speed of 15 kts or less and hold its course for 20 to 30 seconds before launching the first salvo of two missiles. These may be followed, a minute later, by the second pair. Upon launch the missile climbs at an angle of 45° to one of five preset altitudes (100, 150, 200, 250 or 350 m) (328, 492, 656, 820 or 1,148 ft), where the onboard radar searches for a target and the receiver is switched on for very short periods to receive signals from a designated range, the range gate being 0.54 n miles (1 km) on either side of the target. The radar locks only after eight returns have been received, at distances of 3.5 to 12 n miles (6.5 to 22 km), whereupon the seeker guidance system switches off the autopilot. A throw-off gyroscope takes the missile on target a few seconds before impact as it becomes too close for radar-generated homing signals. Russian Navy tacticians calculate that seven to eight missiles are required to destroy a cruiser-size target and four for a destroyer, making salvo firing a major feature of any tactical engagement scenario with SS-N-2 missiles to ensure destruction of the target.

Specifications (SS-N-2c)

Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.87 ft)
Speed: Mach 0.9
Weight (without booster): 2,600 kg (5,732 lb)
Warhead: 454 kg (1,000 lb) hollow-charge
Fuzes: Impact, proximity
Range: 3-54 n miles (5.5-100 km)
Guidance: Autopilot with active radar (supplemented in some with IR)

MS-2 seeker
Frequency: I-band (8-12 GHz) (four presets)
PRF: 300-500 pps (adjustable)
Altitude control: Barometric pressure device

Manufacturer/Contractor

Raduga, Moscow, Russia.

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 'GRAIL' (Strela-2M)

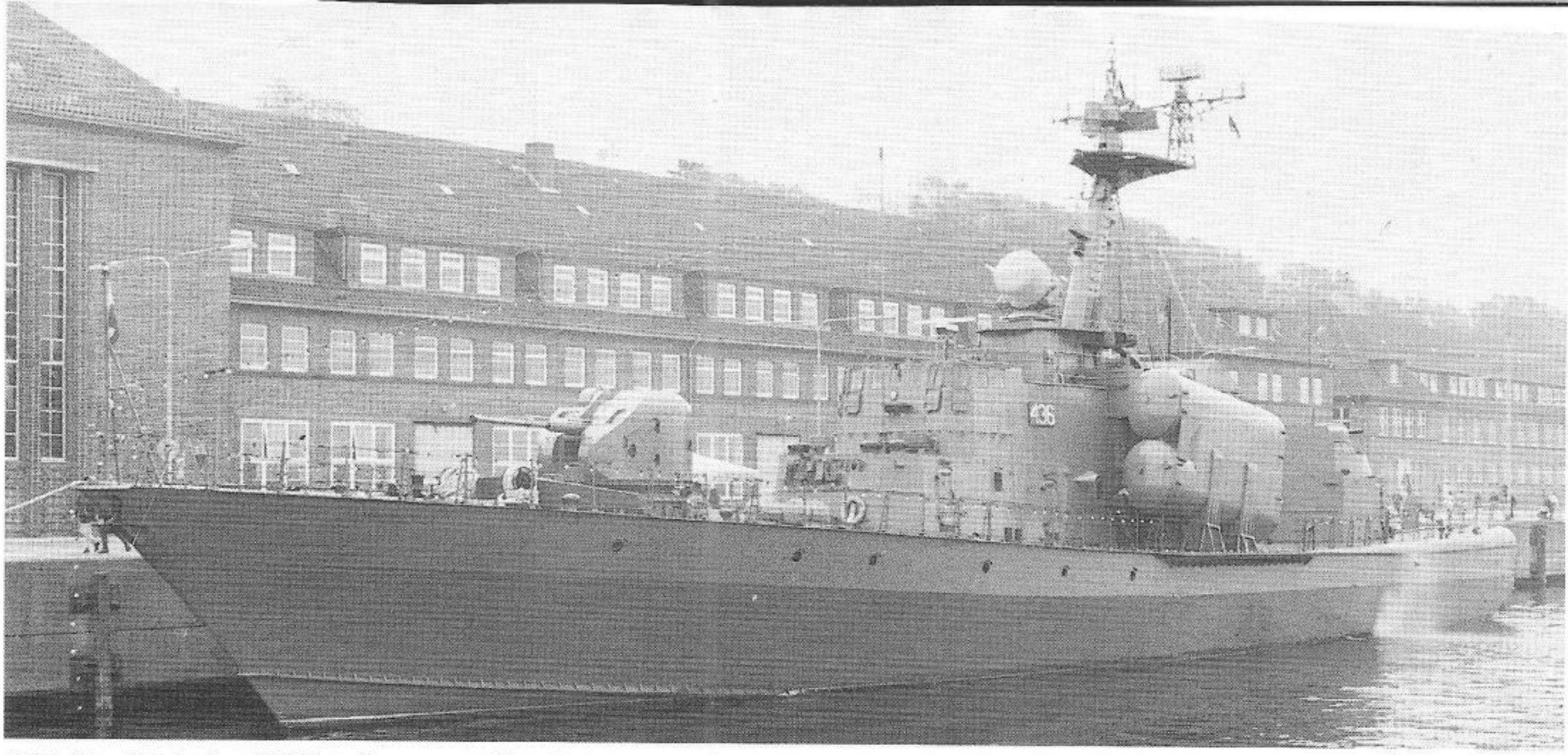
There are two, four-missile launchers for the SA-N-5 short-range SAM system. SA-N-5 is the NATO designation for the Russian Strela-2M (Strela = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired, the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and partially pulls the trigger to activate the missile gyros, which take some four to six seconds to warm up. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spinning it up. Then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has better fragmentation uniformity.

Specifications

(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)



Polish Navy Metalowiecz *(436) in a German port. Note the twin launcher for SS-N-2c, 76 mm gun forward and Bass Tilt above the bridge* (Jane's/H M Steele)

Speed: Mach 1.7
Range: 18-4,500 m (60-15,000 ft)
Guidance: IR homing

Manufacturer/Contractor
Fakel, Russia.

GUNS

AK-176M 76 mm (3 in)/60

There is one single 76 mm (3 in) gun on the foredeck which is intended for air defence, surface engagement and shore bombardment roles. The AK-176M is a four-man mounting which may be operated from the weapon control centre or from a local control station. The AK-176M is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'. This radar is also associated with the AK-630 and the two may form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the *Kondensor* sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day/night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight.

Specifications
Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: n/k
Traverse: 360° at 35°/s
Elevation: −3 to +85° at 30°/s
Range:
  anti-surface: 3.75 n miles (7 km)
  anti-air: 10,000 m (32,800 ft)
Ammunition weight (total): 16 kg (35.3 lb)
Ammunition carried: 252 rounds (ready use); 150 rounds (magazine)
Rate of fire: 120-130 rds/min

30 mm/65 AK-630 close in weapons system

There are two 30 mm Gatling-type AK-630s mounted side by side on the roof of the after deckhouse. These have five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AO-18 weapon is a water-cooled, six-barrelled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but unlike the US weapon AK-630 features a separate radar director, Bass Tilt.

Specifications
Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,919 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
  radar fire control: 4,000 m (13,000 ft)
  electro-optic fire control: 5,000 m (16,400 ft)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
Weight:
  UOF-84 HE-I: 384 g (13.5 oz)
  UOR-84 HE-T: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

Metalowiecz *(436). On the afterdeck are two AK-630 30 mm Gatling-type CIWS and two PK-16 decoy launchers. The solid rectangular antenna on the mast platform is Plank Shave (Russian = Harpun-E) and the rectangular lattice antenna at the masthead is Square Head IFF.* (Jane's/H M Steele)

ELECTRONIC WARFARE SYSTEMS

DECOYS

PK-16

There are two 16-barrel chaff/decoy launchers, located on the quarterdeck.

COMMAND AND CONTROL SYSTEMS

RADARS

Plank Shave (Harpun-E)

Plank Shave (Russian name — Harpun-E) is mounted atop a small tower on the bridge roof. This is an I-band set used for surface search and targeting, and is frequently found in ships armed with SS-N-2 missiles.

Navigation radars

Gornik (435) and *Hutnik* only. Kivacz-2
Metalowicz (436) and *Rolnik* (437) only. Peczora-1
These are both I-band navigation radars, produced in Poland. No further details are known.

Bass Tilt (MR-123)

The Bass Tilt (MR-123) weapon control system includes the Bass Tilt H/I-band radar.

IFF

Square Head

PROPULSION

Specifications

System: Combined gas turbine or gas turbine (COGOG)

Main machinery: 2 Type PR 77 gas turbines; 17.652 MW (24,000 hp); 2 DM 76 gas turbines, 5.884 MW (8,000 hp) with reversible gearbox

Shafts: 2

Ship's services: 2 DGR-2A-200/1500 diesel generators, 400 kW; 1 DGF2A-100/1500 diesel generator, 100 kW

FURTHER INFORMATION

PROGRAMME

These ships were transferred from Russia: 1983-1; 1984-1; 1988-1; 1989-1. Plans to take two more from the former GDR stock have been cancelled.

DESIGN

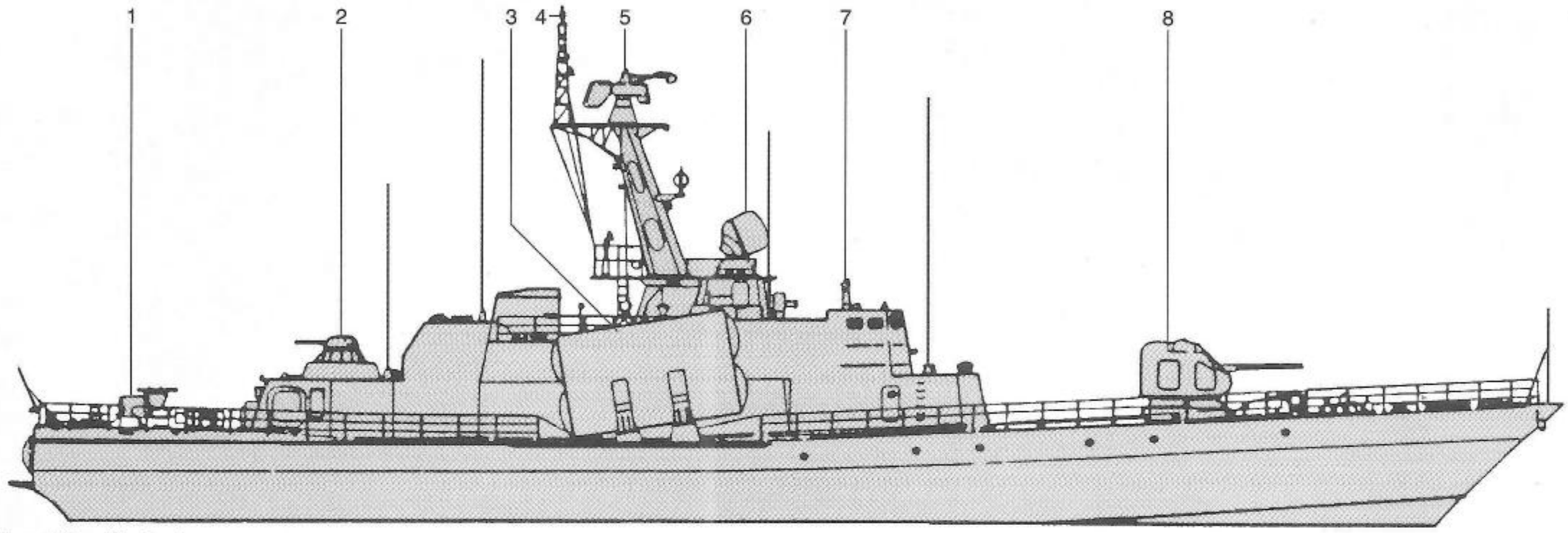
These are similar to other versions of the Tarantul I exported to India (first five), Romania and Yemen.
It should be noted that these ships have no ASW capability, having neither sonar nor ASW weapons.

OPERATIONAL

Based at Gdynia.

Gornik *(434)* (H & L van Ginderen Collection)

ZBORUL (TARANTUL I)



Zborul (Ian Sturton)
1 *PK-16, 16-tube decoy launcher* **2** *AK-630 30 mm, seven-barrel CIWS* **3** *SS-N-2c anti-ship missile launchers* **4** *Square Head IFF* **5** *Plank Shave (Harpun-E) surface search/targeting radar* **6** *Bass Tilt fire director* **7** *Pechora navigation radar* **8** *AK-176M 76 mm (3 in)/60 automatic gun*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Romania
Type: Tarantul I (Type 1241RE)

Class: ZBORUL

Purchased: 3
Active: 3

Displacement:
standard: 385 t
full load: 455 t

Length: 56.1 m (184 ft)
Beam: 10.2 m (36.4 ft)
Draught: 2.5 m (8.2 ft)

Speed: 38 kts
Range: 2,000 n miles at 20 kts; 400 n miles at 36 kts

Complement: 46 (6 officers)

SHIPS

ZBORUL (188)		**LASTUNUL** (189)		**PESCARUSUL** (190)	
Builder	Petrovsky Shipyard, Russia	**Builder**	Petrovsky Shipyard, Russia	**Builder**	Petrovsky Shipyard, Russia
Commissioned	Dec 1990	**Commissioned**	Feb 1992	**Commissioned**	Feb 1992

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

P-22 Rubezh (SS-N-2c 'Styx') medium-range anti-ship missile

There are two twin launchers for SS-N-2c 'Styx', which is designated KT-138E (P-21/P-22) in Polish service. These launchers are in two vertical pairs of missile launch tubes in the waist, either side of the superstructure. There are no reloads. This relatively large anti-ship missile is powered by a liquid-fuelled rocket motor, with a solid fuel booster attached. Once the target is detected the ship must close, with the aim of being within the optimum engagement distance, some 15 to 20 n miles (28 to 37 km). Once ready to launch, the ship must face the target, maintain a speed of 15 kts or less and hold its course for 20 to 30 seconds before launching the first salvo of two missiles. These may be followed, a minute later, by the second pair. Upon launch the missile climbs at an angle of 45° to one of five preset altitudes (100, 150, 200, 250 or 350 m) (328, 492, 656, 820 or 1,148 ft), where the onboard radar searches for a target and the receiver is switched on for very short periods to receive signals from a designated range, the range gate being 0.54 n miles (1 km) on either side of the target. The radar locks only after eight returns have been received, at distances of 3.5 to 12 n miles (6.5 to 22 km), whereupon the seeker guidance system switches off the autopilot. A throw-off gyroscope takes the missile on target a few seconds before impact as it becomes too close for radar-generated homing signals. Russian Navy tacticians calculate that seven to eight missiles are required to destroy a cruiser-size target and four for a destroyer, making salvo firing a major feature of any tactical engagement scenario with SS-N-2 missiles to ensure destruction of the target.

Specifications
(SS-N-2c)
Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.87 ft)
Speed: Mach 0.9
Weight (without booster): 2,600 kg (5,732 lb)
Warhead: 454 kg (1,000 lb) hollow-charge
Fuzes: Impact, proximity
Range: 3-54 n miles (5.5-100 km)
Guidance: Autopilot with active radar (supplemented in some with IR)

MS-2 seeker
Frequency: I-band (8-12 GHz) (four presets)
PRF: 300-500 pps (adjustable)
Altitude control: Barometric pressure device

Manufacturer/Contractor
Raduga, Moscow, Russia.

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 'GRAIL' (Strela-2M)

There are two, four-missile launchers for the SA-N-5 short-range SAM system. SA-N-5 is the NATO designation for the Russian Strela-2M (Strela = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired, the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and partially pulls the trigger to activate the missile gyros, which take some four to six seconds to warm up. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spinning it up. Then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has better fragmentation uniformity.

Specifications
(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 2.6 n miles (4.8 km)
Altitude: 18 - 4,500 m (60 - 15,000 ft)
Guidance: IR homing

Manufacturer/Contractor
Fakel, Russia.

GUNS

AK-176M 76 mm (3 in)/60

There is one single 76 mm (3 in) gun on the foredeck which is intended for air defence, surface engagement and shore bombardment roles. The AK-176M is a four-man mounting which may be operated from the weapon control centre or from a local control station. The AK-176M is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'. This radar is also associated with the AK-630 and the two may form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the *Kondensor* sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day/night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight.

Romanian Tarantul I (Stefan Terzibaschitsch)

Specifications

Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: n/k
Traverse: 360° at 35°/s
Elevation: −3 to +85° at 30°/s
Range:
  anti-surface: 3.75 n miles (7 km)
  anti-air: 10,000 m (32,800 ft)
Ammunition weight (total): 16 kg (35.3 lb)
Ammunition carried: 252 rounds (ready use); 150 rounds (magazine)
Rate of fire: 120-130 rds/min

30 mm/65 AK-630 close in weapons system

There are two 30 mm Gatling-type AK-630s mounted side by side on the roof of the after deckhouse. These have five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AO-18 weapon is a water-cooled, six-barrelled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but unlike the US weapon AK-630 features a separate radar director, Bass Tilt.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,919 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
  radar fire control: 4,000 m (13,000 ft)
  electro-optic fire control: 5,000 m (16,400 ft)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
Weight:
  UOF-84 HE-I: 384 g (13.5 oz)
  UOR-84 HE-T: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog

There are two Watch Dog radar-intercept and warning arrays in each ship.

DECOYS

PK-16

There are two 16-barrelled PK-16 chaff/decoy launchers.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Hood Wink

One Hood Wink electro-optic director is fitted in the bridge roof.

Bass Tilt fire control

Bass Tilt is an H/I-band fire-control system which entered service in the mid-1970s and is part of the fire-control system for the AK-630 CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (4 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.56 ft) high and 1.45 m (4.7 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

RADARS

Plank Shave (Harpun-E)

Plank Shave (Russian name — Harpun-E) is mounted atop a small tower on the bridge roof. This is an I-band set used for surface search and targeting and is frequently found in ships armed with SS-N-2 missiles.

Bass Tilt (MR-123)

The Bass Tilt (MR-123) weapon-control system includes the Bass Tilt H/I-band radar.

Spin Trough

Spin Trough is an I-band navigation radar

IFF

Square Head. High Pole.

PROPULSION

Specifications

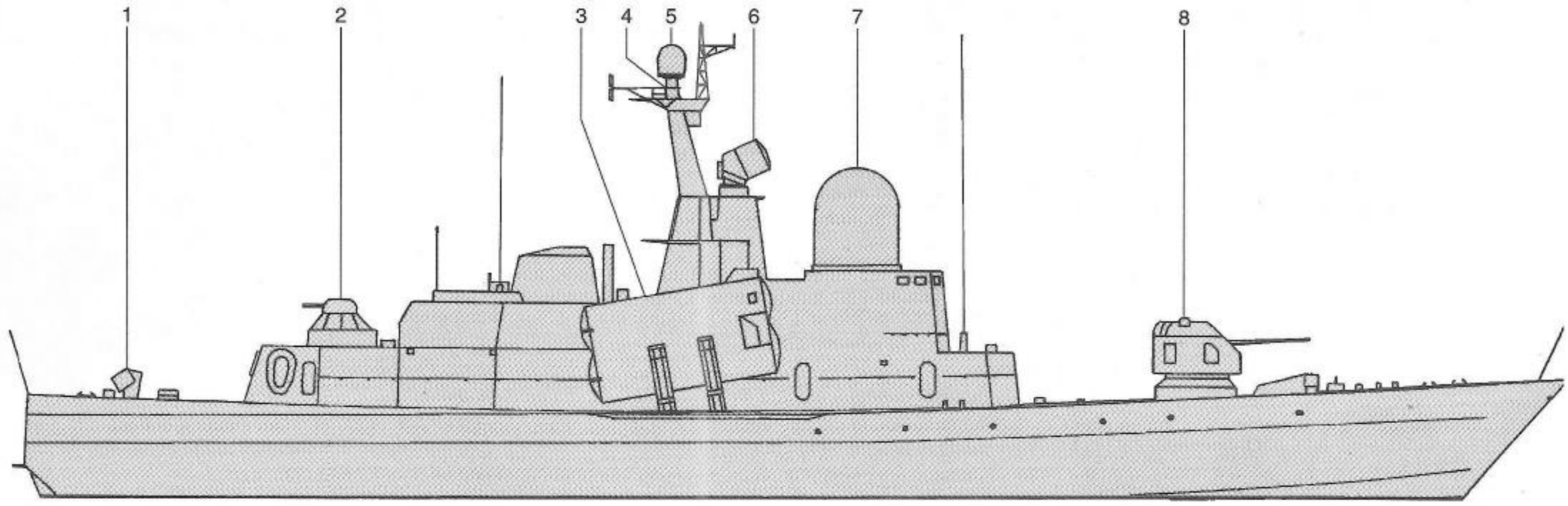
System: Combined gas turbine and gas turbine (COGAG)
Main machinery: 2 Nikolayev Type DR 77 gas turbines; 11.77 MW (16,016 hp(m)) sustained; 2 Nikolayev Type DR 76 gas turbines with reversible gearboxes; 3.67 MW (4,993 hp)
Shafts: 2

FURTHER INFORMATION

COMMENT

These are standard export version Tarantul Is.

TARANTUL II (Type 1241M)



Tarantul II (Ian Sturton)
1 *PK-16 16 barrel decoy launcher* **2** *AK-630 seven-barrel 30 mm CIWS* **3** *SS-N-2c Styx anti-ship missile (four)* **4** *Wine Glass ESM/ECM (two)* **5** *Light Bulb datalink (ship to missile)* **6** *Bass Tilt fire control/targeting (for SS-N-2c)* **7** *Band Stand radar (air surveillance)* **8** *AK-176M 76 mm (3 in)/60 automatic gun*

GENERAL SPECIFICATIONS

Operators: Bulgaria/Russia
Type: 1241.1M

Class: TARANTUL II

National designation: *Raketny Kater* (missile cutter)

Russia
Built: 18
Active: 17

Bulgaria
Acquired: 1
Active: 1

Displacement:
standard: 385 t
full load: 455 t

Length: 56.1 m (184 ft)
Beam: 10.2 m (33.46 ft)
Draught: 2.65 m (8.69 ft)

Speed: 38 kts
Range: 400 n miles at 36 kts; 1,650 n miles at 14 kts

Complement: 38 (5 officers)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

P-22 Rubezh (SS-N-2c 'Styx') medium-range anti-ship missile

The 'Tarantul II' class is armed with four SS-N-2c 'Styx' missiles with two vertical pairs of missile launch tubes in the waist, either side of the superstructure. There are no reloads. This relatively large anti-ship missile is powered by a liquid-fuelled rocket motor, with a solid fuel booster attached. Once the target is detected the ship must close, with the aim of being within the optimum engagement distance of 15 to 20 n miles (28 to 37 km). Once ready to launch, the ship must face the target, maintain a speed of 15 kts or less and hold its course for 20 to 30 seconds before launching the first salvo of two missiles. These may be followed, a minute later, by the second pair. On leaving the launcher, the missile climbs at an angle of 45° to one of five preset altitudes (100, 150, 200, 250 or 350 m (328, 492, 656, 820 or 1,148 ft)), where the onboard radar searches for a target and the receiver is switched on for very short periods to receive signals from a designated range, the range gate being 0.54 n miles (1 km) on either side of the target. The radar locks only after eight positive returns have been received, at distances of 3.5 to 12 n miles (6.5 to 22 km), whereupon the seeker guidance system switches off the autopilot. A throw-off gyroscope takes the missile on target a few seconds before impact as it becomes too close for radar-generated homing signals. Russian Navy tacticians calculate that seven to eight missiles are required to destroy a cruiser-size target and four for a destroyer, making salvo firing a major feature of any tactical engagement scenario with SS-N-2 missiles to ensure destruction of the target.

Specifications

(SS-N-2c)
Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.87 ft)
Speed: Mach 0.9
Weight (without booster): 2,600 kg (5,732 lb)
Warhead: 454 kg (1,000 lb) hollow-charge
Fuzes: Impact, proximity
Range: 3-54 n miles (5.5-100 km)
Guidance: Autopilot with active radar (supplemented in some with IR)

MS-2 seeker
Frequency: I-band (8-12 GHz) (four presets)
PRF: 300-500 pps (adjustable)
Altitude control: Barometric pressure device

Manufacturer/Contractor

Raduga, Moscow, Russia.

SURFACE-TO-AIR MISSILES

SA-N-5 'GRAIL' (Strela-2M)

There is one, four-missile launcher for the SA-N-5 short-range SAM system. SA-N-5 is the NATO designation for the Russian Strela-2M (Strela = arrow), the naval version of the widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched, short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired, the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and partially pulls the trigger to activate the missile gyros, which take some four to six seconds to warm up. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spinning it up. Then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out. The missile homes on the 'hottest' part of the target and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has better fragmentation uniformity.

Specifications

(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 18-4,500 m (60-15,000 ft)
Guidance: IR homing

Manufacturer/Contractor

Fakel, Russia.

GUNS

AK-176M 76 mm (3 in)/60

There is one single 76 mm (3 in) gun on the foredeck which is intended for air defence, surface engagement and shore bombardment roles. The AK-176M is a four-man mounting which may be operated from the weapon control centre or from a local control station. The AK-176M is part of the Bass Tilt weapon control system, which also includes the AK-630. Local control is achieved semi-automatically using the *Kondensor* sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day/night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight.

Specifications

Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: n/k
Traverse: 360° at 35°/s
Elevation: −3 to +85° at 30°/s

Ammunition (total): 16 kg (35.3 lb)
Rate of fire: 120-130 rds/min
Range:
anti surface: 3.75 n miles (7 km)
anti-air: 10,000 m (32,800 ft)

30 mm/65 AK-630 close in weapons system

There are two 30 mm Gatling-type AK-630s mounted side by side on the roof of the after deckhouse. These have five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AO-18 weapon is a water-cooled, six-barrelled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but unlike the US weapon AK-630 features a separate radar director, Bass Tilt.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,919 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (13,000 ft)
electro-optic fire control: 5,000 m (16,400 ft)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
Weight:
UOF-84 HE-I: 384 g (13.5 oz)
UOR-84 HE-T: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Bell Nest

There are two Bell nest radomes. The Bell series is normally associated with an ESM function.

Wine Glass, Half Hat

There are two Wine Glass (formerly known as Football) and two Half Hat radomes in most Tarantul IIs. These have an ESM/ECM function and may be part, with Bell Nest, of an integrated EW suite.

DECOYS

PK-16

There are two Russian PK-16 chaff launchers, which are mounted on the main deck, on either side of the superstructure.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Hood Wink

There is one Hood Wink electro-optic director.

Band Stand

Band Stand is a D/E/F-band radar which is part of the fire-control system for the SS-N-2 missile system, although there may be some connection with the ship's overall air surveillance, as well. The Light Bulb datalink appears to be part of the same system, providing the links between the ship and the missile.

Light Bulb

Light Bulb is the datalink between the ship and the missile and is one of the items which does not appear in export ships.

Bass Tilt fire-control radar

Bass Tilt is an H/I-band fire-control radar which entered service in the mid-1970s and is part of the fire-control system for the AK-630 CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (4 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.56 ft) high and 1.45 m (4.7 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

RADARS

Plank Shave

Plank Shave is mounted on a small platform at the head of the foremast. This is an I-band set used for surface search and targeting and is frequently found in ships armed with SS-N-2 missiles.

Kivach III

Kivach III is an I-band navigation radar.

Bass Tilt

Bass Tilt is an H/I-band fire-control radar (see Weapons Control).

IFF

Square Head. High Pole B.

PROPULSION

Specifications

System: Combined gas turbine and gas turbine (COGAG)
Main machinery: 2 Nikolayev Type DR 77 gas turbines; 11.77 MW (16,016 hp(m)) sustained; two Nikolayev Type DR 76 gas turbines with reversible gearboxes; 3.67 MW (4,993 hp)
Shafts: 2

FURTHER INFORMATION

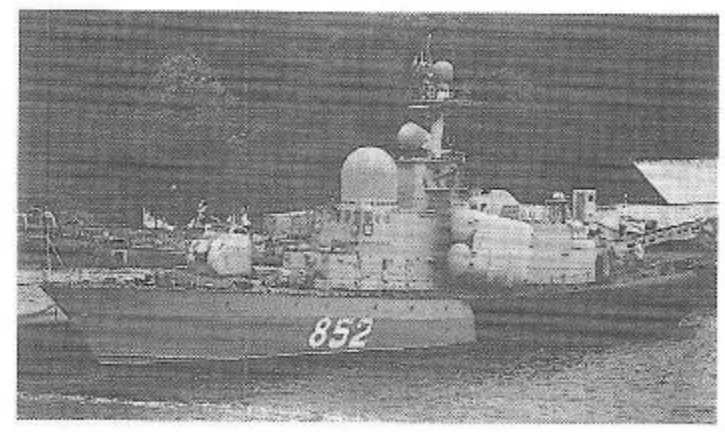
PROGRAMME

Tarantul II was the first production version for the Soviet Navy. It is armed with a new version of SS-N-2 with various guidance features not releasable to foreign navies. One Tarantul II has been sold to Bulgaria and one has been converted as the prototype Tarantul IV.

DEPLOYMENT

The Russian Navy has one Tarantul II in the Caspian Sea and the remainder are split between the Pacific and Black Sea Fleets. Many are not fully operational.

The Bulgarian Tarantul II is based at Sozopol.



A Tarantul II *of the Russian Navy* (Hartmut Ehlers)

TARANTUL III (Type 12411)

GENERAL SPECIFICATIONS

Operator: Russia
Type: 12411

National designation: *Raketny Kater* (missile cutter)

Class: TARANTUL III

Built: 27

Active: 27
Building: 2

Displacement:
standard: 385 t
full load: 455 t

Length: 56.1 m (184 ft)
Beam: 11.5 m (37.7 ft)
Draught: 2.5 m (8.2 ft)

Speed: 36 kts
Range: 400 n miles at 36 kts; 2,400 n miles at 14 kts

Complement: 34 (5 officers)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

SS-N-22 Sunburn Mod 2 3M80 (P270 Moskit)

There are two twin launchers for SS-N-22 'Sunburn' missiles in vertical pairs mounted in the waist. This missile (also known as 3M80 and P-270 Moskit) is ram-jet-powered and has four clipped delta planform wings and four smaller tail surfaces of similar shape in cruciform configuration around the fuselage. All the wings and tail surfaces are folded when the missile is in the launcher. It is also found in the 'Sovremenny' class destroyers.

The system is associated with the 'Band Stand' D/F-band (1-4 GHz) air and surface search radar with a fairly high data rate. This sensor is known to have a secondary tracking function for anti-ship missiles and is part of both the 'Siren' and 'Sunburn' fire-control systems. It is believed the fire-control system can also receive data from the Big Bulge I/J-band radars of the Ka-25 'Hormone B' and Ka-27 'Helix B' although the 'Tarantul' class has no helicopter facilities.

Data on the location of both launcher and target are fed into the missile from the fire-control system, the doors at the front and at the rear of the launcher cell are opened and the booster ignites. The missile may be launched to engage targets in a 120° arc based upon the ship's course. Once the missile clears the launcher the wings and tail surfaces deploy and the missile briefly rises then drops to a cruising altitude of 20 m (65.6 ft), reducing to 7 m (23 ft) on the final run into the target. The active radar seeker then searches for the target and homes upon it when 'lock on' is achieved. In the event of jamming the seeker has a home-on-jam capability. The missile has a high kinetic energy, with a mass of 3,950 kg (8,708 lb) and a speed of Mach 2, which, according to the makers, enable it 'to literally tear apart it's targets'.

The missile takes only 2 minutes to cover its full range and manufacturers state that 1 to 2 missiles could incapacitate a destroyer while 1 to 5 missiles could sink a 20,000 tonne merchantman. An extended range missile, 3M80E is also available.

Specifications
Length: 9.38 m (30.77 ft)
Diameter: 130 cm (51.2 in)
Wing span: n/k
Weight: 3,950 kg (8,708 lb)
Speed: Mach 2
Range: 48 n miles (90 km) (65 n miles (120 km) in 3M80E)
Guidance: Inertial

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 'Grail' (Strela-2M)

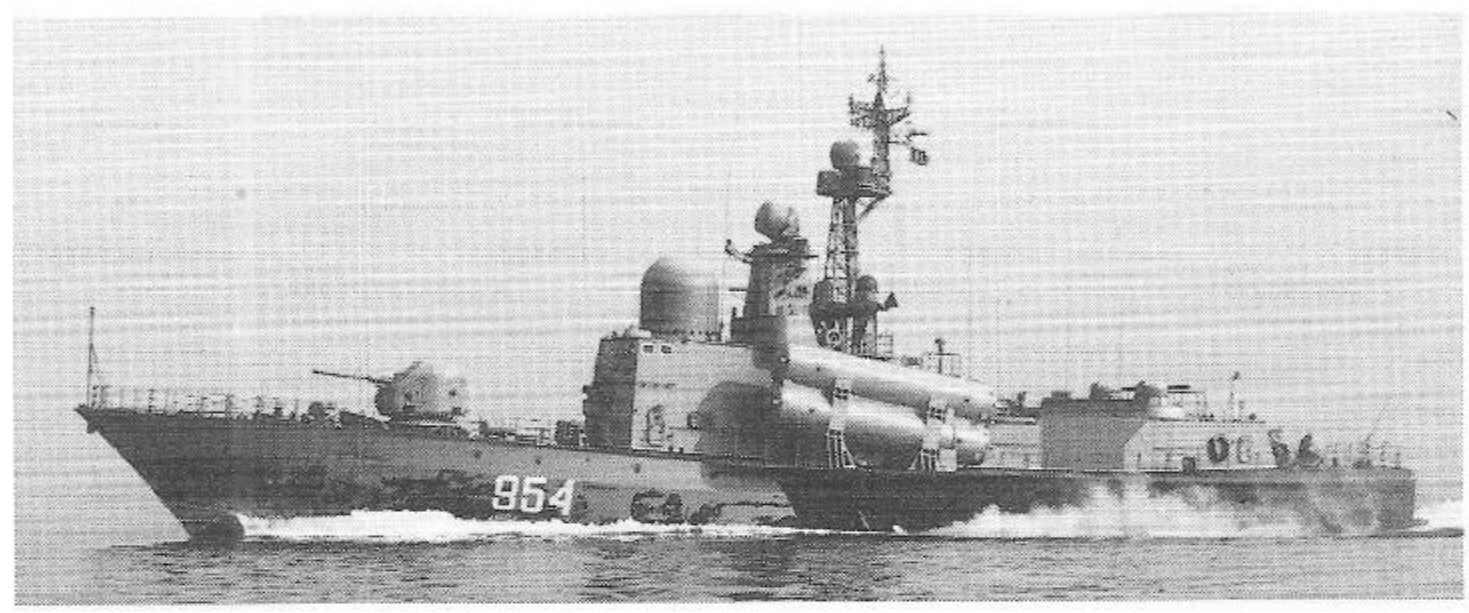
There is one, four-missile launcher for the SA-N-5 short-range SAM system. SA-N-5 is the NATO designation for the Russian Strela-2M (Strela = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired, the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and partially pulls the trigger to activate the missile gyros, which take some four to six seconds to warm up. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spinning it up. Then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the target and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has better fragmentation uniformity.

Specifications
(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 18-4,500 m (60-15,000 ft)
Guidance: IR homing

Manufacturer/Contractor
Fakel, Russia.



A Russian Navy Tarantul III. *The large containers house SS-N-22 anti-ship missiles. The radome on the bridge roof is Band Stand and above it, on its own tower, is Bass Tilt which is part of the system controlling the 76 mm gun and the 30 mm CIWS. On the masthead platform is Light Bulb, the datalink for the SS-N-22 missiles, which is flanked by two Bell Net ESM arrays. Mid-way on the mast are two Wine Glass jammers* (H & L van Ginderen Collection)

GUNS

AK-176M 76 mm (3 in)/60

There is one single 76 mm (3 in) gun on the foredeck which is intended for air defence, surface engagement and shore bombardment roles. The AK-176M is a four-man mounting which may be operated from the weapon control centre or from a local control station. The AK-176M is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'. This radar is also associated with the AK-630 and the two form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the *Kondensor* sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day/night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight.

Specifications
Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: n/k
Traverse: 360° at 35°/s
Elevation: −3 to +85° at 30°/s
Ammunition (total): 16 kg (35.3 lb)
Rate of fire: 120-130 rds/min
Range:
anti-surface: 3.75 n miles (7 km)
anti-air: 10,000 m (32,800 ft)

30 mm/65 AK-630 close in weapons system

There are two 30 mm Gatling-type AK-630s mounted side by side on the roof of the after deckhouse. These have five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AO-18 weapon is a water-cooled, six-barrelled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but unlike the US weapon AK-630 features a separate radar director, Bass Tilt.

Specifications
Calibre: 30 mm
Length of barrel: 65 calibres

Number of barrels: 6
Muzzle velocity: 890 m/s (2,919 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)

Range:
radar fire control: 4,000 m (13,000 ft)
electro-optic fire control: 5,000 m (16,400 ft)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)

Ammunition types:
Weight:
UOF-84 HE-I: 384 g (13.5 oz)
UOR-84 HE-T: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Bell Nest
The Bell series of radomes is normally associated with an ESM function.

Wine Glass, Half Hat
There are two Wine Glass (formerly known as Football) and two Half Hat radomes in most Tarantul IIIs. They have an ESM/ECM function and may be part, with Bell Nest, of an integrated EW suite.

DECOYS

PK-10
There are four PK-10 chaff/decoy launchers. PK-10 is a Russian naval decoy system about which details were first revealed in 1993. The system consists of KT-216 launchers, a control console and three munitions. The launcher is a 10-barrel unit, with the 120 mm barrels fixed at about 45° on a traversing stand. The control console is a relatively simple design with simple controls capable of controlling up to four launchers. The munitions are all for seduction purposes. The SR-50 is a chaff round with a payload of 11 kg (24.25 lb). The SOM-50 is a heat seeker/laser-guided missile seduction round with 7.3 kg (16.1 lb) payload while the SK.50 is a combined round with a 9.1 kg (20 lb) payload.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Hood Wink
There is one Hood Wink electro-optic director.

Band Stand
Band Stand is a D/E/F-band radar which is part of the fire-control system for the SS-N-22 missile system, although there may be some connection with the ship's overall air surveillance, as well. The Light Bulb datalinks may well be part of the same system, providing the links between the ship and the missile.

Light Bulb
Light Bulb is the datalink between the ship and the missile and is one of the items which does not appear in export ships.

Vympel fire-control system
The fire-control system is designated Vympel whose prime component is the Bass Tilt H/I-band fire-control radar which entered service in the mid-1970s. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (4 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.56 ft) high and 1.45 m (4.76 ft) long.

RADARS

Plank Shave
Plank Shave is mounted atop a small tower on the bridge roof. This is an I-band set used for surface search and targeting and is frequently found in ships armed with SS-N-2 missiles.

Kivach III
Kivach III is an I-band navigation radar.

Bass Tilt
Bass Tilt is an H/I-band fire-control radar (see 'Weapons Control').

IFF
Square Head. High Pole B.

PROPULSION

Specifications
System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 Nikolayev Type DR 77 gas turbines, 11.77 MW (16,016 hp(m)) sustained; two CM 504 diesels, 5.88 MW (8,000 hp(m))
Shafts: 2

FURTHER INFORMATION

PROGRAMME

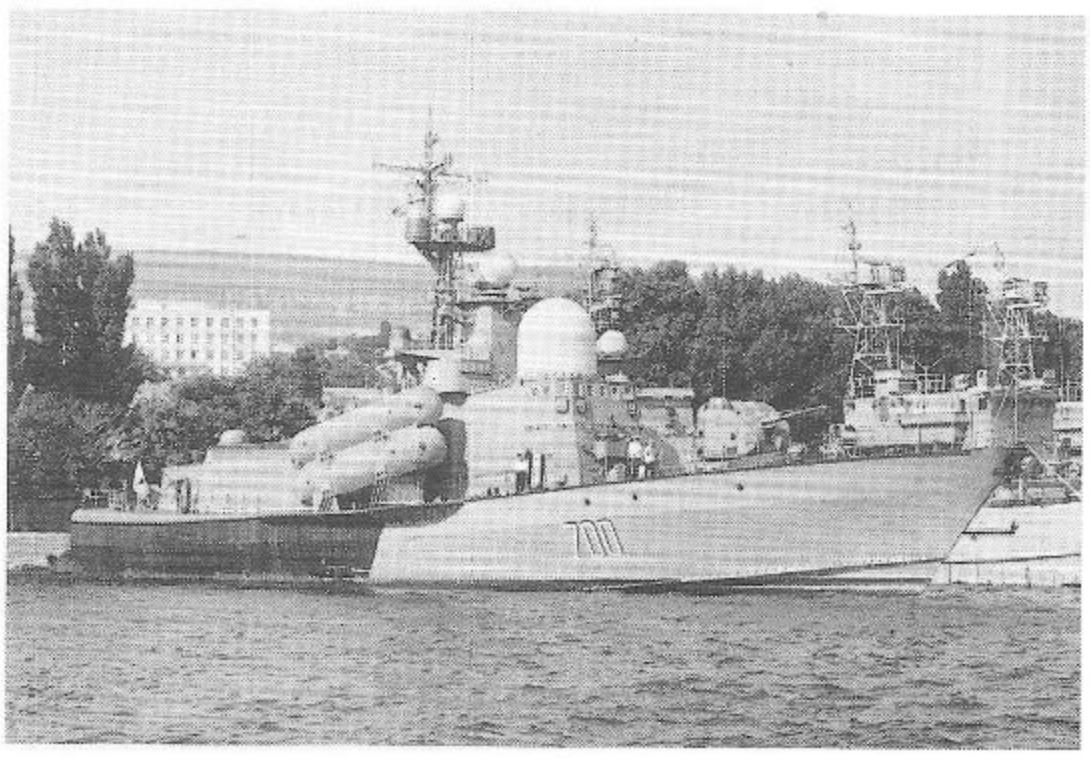
The first experimental Tarantul III with four SS-N-22 was completed at Petrovsky in 1981. Since then, 26 production Tarantul IIIs have been built at St Petersburg and Khabarovsk, although the last pair are unlikely to be completed at Khabarovsk.

MODERNISATION

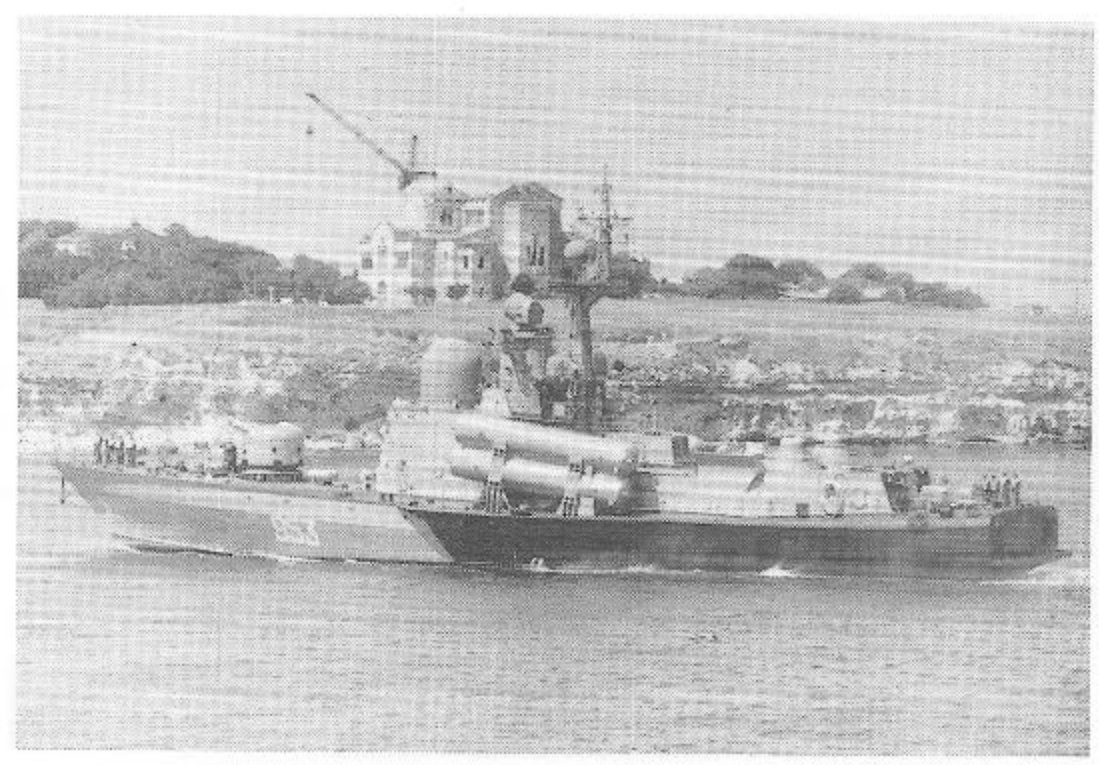
One Tarantul III has served as a trials platform for a modified version of SS-N-22, with a longer range. Designated 3M80E, the presence of this missile can be distinguished by different end caps on the launcher doors.

OPERATIONAL

One Tarantul III is in the Caspian Sea and the remainder are split between the Pacific and Black Sea Fleets. Some may not be fully operational.

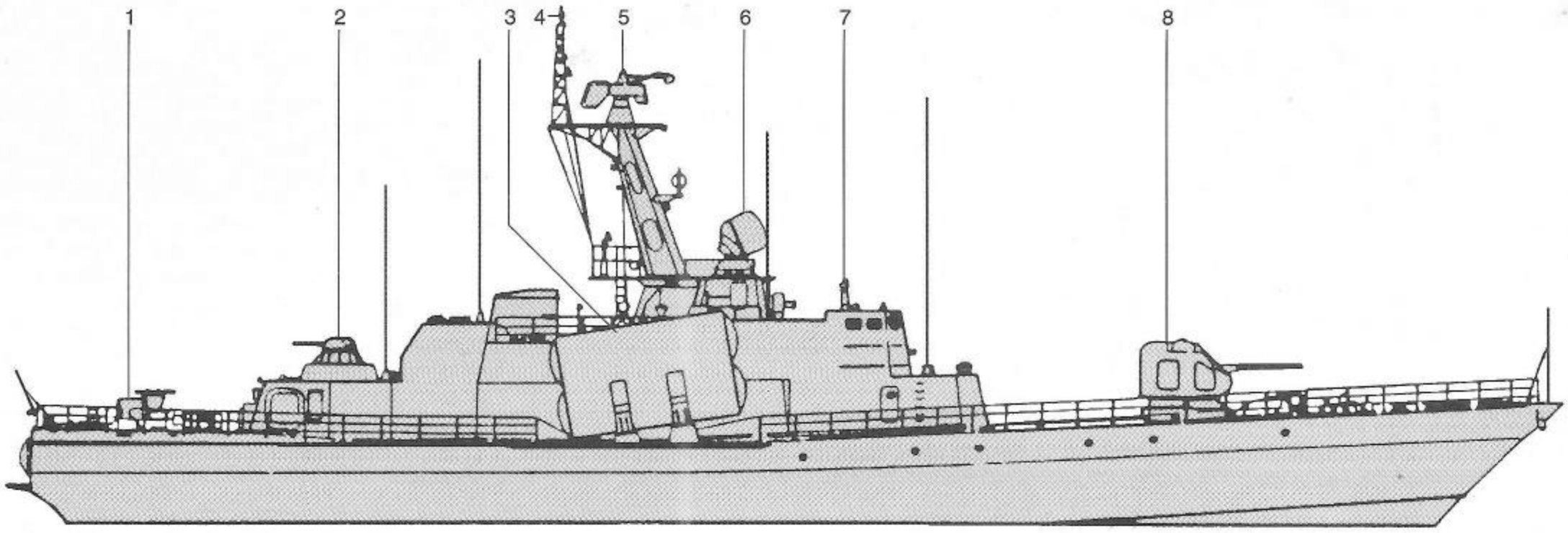


Tarantul III (H & L van Ginderen Collection)



Tarantul III (H & L van Ginderen Collection)

971 (TARANTUL I) (TYPE 1241RE)



971 Tarantul (Ian Sturton)
1 *PK-16, 16-tube decoy launcher* **2** *AK-630 30 mm, seven-barrel CIWS* **3** *SS-N-2c anti-ship missile launchers* **4** *Square Head IFF* **5** *Plank Shave (Harpun-E) surface search/targeting radar* **6** *Bass Tilt fire director* **7** *Pechora navigation radar* **8** *AK-176M 76 mm (3 in)/60 automatic gun*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Yemen
Type: Tarantul I (Type 1241RE)

Class: 971

Purchased: 2
Active: 2

Displacement:
standard: 385 t
full load: 450 t

Length: 56.1 m (184.1 ft)
Beam: 10.2 m (33.5 ft)
Draught: 2.5 m (8.2 ft)

Speed: 38 kts
Range: 2,000 n miles at 20 kts; 400 n miles at 36 kts

Complement: 50

SHIPS

971 976

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

P-22 Rubezh (SS-N-2c 'Styx') medium-range anti-ship missile

There are two twin launchers for SS-N-2c 'Styx', which is designated KT-138E (P-21/P-22) in Polish service. These launchers are in two vertical pairs of missile launch tubes in the waist, either side of the superstructure. There are no reloads. This relatively large anti-ship missile is powered by a liquid-fuelled rocket motor, with a solid fuel booster attached. Once the target is detected the ship must close, with the aim of being within the optimum engagement distance, some 15 to 20 n miles (28 to 37 km). Once ready to launch, the ship must face the target, maintain a speed of 15 kts or less and hold its course for 20 to 30 seconds before launching the first salvo of two missiles. These may be followed, a minute later, by the second pair. Upon launch the missile climbs at an angle of 45° to one of five preset altitudes (100, 150, 200, 250 or 350 m) (328, 492, 656, 820 or 1,148 ft), where the onboard radar searches for a target and the receiver is switched on for very short periods to receive signals from a designated range, the range gate being 0.54 n miles (1 km) on either side of the target. The radar locks only after eight returns have been received, at distances of 3.5 to 12 n miles (6.5 to 22 km), whereupon the seeker guidance system switches off the autopilot. A throw-off gyroscope takes the missile on target a few seconds before impact as it becomes too close for radar-generated homing signals. Russian Navy tacticians calculate that seven to eight missiles are required to destroy a cruiser-size target and four for a destroyer, making salvo firing a major feature of any tactical engagement scenario with SS-N-2 missiles to ensure destruction of the target.

Specifications

(SS-N-2c)
Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.87 ft)
Speed: Mach 0.9
Weight (without booster): 2,600 kg (5,732 lb)
Warhead: 454 kg (1,000 lb) hollow-charge
Fuzes: Impact, proximity
Range: 3-54 n miles (5.5-100 km)
Guidance: Autopilot with active radar (supplemented in some with IR)

MS-2 seeker
Frequency: I-band (8-12 GHz) (four presets)
PRF: 300-500 pps (adjustable)
Altitude control: Barometric pressure device

Manufacturer/Contractor

Raduga, Moscow, Russia.

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 'GRAIL' (Strela-2M)

There are two, four-missile launchers for the SA-N-5 short-range SAM system. SA-N-5 is the NATO designation for the Russian Strela-2M (Strela = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired, the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and partially pulls the trigger to activate the missile gyros, which take some four to six seconds to warm up. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spinning it up. Then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has better fragmentation uniformity.

Specifications

(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 5.5 km (2.6 n miles)
Altitude: 18 - 4,500 m (60 - 15,000 ft)
Guidance: IR homing

Manufacturer/Contractor

Fakel, Russia.

GUNS

AK-176M 76 mm (3 in)/60

There is one single 76 mm (3 in) gun on the foredeck which is intended for air defence, surface engagement and shore bombardment roles. The AK-176M is a four-man mounting which may be operated from the weapon control centre or from a local control station. The AK-176M is part of a weapon control system based upon the H-band fire-control radar with the NATO desig-

nation 'Bass Tilt'. This radar is also associated with the AK-630 and the two may form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the *Kondensor* sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day/night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight.

Specifications

Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: n/k
Traverse: 360° at 35°/s
Elevation: −3 to +85° at 30°/s
Range anti-surface: 3.75 n miles (7 km)
anti-air: 10,000 m (3,280 m)
Ammunition weight (total): 16 kg (35.3 lb)
Ammunition carried: 252 rounds (ready use); 150 rounds (magazine)
Rate of fire: 120-130 rds/min

30 mm/65 AK-630 close in weapons system

There are two 30 mm Gatling-type AK-630s mounted side by side on the roof of the after deckhouse. These have five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AO-18 weapon is a water-cooled, six-barrelled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but unlike the US weapon AK-630 features a separate radar director, Bass Tilt.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,919 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (13,000 ft)
electro-optic fire control: 5,000 m (16,400 ft)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.224 kg (2.7 lb)
Ammunition types:
Weight:
UOF-84 HE-I: 384 g (13.5 oz)
UOR-84 HE-T: 388 g (13.68 oz)
Fuze: MG-32 point impact (both rounds)

ELECTRONIC WARFARE SYSTEMS

DECOYS

PK-16

There are two 16-barrelled PK-16 chaff/decoy launchers.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Hood Wink

One Hood Wink electro-optic director is fitted in the bridge roof.

Bass Tilt fire control

Bass Tilt is an H/I-band fire-control system which entered service in the mid-1970s and is part of the fire-control system for the AK-630 CIWS. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (4 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.56 ft) high and 1.45 m (4.7 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

RADARS

Plank Shave (Harpun-E)

Plank Shave (Russian name — Harpun-E) is mounted atop a small tower on the bridge roof. This is an I-band set used for surface search and targeting and is frequently found in ships armed with SS-N-2 missiles.

Bass Tilt (MR-123)

The Bass Tilt (MR-123) weapon control system includes the Bass Tilt H/I-band radar.

Spin Trough

Spin Trough is an I-band navigation radar

IFF

Square Head. High Pole.

PROPULSION

Specifications

System: Combined gas turbine and gas turbine (COGAG)
Main machinery: 2 Nikolayev Type DR 77 gas turbines; 11.77 MW (16,016 hp(m)) sustained; 2 Nikolayev Type DR 76 gas turbines with reversible gearboxes; 3.67 MW (4,993 hp)
Shafts: 2

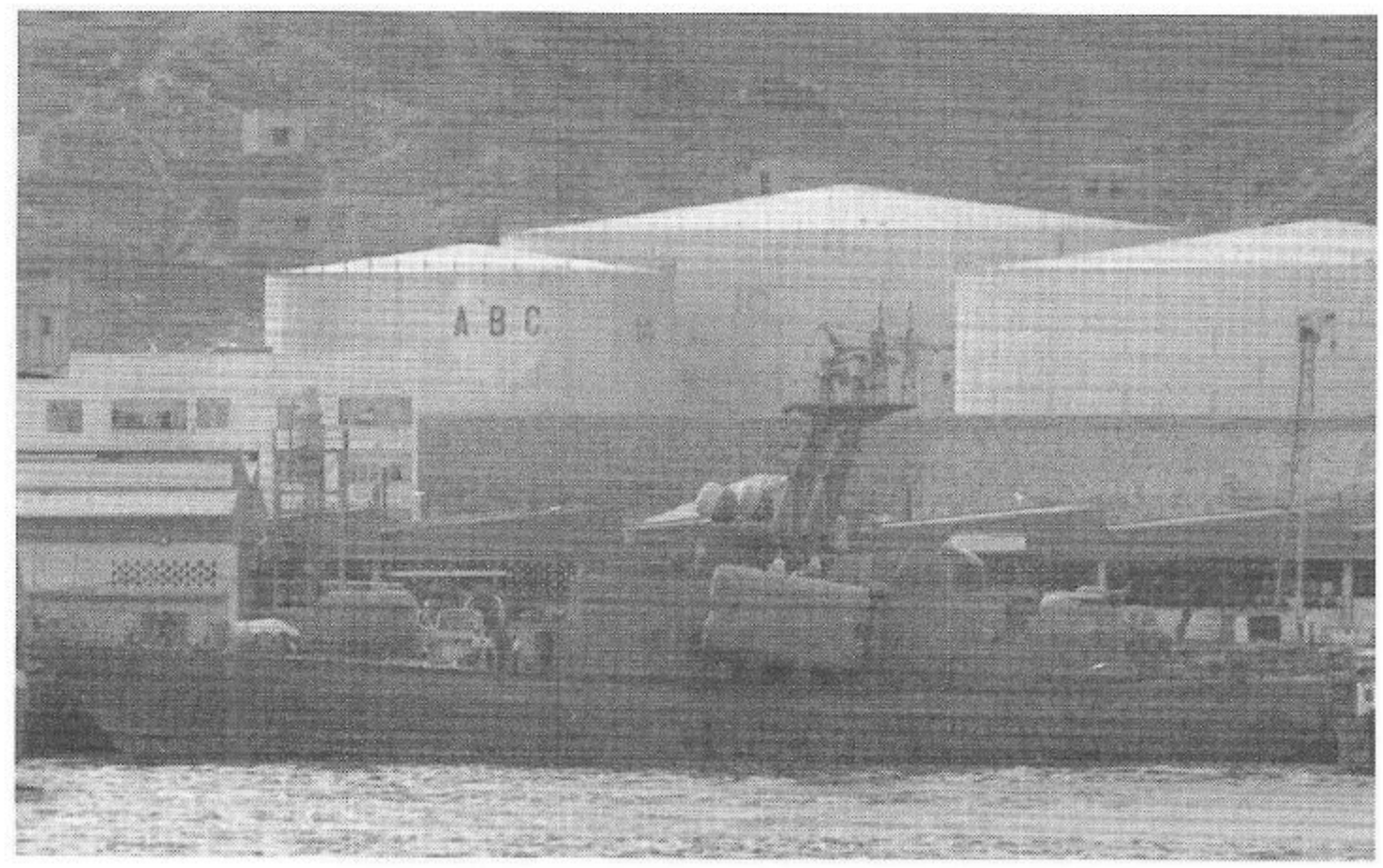
FURTHER INFORMATION

PROGRAMME

The first ship was delivered from Russia on 7 December 1990, followed by the second on 15 January 1991. This is the standard export version — Type 1241RE.

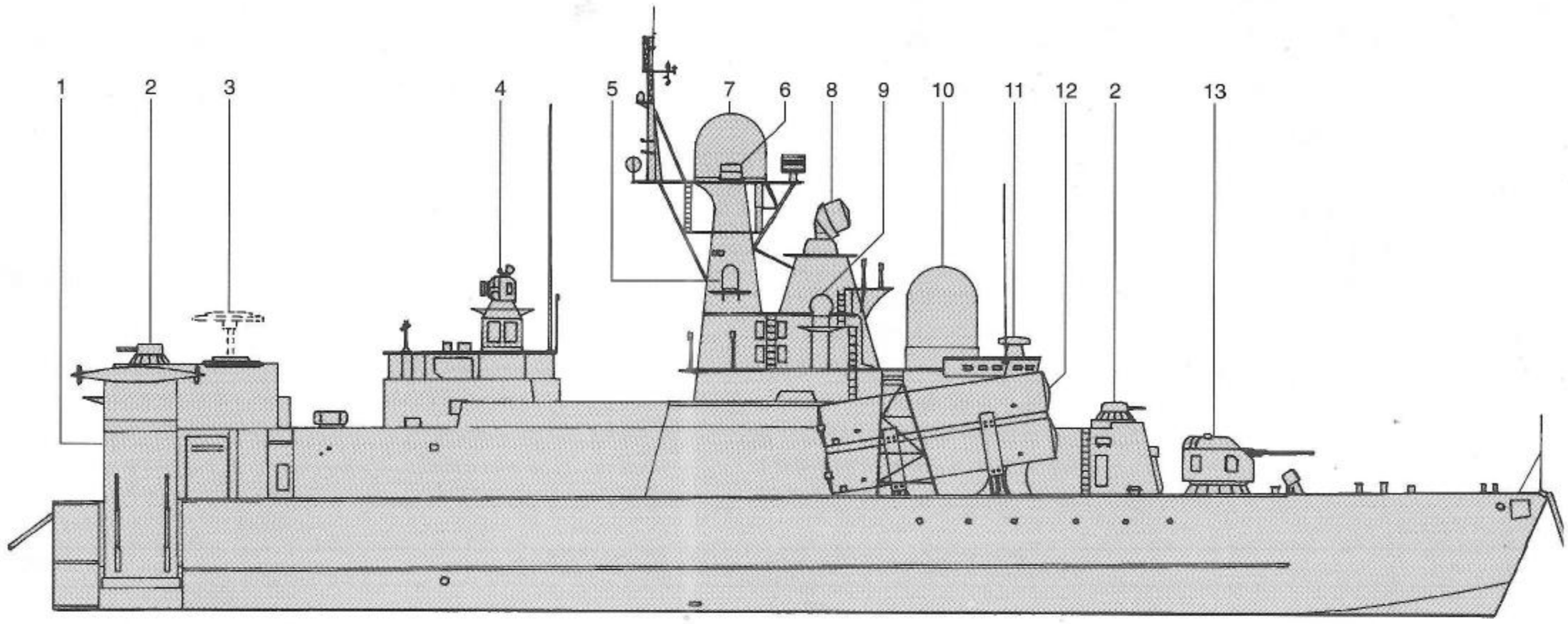
DEPLOYMENT

The missile servicing facilities in Aden were destroyed in an explosion in mid-1994. However, at least one of the class was still operational in 1996.



Yemeni Tarantul I *(Type 1241RE)*

DERGACH (SIVUCH) TYPE 1239



Bora (Ian Sturton)
1 *Retractable Z-drive* **2** *AK-630 30 mm/65 CIWS* **3** *SA-N-4 twin-arm launcher for SAM* **4** *Pop Group fire control* **5** *Light Bulb datalink* **6** *Half Hat* **7** *Cross Dome surface search radar* **8** *Bass Tilt fire control* **9** *Football A* **10** *Band Stand* **11** *Cheese Cake (SRN-207) navigation radar* **12** *SS-N-22 Sunburn (Moskit)* anti-ship missile launcher (total eight) **13** *AK-176M 76 mm/60 gun*

GENERAL SPECIFICATIONS

Operator: Russia
Type: Type 1239

Class: DERGACH

Built: 2
Active: 2

Displacement:
full load: 1,000 t

Dimensions
Length: 65.0 m (213.3 ft)
Beam: 18 m (59.0 ft)
Draught:
hullborne: 3.3 m (10.83 ft)
cushionborne: 1.1 m (3.61 ft)

Speed (calm water): 45 kts
Range:
cushionborne: 800 n miles at 40 kts
hullborne: 2,000 n miles at 12 kts

Complement: 60

SHIPS

BORA (MRK 27)

Built	Zelenodolsk 340, Russia
Launched	1987
Commissioned	1990

SAMUM (MRK 17)

Built	Zelenodolsk 340, Russia
Launched	1992
Commissioned	1994

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

SS-N-22 Sunburn (3M-80 Zubr)

There are two quad launchers for the SS-N-22 located either side of the bridge. SS-N-22 is an active radar homing, sea-skimming, anti-ship missile with a range of 110 km (60 n miles) and a cruising speed of Mach 2.5. It carries a 300 kg (661 lb) HE warhead, although nuclear warheads are presumably still stored ashore.

SS-N-22 is a ramjet-powered missile and the system is associated with the 'Band Stand' D/F-band (1-4 GHz) air and surface search radar with a fairly high data rate. This sensor is known to have a secondary tracking function for anti-ship missiles and is part of both the 'Siren' and 'Sunburn' fire-control system.

Data on the location of both launcher and target are fed into the missile from the fire-control system, the doors at the front and at the rear of the launcher cell are opened and the booster ignites. The missile may be launched to engage targets in a 120° arc based upon the ship's course. Once the missile clears the launcher the wings and tail surfaces deploy and the missile briefly rises then drops to a cruising altitude of 20 m (65.6 ft) by which time the ramjet is operating. The active radar seeker then searches for the target and homes upon it, until 'lock on' is achieved. In the event of jamming, the seeker has a home-on-jam capability.

The missile takes only 2 minutes to cover its full range and manufacturers claim that 1 to 2 missiles could incapacitate a destroyer, while 1 to 5 missiles could sink a 20,000 tonne merchantman. An extended range missile, 9M80E is now available.

Specifications

Length: 9.38 m (30.7 ft)
Diameter: 130 cm (4.2 ft)
Wing span: n/k
Weight: 3,950 kg (8,708 lb)
Speed: Mach 2
Range: 48 n miles (90 km); 65 n miles (120 km) in 3M80E
Guidance: Inertial

SURFACE-TO-AIR MISSILES (SAM)

SA-N-4 Gecko (Osa-M)

There is a single twin-arm launcher for the SA-N-4 semi-active radar homing missile, located at the stern. SA-N-4 has a range of 15 km (8 n miles) at a speed of Mach 2.5 and a total of 20 missiles is carried.

The missile loading and launching system is unusual, being of cylindrical construction and the twin-rail launcher retracts beneath the hinged flat cover plate between launches to reload. This is likely to restrict the firing rate of the system, which must be slowed even further by the need to close the magazine cover before each launch.

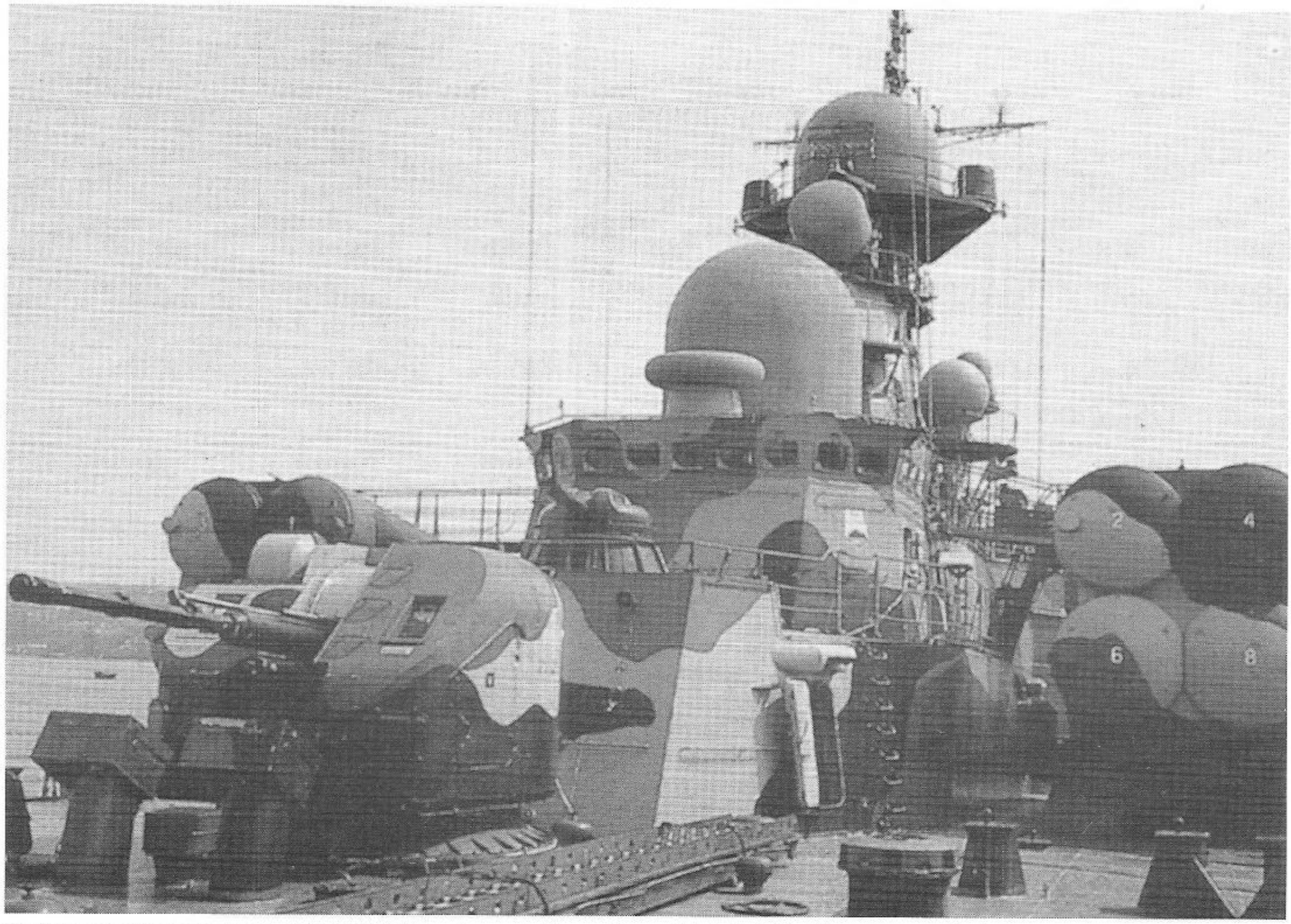
The launcher is about 5 m (16 ft) high, 4.2 m (13.7 ft) in diameter and has a 360° theoretical field of fire in azimuth and 90° in elevation. Below the launcher are four revolving drums each with five missiles while the electromechanical and hydraulic machinery is below that.

The Pop Group fire control system includes a frequency-agile monopulse radar, which has a parabolic rotating search antenna operating in H-band (6-8 GHz) with a typical acquisition range of 16 n miles (30 km). There are two J-band (10-20 GHz) antennas, one of them for a pulse Doppler target-tracking element with a range of 10.75 n miles (20 km) and the smaller parabolic antenna being used to track the missile. Above the prime antennas is a smaller, circular one which emits an I-band (8-10 GHz) uplink capture beam which gathers the missile shortly after launch. The director also has a small, rectangular command uplink emitter.

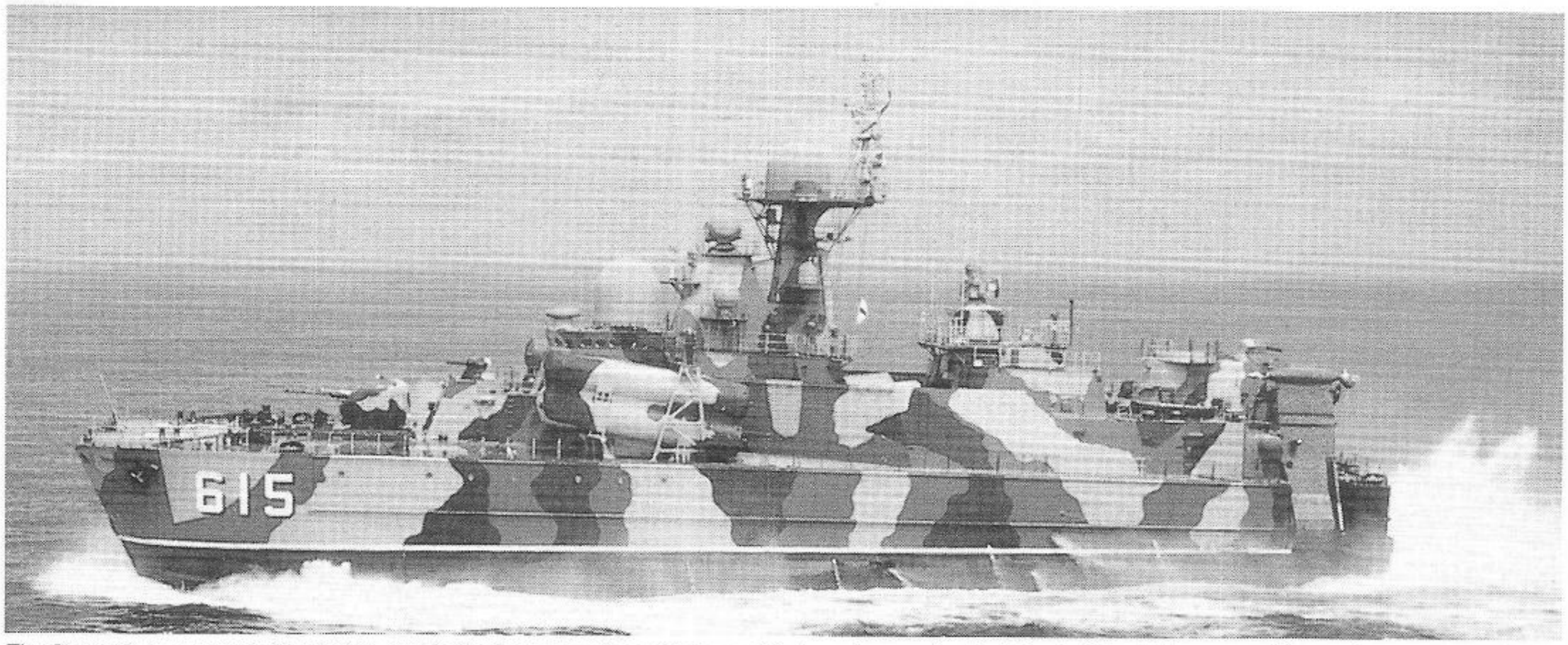
The engagement sequence is likely to see the target acquired by the air search radar. The data is then displayed on a panoramic display in the operator's console where it is designated either automatically or manually. The missile or missiles are launched and while one antenna automatically illuminates the target, the second tracks the missile and transmits command signals. The booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.5 km) then the sustainer burns for 15 seconds.

Specifications

Length: 3.1 m (10.1 ft)
Diameter: 21 cm (8.2 in)
Wing span: 64 cm (25 in)



The foredeck with the 76 mm gun and the SS-N-22 launchers; note the numbers, which indicate the firing sequence. The 'squashed mushroom' -shaped device on the bridge roof is Cheese Cake navigation radar and behind it are Cake Stand, Bass Tilt and Cross Dome. Note also the Football A to the right of Bass Tilt



The Dergach is a remarkable design and is the largest surface-effect warship to enter service. In this shot the Z-drive propulsion units are retracted. The armament is concentrated forward, with only a single AK-630 aft of the mast

Weight: 130 kg (287 lb)
Speed: Mach 2
Range: 0.75-8 n miles (1.5-15 km)
Height: 25-5,000 m
Guidance: Radar command

GUNS

AK-176M 76 mm (3 in)/60

There is one AK-176M 76 mm gun mounted on the foredeck. The AK-176M is designed for air defence, surface engagement and shore bombardment roles and is a four-man mounting which may be either operated from the weapon control centre or from a local control station. The barrel is cooled externally by taking seawater from the ship's fire main through a jacket which lies around the liner.

The AK-176M is part of a weapon control system based upon the H-band fire-control radar with the NATO designation 'Bass Tilt'. This radar is also associated with the AK-630 and the two appear to form an integrated weapon system. The radar director is mounted on a pedestal and has an antenna with drum-shaped radome inclined at an angle of approximately 45°. Local control is achieved semi-automatically using the Kondensor sight which is installed as a backup in the event of the failure of 'Bass Tilt'. It is a day-night sight which may be used to engage both surface and air targets. In the event of a power failure the crew may use the WD-221 optical sight. Some vessels appear to have the mounting in a stand-alone configuration supported by other fire-control radars.

Specifications

Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,214 ft/s)
Traverse: 360° at 35°/s
Elevation: −7 to +85° at 30°/s
Ammunition (total): 16 kg (35 lb)
Rate of fire: 120 rds/min

30 mm/65 AK 630

There are two 30 mm 65 calibre AK-630 Gatling close in weapon systems: one is before the bridge, the second on the stern. These have five roles, engaging anti-ship missiles, aircraft, small surface vessels, drifting mines and unprotected targets ashore. The AO-18 weapon is a water-cooled, six-barrelled, Gatling-principle weapon with fixed breech block and revolving barrels. The weapon is believed to operate in a similar manner to that of the Phalanx, firing bursts of up to 400 rounds, but unlike the US weapon AK-630 features a separate radar director.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,919 ft/s)
Cooling: Water
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range: 4,000 m (radar fire control), 5,000 m (electro-optic fire control)
Rate of fire: 4,000-5,000 rds/min
Magazine: 2,000 rounds
Weight of complete round: 1.22 kg (2.7 lb)
Ammunition types:
UOF-84 HE-I weight: 384 g (13.05 oz)
UOR-84 HE-T weight: 388 g (13.07 oz)
Fuze: MG-32 point impact (both rounds)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Foot Ball A and Half Hat

There are two Foot Ball A radomes and two Half Hats. All appear to serve an ESM or ECM purpose.

DECOYS

PK-16 and PK-10

There are two PK-16 and two PK-10 decoy launchers for chaff. PK-10 consists of KT-216 launchers, a control console and three munitions. The launcher is a 10-barrel unit, with the 120 mm barrels fixed at about 45°. The launcher appears to be turnable. The control console appears to be a relatively simple design capable of controlling up to four launchers and with simple controls. The munitions are all for seduction purposes. The SR-50 is a chaff round with a payload of 11 kg (24.2 lb). The SOM-50 is a heat-seeker/laser-guided missile seduction round with 7.3 kg (16 lb) payload while the SK.50 is a combined round with 9.1 kg (29.8 lb) of payload.

Manufacturer/Contractor

General Export for Defence, Moscow, Russian Federation.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Monolit

The Udaloy II is armed with the same SS-N-22 weapons system as the 'Dergach' class and has a remarkably similar sensor fit, indicating that the sensors serve similar purposes in the two ships. This suggests that the Dergach is fitted with the Monolit targeting system, which consists of the Band Stand missile tracker, the Light Bulb and Bell Nest datalinks

Light Bulb

There are two Light Bulb radomes, which appear to function both as data links to the missile and also to over-the-horizon target acquisition/trackers, such as aircraft.

Bell Nest

There is one Bell Nest datalink, purpose unknown.

Band Stand weapons control radar

Band Stand is the name given by NATO to the Russian D/E/F-band radar identified by its large dome-shaped radome, which appears on all ships armed with SS-N-22. It appears to possess target acquisition and missile control functions.

RADARS

Cross Dome

Cross Dome is an E/F-band air and surface search radar, which is under the large radome at the mast-head. It is also found on 'Parchim II' class frigates.

Bass Tilt

Bass Tilt is an H-band system with its director mounted on the pedestal immediately before the mast. Its antenna is drum-shaped, 1.2 m (3.9 ft) in diameter and is inclined at an angle of approximately 45°. The radar is linked to a ballistic computer and controls the two AK-630 gun mountings. There is usually a standby optical and/or electro-optical control system, the latter possibly based upon the sensor with the NATO code-name 'Tee Plinth', although no evidence of such a system has been seen on this ship.

Pop Group

Pop Group is the weapon control system for the SA-N-4 missile system and is located on the small plinth on the after deck. The director includes an acquisition radar with a long, curved antenna on top of the cab and two target trackers. The latter two are of different size, but presumably the smaller one performs a similar function to the larger, but at higher frequencies, which would enable them to direct two different missiles against the same target. The system operates in the F/H/I-band.

Cheese Cake SRN-207

The I-band navigation radar is a new type with an antenna totally enclosed in a flat-topped circular radome. It has the NATO reporting name 'Cheese Cake'.

Square Head Naval IFF System

The antenna of this shipborne system consists of a broadside array of dipoles with a rectangular reflector/support frame measuring about 1.4 m (4.6 ft) high by 2 m (6.5 ft) wide. It was originally thought to be a long wavelength search radar of modest power, but later evidence confirms that its function is that of an IFF interrogator antenna or directional array for transmission of guidance signals to surface-to-surface missiles. It is most frequently seen on the older types of CIS missile carrying boats and these carry two or four such arrays on sponsons fore and aft of the mainmast. Recent information strongly suggests that the system operates in G-band.

Salt Pot

Salt Pot is another IFF device.

PROPULSION

Specifications

System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 gas turbines, 40.6 MW (55,216 hp); 2 diesels, 7.4 MW (10,064 hp); 2 auxiliary diesels
Propellers: 2 fixed pitch propellers; 2 retractable Z-drives

FURTHER INFORMATION

PROGRAMME

These remarkable ships were built at Zelenodolsk 340, the first being launched in 1987 and commissioned in 1990, followed by the second, which was launched in 1992 and commissioned in 1994. The current two are operated by the Russian Navy but the type has been declared available for export. They are classified as PGGAs (Guided Missile Patrol Air Cushion Vessels).

DESIGN

The large Surface Effect Ships (SES) were designed by Central Marine design Bureau 'Almaz'. They are of twin hull design and are constructed of aluminium-magnesium alloy. They are powered by two gas turbines and two diesels, with two auxiliary diesels for hull-borne slow-speed travel. There are also two, twin-propeller Z-drives which are stowed vertically and swivel through 180° to propel the ship when cushionborne.

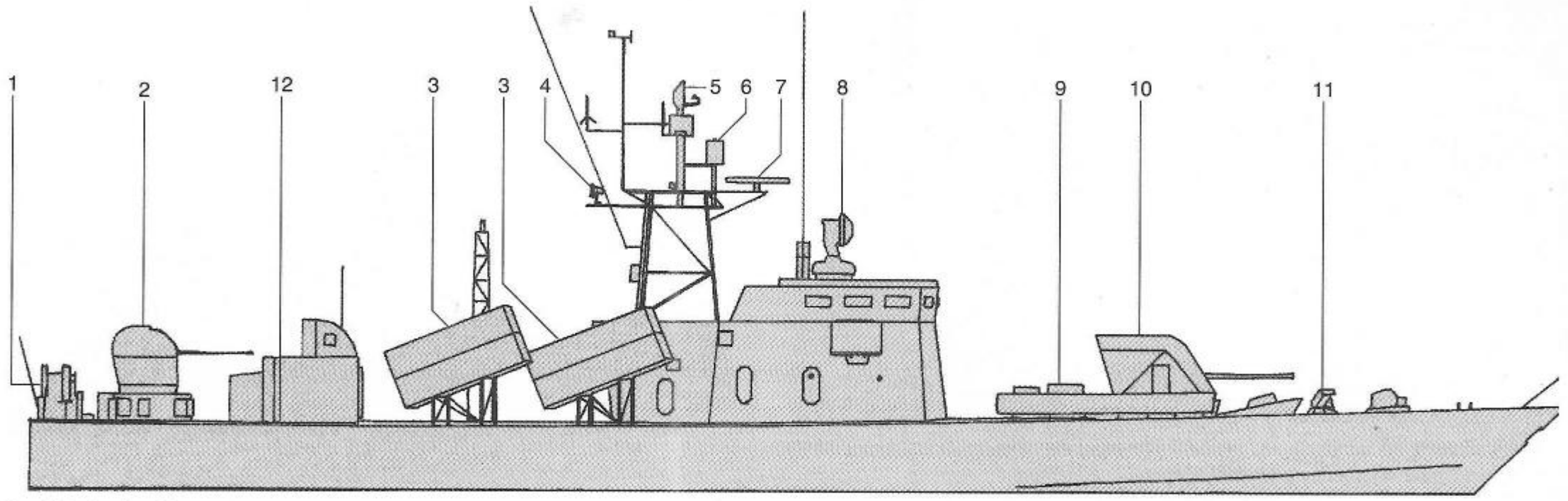
DEPLOYMENT

Bora is based in the Black Sea at Sevastopol and *Samum* in the Baltic.

FUTURE

The design is reported to be unreliable and plans to build more have been shelved. Nevertheless, this is a remarkably imaginative design, full of innovations, with a heavy weapons and sensor fit on a corvette-sized hull.

STOCKHOLM



Stockholm (Ian Sturton)
1 *Thomson-CSF TSM 2642 Salmon VDS* **2** *Bofors 40 mm/70* **3** *Saab RBS 15 Mk II (total eight) anti-ship missiles* **4** *CelsiusTech 9LV 100 electro-optic director* **5** *CelsiusTech Sea Giraffe 50HC air/surface search radar* **6** *Argo Systems AR 700 radar intercept* **7** *Terma PN612 navigation radar* **8** *CelsiusTech 9LV 200 Mk 3 fire-control radar* **9** *Two 533 mm (21 in) torpedo tubes* **10** *Bofors 57 mm/70 Mk 2 automatic gun* **11** *Saab Elma LLS-920 nine-tube ASW mortar* **12** *Two 400 mm (15.75 in) torpedo tubes*

GENERAL SPECIFICATIONS

Operator: Sweden
Type: Guided missile corvette

Class: STOCKHOLM

Built: 2
Active: 2

Displacement:
standard: 310 t
full load: 335 t

Dimensions
Length: 50 m (164 ft)
Beam: 7.5 m (24.6 ft)
Draught: 2.1 m (6.9 ft)

Speed: 32 kts (gas turbine); 20 kts (diesel)

Complement: 30 (7 officers)

SHIPS

STOCKHOLM (K 11)

Builder	Karlskronavarvet, Karlskrona, Sweden
Laid down	1 Aug 1982
Launched	24 Aug 1984
Commissioned	22 Feb 1985

MALMÖ (K 12)

Builder	Karlskronavarvet, Karlskrona, Sweden
Laid down	14 Mar 1983
Launched	22 Mar 1985
Commissioned	10 May 1985

WEAPONS SYSTEMS

WEAPONS FIT

The forward weapons are permanently installed — one 57 mm gun and two 533 mm (21 in) torpedo tubes — as is the single 40 mm cannon aft. The remainder has, however, been designed to be interchangeable. Thus, either eight, four or no RBS-15 SSM launchers can be mounted as can either two additional 533 mm (21 in) or four 400 mm torpedo tubes, or mine rails for 40 mines.

SURFACE-TO-SURFACE MISSILES (SSM)

Saab RBS-15 Mk II

The 'Stockholm' class can carry a maximum of four twin launchers for the Saab RBS-15 Mk II anti-ship missile, mounted in four pairs at the after end of the superstructure. The RBS-15 Mk II missile system features inertial guidance and active radar homing to 54 n miles (100 km) at Mach 0.8. In the missile's nose is the CelsiusTech 9GR400 monopulse J-band (12-18 GHz), broadband, frequency-agile radar, which has two operator-selected modes: active or active/passive lock on. The ship system is operated by one man and consists of control and display panels, a computer, launcher switching units and power supply.

The system receives data from ship sensors, ship fire-control system or from external sensors on land, sea or air. The fire-control panel and the computer are in the ship's combat information centre. The combat mode has preparation and firing sub-modes with the former offering automatic and/or manual selection for target data, missile readiness, tactical parameters and salvo numbers. The tactical parameters' data includes seeker search pattern, target selection logic and trajectory. There is a separate selection of the distance the missile will travel in the high-level cruise phase. Using this and other data, the system calculates missile heading, seeker parameters, tactical boundaries and the time to the point when the missile will enter the low-level cruise phase.

The firing sub-mode is initiated manually but the selected missiles are automatically activated and their container doors are automatically opened. The system compensates for ship motion and ignites the boost motors which burn for approximately three seconds before being jettisoned. As the missile reaches its maximum altitude the turbojet is activated and the missile turns towards the target, the maximum offset being about 90°. It then enters a predetermined high-level cruise phase, which allows it to overfly islands, then descends to the low-level cruise phase. At an appropriate distance from the target the seeker is activated and the predetermined search pattern is adopted. Once the seeker has locked on to the target the missile can then enter its terminal sea-skimming phase.

Specifications

Length: 4.33 m (14.2 ft)
Diameter: 50 cm (19.7 in)
Wing span: 1.4 m (4.6 ft) (unfolded)
Weight (without boosters): 626 kg (1,380 lb)
Speed: In excess of Mach 0.8
Range: 54 n miles (100 km)
Warhead: 200 kg (441 lb) HE (blast fragmentation)

Manufacturer/Contractor

CelsiusTech, Sweden.

TUBES

533 mm (21 in) tubes

There are two fixed 533 mm (21 in) torpedo tubes on the foredeck, one on either side, facing outwards at an angle of about 20°. A further two 533 mm tubes can be mounted aft.

400 mm (15.75 in) torpedo tubes

A maximum of four 400 mm (15.75 in) torpedo tubes can be mounted.

TORPEDOES

FFV Tp 613 533 mm (21 in) heavyweight torpedo

The Tp 613 is a wire-guided weapon with passive homing and a range of 8.2 n miles (15 km) at 45 knots. TP 613 is one of the Tp 61 family of long-range torpedoes with HTP (high-test peroxide) propulsion. Two speeds can be selected before launch and can be changed during the run.

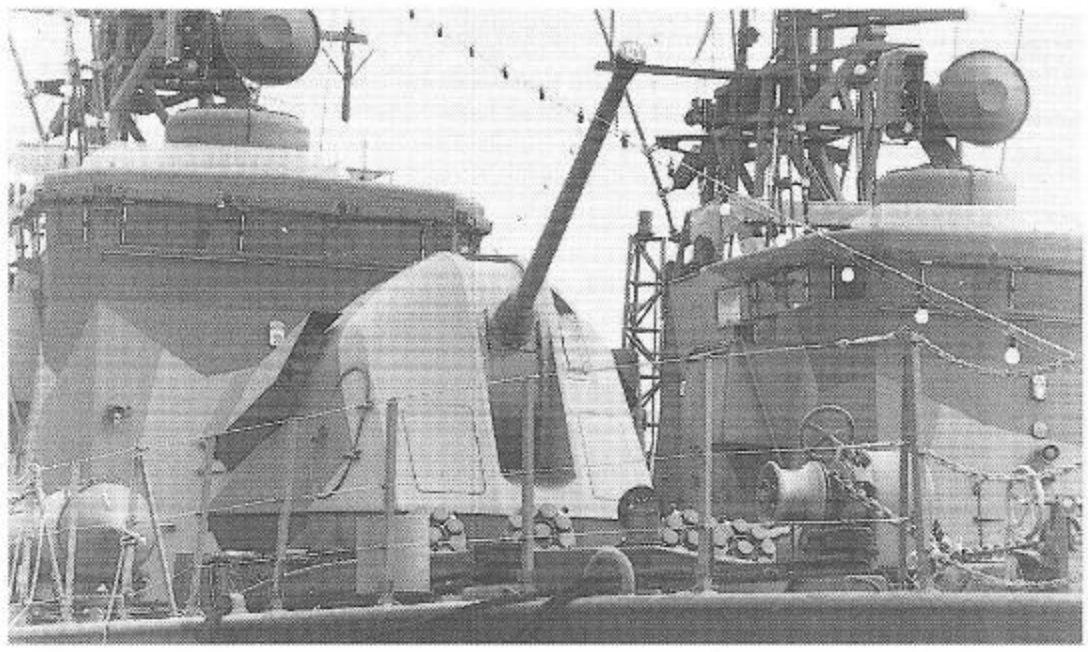
Specifications

Length: 6.98 m (22.9 ft)
Diameter: 533 mm (21 in)
Weight: 1,860 kg (4,100 lb)
Warhead: 240 kg (529 lb)
Speed: 45 kts

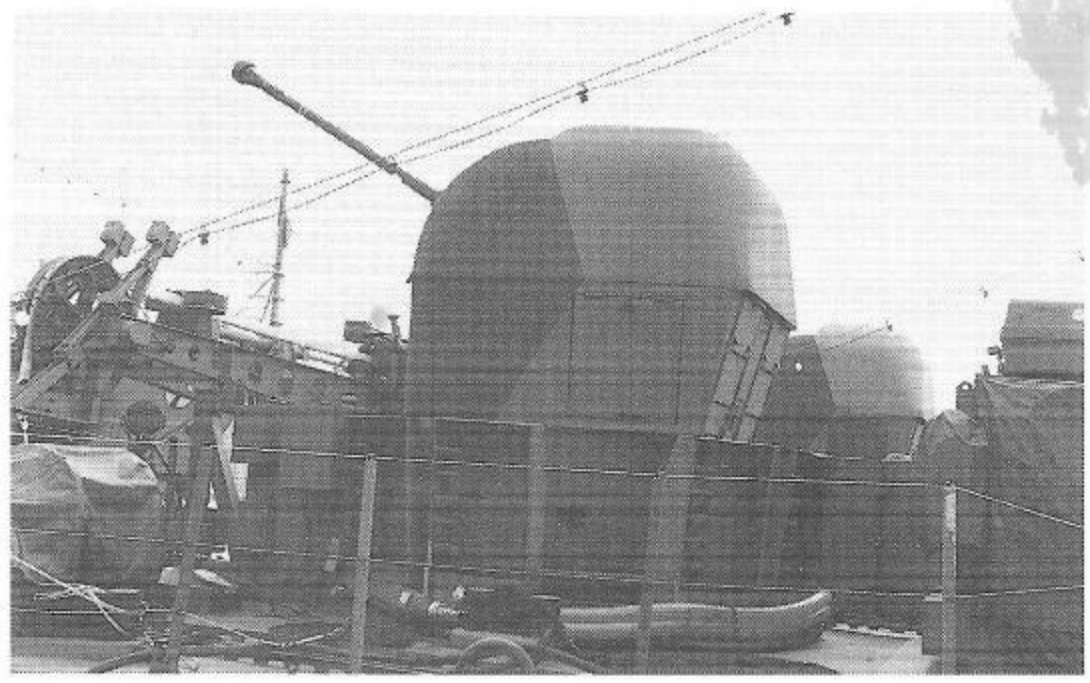
Manufacturer/Contractor

FFV, Sweden.

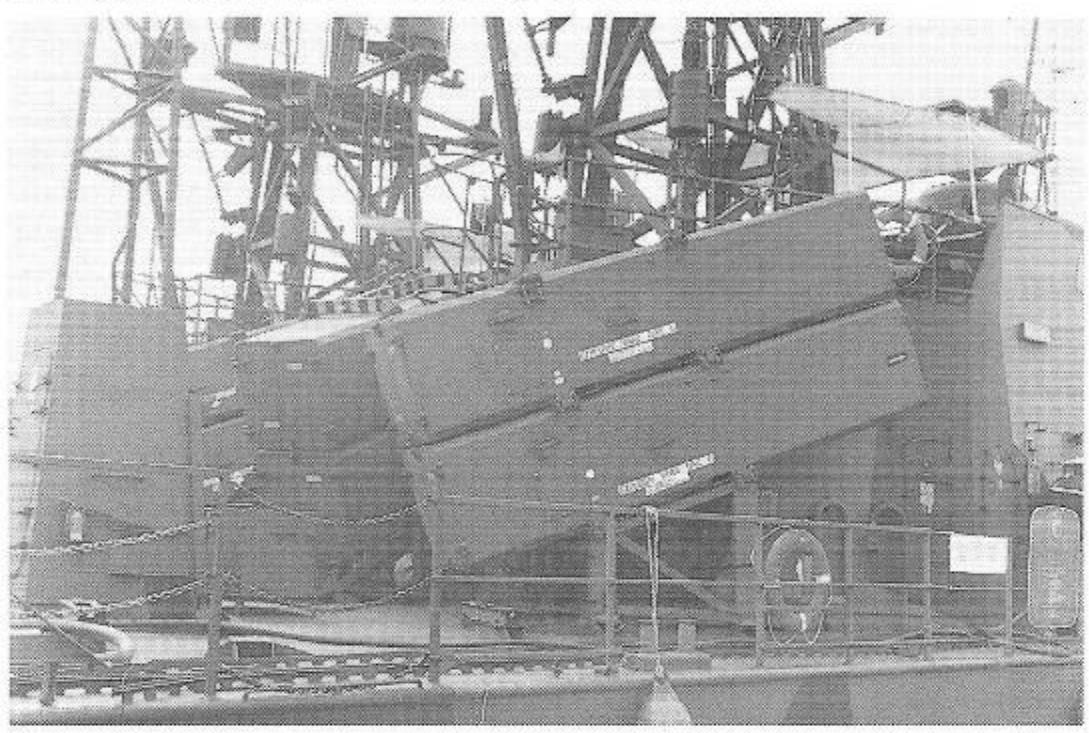
Weapons aboard Malmö *(K 12) (H M Steele)*



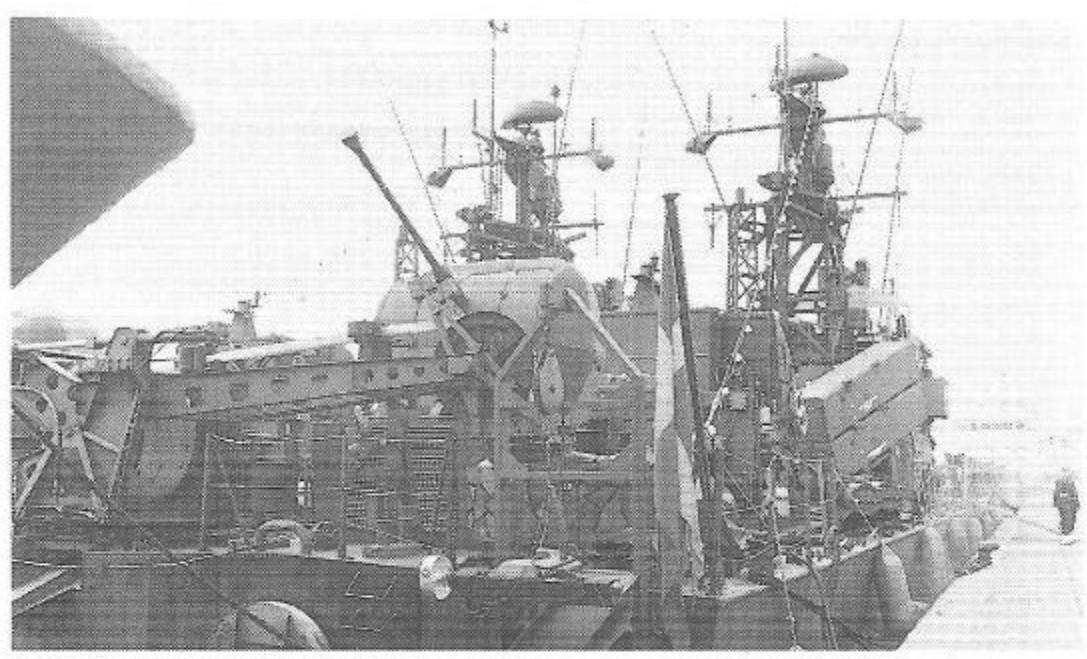
Bofors 57 mm/70 Mk 2 with rocket flares on the side of the gun house. In front of the gun are four Saab Elma ASW grenade launchers



Bofors 40 mm/70 automatic anti-aircraft gun



Saab RBS-15 Mk II anti-ship missile launchers



Stern view showing crane for Thomson-CSF TSM 2642 variable depth sonar, Bofors 40 mm gun, Saab RBS-15 missiles, and below the missile tubes, two 400 mm torpedo tubes

FFV Tp43 400 mm (15.75 in) torpedo

The Tp43 torpedo is a lightweight multirole weapon derived from the Tp41 and Tp42. The weapon is equipped with a 50 kg (110 lb) warhead and three-bladed contrarotating propellers. The propulsion system is based on a SAFT silver/zinc oxide battery. The combination of homing and wire guidance is claimed to result in a very high hit probability. Three different speeds are selectable during the run.

Specifications

Length: 2.64 m (8.66 ft)
Diameter: 400 mm (15.75 in)
Weight: 280/310 kg (617/683 lb) (min/max) including battery and guidance wire
Warhead: 45 kg (99 lb) shaped charge HE
Propulsion: Electric

Manufacturer/Contractor

FFV, Sweden.

GUNS

Bofors SAK 57 L/70 Mk 2

There is a single Bofors SAK 57 L/70 Mk 2 in 'A' position. This is intended to engage air and surface targets and to provide gunfire in support of troops ashore. It is housed inside a 'stealthy' shield.

Specifications

Calibre: 57 mm
Length of barrel: 70 calibres
Traverse: 360° at 55°/s
Elevation: −10 to +77° at 40°/s
Crew: 3
Range: 9 n miles (17 km)
Rate of fire: 220 rds/min
Projectile weight: 2.4 kg (5.3 lb)

Bofors 40 mm L/70

One single Bofors 40 mm anti-aircraft gun is mounted on a platform on the after deck. It has a Glass-Reinforced Plastic (GRP) shield.

Specifications

Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000-1,025 m/s (3,280-3,362 ft/s)
Range:
anti-surface: 6.75 n miles (12.5 km)
anti-air (nominal): 6,900 m (22,630 ft)
Rate of fire: 300 rds/min (practical)
Ammunition: 2.21 kg (4.9 lb)

Manufacturer/Contractor

Bofors Weapon Systems, Sweden.

ANTI-SUBMARINE MORTARS

Saab Elma LLS-920 incident weapon

Four nine-tubed launchers for the Elma ASW grenade. This weapon launches a grenade with a 4.2 kg (9.26 lb) warhead over a range of 350 m (1,148 yd), and was developed to counter submarine incursions in Swedish waters. It is intended to be capable of forcing a submarine to the surface rather than destroying it in the manner of a torpedo; hence the designation 'incident weapon.' Thus, the concept is to dissuade a submarine from entering Swedish waters without the political consequences of destroying it.

The LLS-920 non-magnetic, nine-tube Elma launchers are loaded from the muzzle, with firing initiated from the Combat Information Centre (CIC). A variety of programmable patterns result in carpets of 9, 18, 27 and 36 grenades. The Elma grenade is equipped with a shaped charge warhead the blast jet of which is capable of penetrating a submarine's pressure hull after passing through the water-filled superstructure.

Specifications

Launcher weight: 103 kg (227 lb)
Tube calibre: 100 mm (4 in)
Grenade weight: 4.35 kg (9.6 lb)
System range: 250-350 m (820-1,148 ft)

Manufacturer/Contractor

Saab, Sweden.

DEPTH CHARGES

Depth charges can be carried on and laid from the mine rails.

MINES

A maximum of 40 mines can be laid from the mine rails, if other weapons are removed.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

ARGOSystems AR 700 APECS II radar detection and jamming system

AR 700 APECS II is an advanced modular ESM/ECM system covering frequencies from 0.5 to 18 GHz, which is designed to counter most known radar threats. It is a fully automatic system, identifying and jamming threat emitters using a mixture of IFM receivers and microprocessor-controlled jammers, with high-speed switching enabling up to 16 threats to be jammed simultaneously. The antenna array consists of a mast-mounted ESM antenna assembly with two DF arrays, one omnidirectional unit and two monopulse units; system processing equipment; operator's console and two ECM transmitters (port and starboard) with their antenna systems located inside the transmitter units.

Specifications
ESM frequency coverage: 0.5-18 GHz
High sensitivity: Up to −67 dBm
Detection range: 200 n miles (ships); 50 n miles (aircraft)
DF accuracy: 4° RMS; 2° RMS fine DF
Automatic tracking: 500 active signals in dense signal environment
Signal identification speed: <1s
ECM azimuth coverage: 360° using a 60-beam jammer (one beam per 6° azimuth sector)
Radiated power: 180 kW nominal mid-band
ECM frequency coverage: 7.5-18 GHz

Manufacturer/Contractor
ARGOSystems Inc, Sunnyvale, California, USA.

ELECTRONIC COUNTERMEASURES (ECM)

CelsiusTech 9CM/9EW Philax
The 9CM/9EW system in the 'Stockholm' class is based upon two Philax fixed launchers, each of which consists of four magazines similar to those used in Dagaie with Lacroix munitions. Usually the magazines contain chaff munitions but one may be replaced by an infra-red (IR) munitions magazine. Each chaff magazine has 36 × 40 mm grenades, each weighing 0.35 kg (0.77 lb), with a 0.175 kg (0.38 lb) payload. They are fired at intervals of 0.1 second per group and within 1 second begin to create a cloud with a 1,000 m² radar cross-section, which is complete within up to 5 seconds at a height of 40 to 60 m (131 to 197 ft). The IR container is 131 × 468 × 357 mm and weighs 28.5 kg (63 lb), the munitions covering the 3-5 and 8-14 µm bands.

Specifications
Launchers
Length: 87.5 cm (2.9 ft)
Height: 72 cm (2.4 ft)
Width: 95 cm (3.1 ft)
Weight (unloaded): 180 kg (397 lb)

Control Unit
Length: 32.9 cm (1 ft)
Height: 40.8 cm (1.3 ft)
Width: 49 cm (1.6 ft)
Weight: <20 kg (<44 lb)
Power requirement: 220/115 V, 50/60 Hz

Manufacturer/Contractor
CelsiusTech, Sweden.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

CelsiusTech MARIL 880 command and fire-control system
The MARIL 880 Command and Control Information System (CCIS) is designed to provide ships ranging in size from offshore patrol vessels to destroyers with target detection, identification and tracking facilities together with movement prediction, threat evaluation, weapon co-ordination and unit deployment. There is an optional torpedo fire-control element and the CCIS has built-in facilities for simulation and training. The system features a mainframe architecture using two Censor 932E 32-bit computers with a memory of up to 512 k. One of the computers provides redundancy and the peripherals include an input/output device, data recorder and either a printer or a plotter. Software is written in the Assembler language and involves some 240,000 lines of code.

The system is linked through a single or duplicated CCIS bus to the display system, up to four radars (through a plot extractor), weapon control systems, navigation and communications systems. A datalink terminal is incorporated in the system. The consoles present a raw radar picture with track symbols, labels and bearing-vector lines. They are primarily for compiling the tactical situation as well as for target allocation to weapon systems. They can also be used for weapon co-ordination and control. The MCI which allows the selection of one of four radars and one of the three video channels consists of a roller ball, 11 function keys (each of which may have 12 functions), together with page select, mode select, display select and alphanumeric keys.

Manufacturer/Contractor
CelsiusTech, Sweden.

WEAPONS CONTROL

CelsiusTech 9LV 300
The weapons control system is based on the Mk 2/2.5 derivatives of the 9LV 200 Mk1/2. It uses electro-optical and computing elements from the 9LV 100 electro-optic director. It can engage two air targets simultaneously and for surface engagements, using surface-to-surface missiles, it features a track while scan capability.

Manufacturer/Contractor
CelsiusTech, Sweden.

RADARS

Ericsson Sea Giraffe 50 HC
The Sea Giraffe is used for air and surface search, with the antenna sited at the masthead.

Specifications
Operating frequency: G/H-band
Output power: 60 kW; average power 1,200 W
Antenna rotation rate: 60/30 rpm
Instrumented range: 25, 50, 100 and 150 km
Tracking capacity: More than 30 automatically initiated air targets; more than 50 manually initiated surface targets
Antenna sidelobe levels: −45 dB
Beamwidth bearing: 1.8°
Elevation coverage: 0-70°

Manufacturer/Contractor
CelsiusTech, Sweden.

PN-612
PN-612 is one of the Skanter range of I-band navigation radars.

Manufacturer/Contractor
Terma Elektronik, Denmark.

9LV 200 Mk 3 Sea Viking radar/electro-optic director
There are two Sea Viking directors which control the guns, controlling different weapons in sequence, and with an automated air defence function for use against multiple targets. It takes sensor data, evaluates the threat and automatically deploys the most effective hard or soft kill countermeasure to neutralise each target. The prime sensor is a tracking Ku/J-band radar with stabilised cassegrain monopulse antenna and travelling-wave tube transmitter which operates in the 15.9-17.1 GHz frequency range and permits the combination of pulse Doppler-MTI operation with batch-to-batch frequency agility. Pulse-to-pulse frequency agility is retained for use when return suppression is not required. The radar may be supplemented by a range of electro-optical sensors including a Si-Vidicon CCIR-compatible TV camera with 300 mm lens and 42 × 31 mrad field of view, an 8-12 µm infra-red camera using Cadmium Mercury Telluride detectors with closed-cycle Sterling cooling and fields of view of 52 × 35 mrad and 157 × 105 mrad. There may also be a 1.06 µm Nd:YAG laser rangefinder with a peak power of 4 MW and a PRF of 10 Hz.

Manufacturer/Contractor
CelsiusTech, Sweden

SONARS

Simrad SA 950
The hull-mounted Simrad SA 950 is normally employed as a mine-avoidance sonar, but it appears that in this class it is used as an active attack sonar.

Manufacturer/Contractor
Simrad, Norway.

TSM 2642 Salmon
TSM2642 Salmon is a compact, active, Variable-Depth Sonar (VDS), based on an acoustic array of 24 staves in a streamlined fish, with a towing winch, transmitter and receiver unit and operator console with colour display. Embedded facilities include passive listening, sound ray tracer, integrated onboard simulator, and acoustic propagation prediction.

Specifications
Acoustic array: 24 identical staves of 7 transducers, weight 260 kg (573 lb)
Frequency: 19 kHz approximately
Transmitter: Omnidirectional transmission in CW and FM modes
Receiver: 36 preformed beams; advanced processing coherent in FM with pulse compression and spectrum analysis (FFT) in CW

Manufacturer/Contractor
Thomson-CSF, France.

PROPULSION

Specifications
System: Combined diesel and gas turbine (CODAG)
Main machinery: 1 General Motors/Allison 570-KF gas turbine 4.74 MW (6,540 hp); 2 MTU 16V 396 TB93 diesels 3.1 MW (4,200 hp)
Shafts: 3

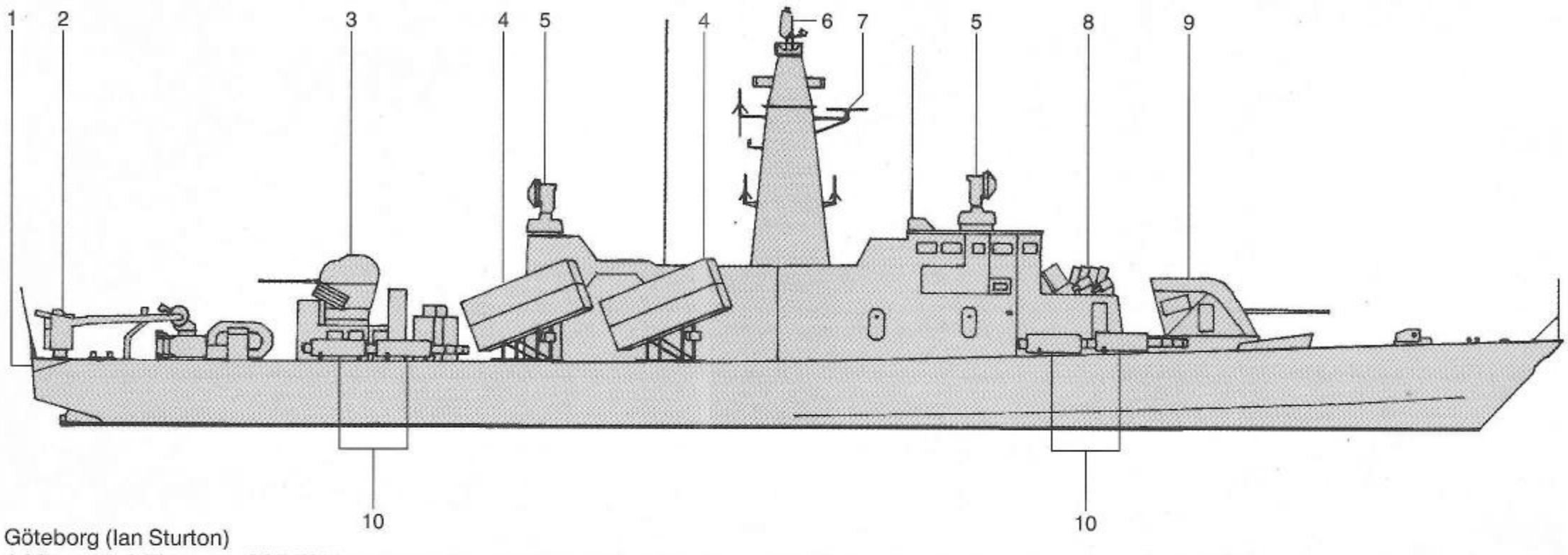
FURTHER INFORMATION

PROGRAMME
The order for this class of two was placed in September 1981.

DESIGN
The design was developed from the 'Spica II' class.

MODERNISATION
The RBS-15 missile system was upgraded to Mk II standard from 1994.

GÖTEBORG



Göteborg (Ian Sturton)
1 *Mine rails* **2** *Thomson CSF TSM 2643 variable depth sonar* **3** *Bofors 40 mm/70 (Bofors Sea Trinity in one ship)* **4** *Saab RBS 15 twin launcher (eight missiles)* **5** *Bofors 9LV 200 Mk 3 Sea Viking electro-optic director* **6** *CelsiusTech Sea Giraffe 150 HC air/surface search radar* **7** *Terma PN-12 navigation radar* **8** *Saab Elma LLS-920 nine-tube ASW mortars* **9** *Bofors 57 mm/70 Mk 2 gun* **10** *FFV 400 mm torpedo tubes (aft facing)*

GENERAL SPECIFICATIONS

Operator: Sweden
Type: Guided missile corvette

Class: GÖTEBORG

Built: 4
Active: 4

Displacement:
standard: 330 t
full load: 399 t

Length: 57 m (187 ft)
Beam: 8 m (26.2 ft)
Draught: 2 m (6.6 ft)

Speed: 30 kts

Complement: 36 (9 officers) plus 4 spare berths

SHIPS

GÖTEBORG (K 21) (Gbg)*

Builder	Karlskronavarvet, Karlskrona, Sweden
Laid down	10 Feb 1987
Launched	14 Apr 1989
Commissioned	15 Feb 1990

GÄLVE (K 22) (Gle)*

Builder	Karlskronavarvet, Karlskrona, Sweden
Laid down	21 Mar 1988
Launched	23 Mar 1990
Commissioned	1 Feb 1991

KALMAR (K 23) (Kmr)*

Builder	Karlskronavarvet, Karlskrona, Sweden
Laid down	21 Nov 1988
Launched	1 Nov 1990
Commissioned	1 Sep 1991

SUNDSVALL (K 24) (Svl)*

Builder	Karlskronavarvet, Karlskrona, Sweden
Laid down	20 Nov 1989
Launched	29 Nov 1991
Commissioned	7 July 1993

* Three letter groups in brackets are the Swedish pennant designators

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Saab RBS 15

The 'Göteborg' class has four twin launchers for the Saab RBS anti-ship missile mounted in four pairs at the after end of the superstructure. The RBS 15 missile system features inertial guidance and active radar homing to 37.8 n miles (70 km) at Mach 0.8, although the missiles are about to be upgraded to Mk II standard which will increase their range to 60 n miles (110 km). In the missile's nose is the CelsiusTech 9GR400 monopulse J-band (12-18 GHz) seeker. The broadband, frequency-agile radar with its digital processing is claimed to provide a high Electronic Counter CounterMeasures (ECCM) performance. The seeker has two modes which may be selected by the operator; active or active-passive lock on. The ship system is operated by one man and consists of control and display panels, a computer, launcher switching units and power supply. The system receives data from ship sensors, ship fire-control system or from external sensors on land, sea or air. The fire-control panel and the computer are in the ship's combat information centre.

There are three modes of operation; test, simulation and combat. The combat mode has preparation and firing sub-modes with the former offering automatic and/or manual selection of target data, missile readiness, tactical parameters and salvo numbers. The tactical parameters' data includes seeker search pattern, target selection logic and trajectory. There is a separate selection of the distance the missile will travel in the high-level cruise phase. Using this and other data the system calculates missile heading, seeker parameters, tactical boundaries and the time to the point when the missile will enter the low level cruise phase.

The firing sub-mode is initiated manually but the selected missiles are automatically activated and their container doors are automatically opened. The system compensates for ship motion and ignites the boost motors which burn for approximately three seconds before being jettisoned. As the missile reaches its maximum altitude, the turbojet is activated and the missile turns towards the target, the maximum offset being about 90°. It then enters a predetermined high-level cruise phase, which allows it to overfly islands, then descends to the low-level cruise phase.

At an appropriate distance from the target the seeker is activated and the predetermined search pattern is adopted. Once the seeker has locked on to the target the missile can then enter its terminal sea-skimming phase.

Specifications

Length: 4.33 m (14.2 ft)
Diameter: 50 cm (19.7 in)
Wing span: 1.4 m (4.6 ft) (unfolded)
Weight (without boosters): 626 kg (1,380 lb)

Speed: In excess of Mach 0.8
Range: In excess of 38 n miles (70 km)
Warhead: 200 kg (440 lb) HE (blast fragmentation)

Manufacturer/Contractor

CelsiusTech, Sweden.

TUBES

400 mm (15.75 in) torpedo tubes

There are four 400 mm (15.75 in) torpedo tubes, all on the starboard side, and all firing aft at an angle of about 20° to the centreline. One pair of tubes is abreast the bridge and one pair on the quarter deck.

TORPEDOES

Bofors 400 mm, Tp 43, anti-submarine torpedoes

The Tp 43 torpedo is a multirole weapon derived from the Tp 41 and Tp 42. The weapon is equipped with a 50 kg (110 lb) warhead and three-bladed contrarotating propellers. The propulsion system is based on a SAFT silver/zinc-oxide battery. The combination of homing and wire guidance is claimed to result in a very

Gälve *(K 22). Note the RBS 15 anti-ship missile launchers and the Bofors 40 mm automatic mount. On the stern is the cable reel and fish for the Thomson-CSF TSM 2643 Salmon VDS* (Jane's/H M Steele)

Gälve *(K 22). The Bofors 57 mm/70 Mk 2 is in a 'stealthy' housing and has flare launchers on the side. On the platform above the gun is a Saab Elma ASW mortar, together with four CelsiusTech Philax flare/chaff launchers* (Jane's/H M Steele)

high hit probability. Three different speeds are selectable during the run.

Specifications
Length: 2.64 m (8.6 ft)
Diameter: 400 mm(15.7 in)
Weight: 280/310 kg (617/683 lb) (min/max) including battery and guidance wire
Warhead: 45 kg (99 lb) shaped charge HE
Propulsion: Electric

Manufacturer/Contractor
Bofors Underwater Systems, Sweden.

GUNS

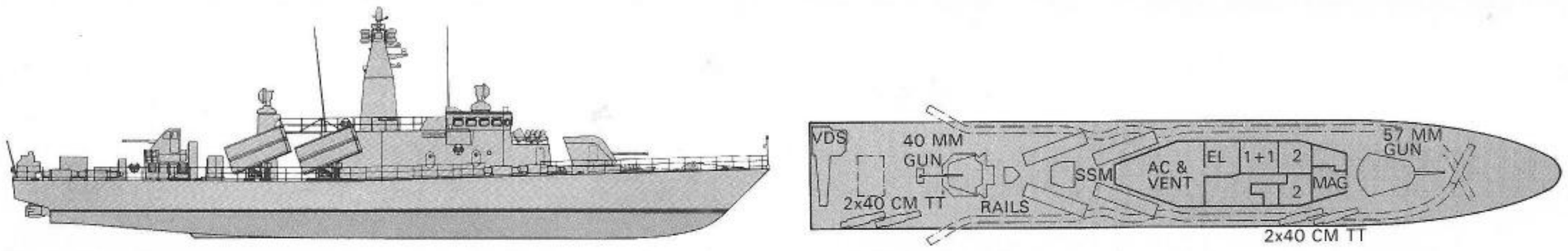
Bofors SAK 57 L/70 Mk 2
There is a single Bofors SAK 57 L/70 Mk 2 in 'A' position. This is intended to engage air and surface targets and to provide gunfire in support of troops ashore. It is housed inside a 'stealthy' shield.

Specifications
Calibre: 57 mm
Length of barrel: 70 calibres
Traverse: 360° at 55°/s
Elevation: −10 to +77° at 40°/s
Crew: 3
Range: 9 n miles (17 km)
Rate of fire: 220 rds/min
Projectile weight: 2.4 kg (5.3 lb)

Bofors 40 mm/70
One single Bofors 40 mm anti-air gun is mounted on a platform on the after deck.

It has a Glass-Reinforced Plastic (GRP) shield.

Specifications
Calibre: 40 mm
Length of barrel: 70 calibres



Views of 'Göteborg' class showing the location of the torpedo tubes and the mine rails (CelsiusTech)

Muzzle velocity: 1,000 - 1,025 m/s (3,280-3,362 ft/s)
Range:
anti-surface: 6.75 n miles (12.5 km)
anti-air (nominal): 6,900 m (22,600 ft)
Rate of fire: 300 rds/min (practical)
Ammunition: 2.21 kg (4.9 lb)

Manufacturer/Contractor
Bofors Weapon Systems, Sweden.

ANTI-SUBMARINE MORTARS

Saab Elma LLS-920
There are four nine-tubed Elma LLS-920 launchers on a small platform deck immediately ahead of the bridge. Described officially as an 'incident weapon,' the LLS-920 was developed to counter submarine incursions in Swedish waters and is designed to force a submarine target to the surface, thus avoiding the political consequences of destroying it. The non-magnetic, nine-tube LLS-920 launchers are loaded from the muzzle and firing is initiated from the Combat Information Centre (CIC), using programmable patterns of 9, 18, 27 and 36 grenades. The Elma grenade has a shaped-charge warhead, which is designed to penetrate a submarine's pressure hull after passing through the water-filled superstructure.

Specifications
Launcher weight: 103 kg (227 lb)
Tube calibre: 100 mm
Grenade weight: 4.35 kg (9.6 lb)
System range: 250-350 m (820-1,148 ft)

DEPTH CHARGES

Depth charges are carried on the mine rails in place of mines.

MINES

All four ships have a minelaying capability.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

ARGOSystems APECS-II radar detection and jamming system
APECS-II (Advanced Programmable Electronic Countermeasures System) is a modular ESM/ECM system covering frequencies from 0.5 to 18 GHz, which is designed to counter most known radar threats. It is a fully automatic system, identifying and jamming threat emitters using a mixture of IFM receivers and microprocessor-controlled jammers, with high-speed switching enabling up to 16 threats to be jammed simultaneously. The antenna array consists of a mast-mounted ESM antenna assembly with two DF arrays, one omnidirectional unit and two monopulse units; system processing equipment; operator's console and two ECM transmitters (port and starboard) with their antenna systems located inside the transmitter units.

Specifications
ESM frequency coverage: 0.5-18 GHz
High sensitivity: Up to −67 dBm
Detection ranges: Ships — 200 n miles; aircraft — 50 n miles
DF accuracy: 4° RMS; 2° RMS fine DF
Automatic tracking: 500 active signals in dense signal environment
Signal identification speed: <1s
ECM azimuth coverage: 360° using a 60-beam jammer (one beam per 6° azimuth sector)
Radiated power: 180 kW nominal mid-band
ECM frequency coverage: 7.5-18 GHz

Manufacturer/Contractor
ARGOSystems Inc, Sunnyvale, California, USA.

ELECTRONIC COUNTERMEASURES (ECM)

CelsiusTech Philax
The 9CM/9EW system in the 'Göteborg' class is based upon the Philax fixed launcher, which consists of four magazines similar to those used in Dagaie with Lacroix munitions. Usually the magazines contain chaff munitions but one may be replaced by an infra-red (IR) munitions magazine. Each chaff magazine has 36 × 40 mm (1.4 × 1.6 in) grenades, each weighing 0.35 kg (0.8 lb), with a 0.175 kg (0.4 lb) payload. They are fired at intervals of 0.1 second per group and within 1 second begin to create a cloud with a 1,000 m² radar cross-section, which is complete within <5 seconds at a height of 40-60 m (131-197 ft). The IR container is 131 × 468 × 357 mm (5.1 × 18.4 × 14 in and weighs 28.5 kg (63 lb).

Specifications
Launchers
Length: 87.5 cm (2.8 ft)
Height: 72 cm (2.3 ft)
Width: 95 cm (3.1 ft)
Weight (unloaded): 180 kg (397 lb)

Control Unit
Length: 32.9 cm (13 in)
Height: 40.8 cm (16 in)
Width: 49 cm (19 in)
Weight: <20 kg (<44 lb)
Power requirement: 220/115 V, 50/60 Hz

Manufacturer/Contractor
CelsiusTech, Sweden.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

CelsiusTech 9LV Mk 3 command and weapon control system
The 9LV Mk 3 command system has a distributed architecture and is based upon a 32-bit computer using Motorola 68020 and 68040 microprocessors and Ada-language software, workstations and Ethernet IEEE 802.3 standard local area networks. Memory consists of 4 MByte RAM and 256 k of Erasable Programmable Read Only Memory (EPROM). The hardware is used to create nodes which may be workstations, processing or interface nodes with a network interface, one or more processing units, power supply, local Programmable Feed Only Memory (PROM), and appropriate interfaces. Memory management is by means of the Motorola 68851 while the floating-point processor is the Motorola 68881. All the software programs run independently but communicate through an Inter-Program Communication 2000 (IPC2000) mechanism. The software is in Ada and the basic system has about 500,000 lines of code but this is usually more than doubled to meet added requirements.

Each system consists of a dual-redundant local area network which interfaces with all sensors, weapon systems and workstations. The system is supported by two processor units (one redundant) which provide command, communications and control as well as a database. The systems are capable of acting as a data handling system compiling the tactical situation, conducting threat evaluation and target designation as well as providing navigation and offboard sensor data (the latter via a datalink) while recording and providing a simulation capability.

Manufacturer/Contractor
CelsiusTech, Sweden.

WEAPONS CONTROL

9LV 200 Mk 3 Sea Viking electro-optic director
There are two Sea Viking directors, which control the guns, controlling different weapons in sequence, and with an automated air defence function for use against multiple targets. It takes sensor data, evaluates the threat and automatically deploys the most effective hard or soft kill countermeasure to neutralise each target. The prime sensor is a tracking Ku/J-band radar with stabilised cassegrain monopulse antenna and travelling-wave tube transmitter which operates in the 15.9-17.1 GHz frequency range and permits the combination of pulse Doppler-MTI operation with batch-to-batch frequency agility. Pulse-to-pulse frequency agility is retained for use when return suppression is not required. The radar may be supplemented by a range of electro-optical sensors including a Si-Vidicon CCIR-compatible TV camera with 300 mm lens and 42 × 31 mrad field of view, an 8-12 μ m infra-red camera using Cadmium Mercury Telluride detectors with closed-cycle Sterling cooling and fields of view of 52 × 35 mrad and 157 × 105 mrad. There may also be a 1.06 μ Nd:YAG laser rangefinder with a peak power of 4 MW and a PRF of 10 Hz.

There are 2 directors per ship, co-located with I/J electro-optic band fire-control radars.

Manufacturer/Contractor
CelsiusTech, Sweden.

9LV 450 SESYM fire-control system
9LV 450 (known in Swedish service as SESYM (*Strids-och Eldlednings System for Marinen*)) features a separate air search radar and integrated EW suite, which permits automatic tracking and threat evaluation of a large number of air and surface targets. There is a standard 23 in (58.4 cm) tactical electronic plot. A high capacity datalink using the Time Division Multiple Access (TDMA) principle is included for exchanging data with

other warships and shore commands. The system can control four guns of different calibres, anti-ship missiles and various ECM systems. A surface-to-air missile capability is an option, but is not included in the 'Göteborg' class.

The ASW subsystem features its own processor and software, and a horizontal console with PPI display which can also show sound path propagation data, alphanumeric display and operator's panels. It uses the ship sonar system for search and tracking, presents and evaluates the data, predicts the target's position, calculates the control data for the ASW weapons and calculates the ship's course. The system is designed to control ASW rockets and torpedoes but can be adapted for use with depth charges

Manufacturer/Contractor
CelsiusTech, Sweden.

CelsiusTech 9EW 400 ESM/ECDI system
9EW400 responds to directions from the APECS-II system and controls the Philax chaff and IR decoy launchers, the active ECM system and laser warning receivers.

Manufacturer/Contractor
CelsiusTech, Sweden.

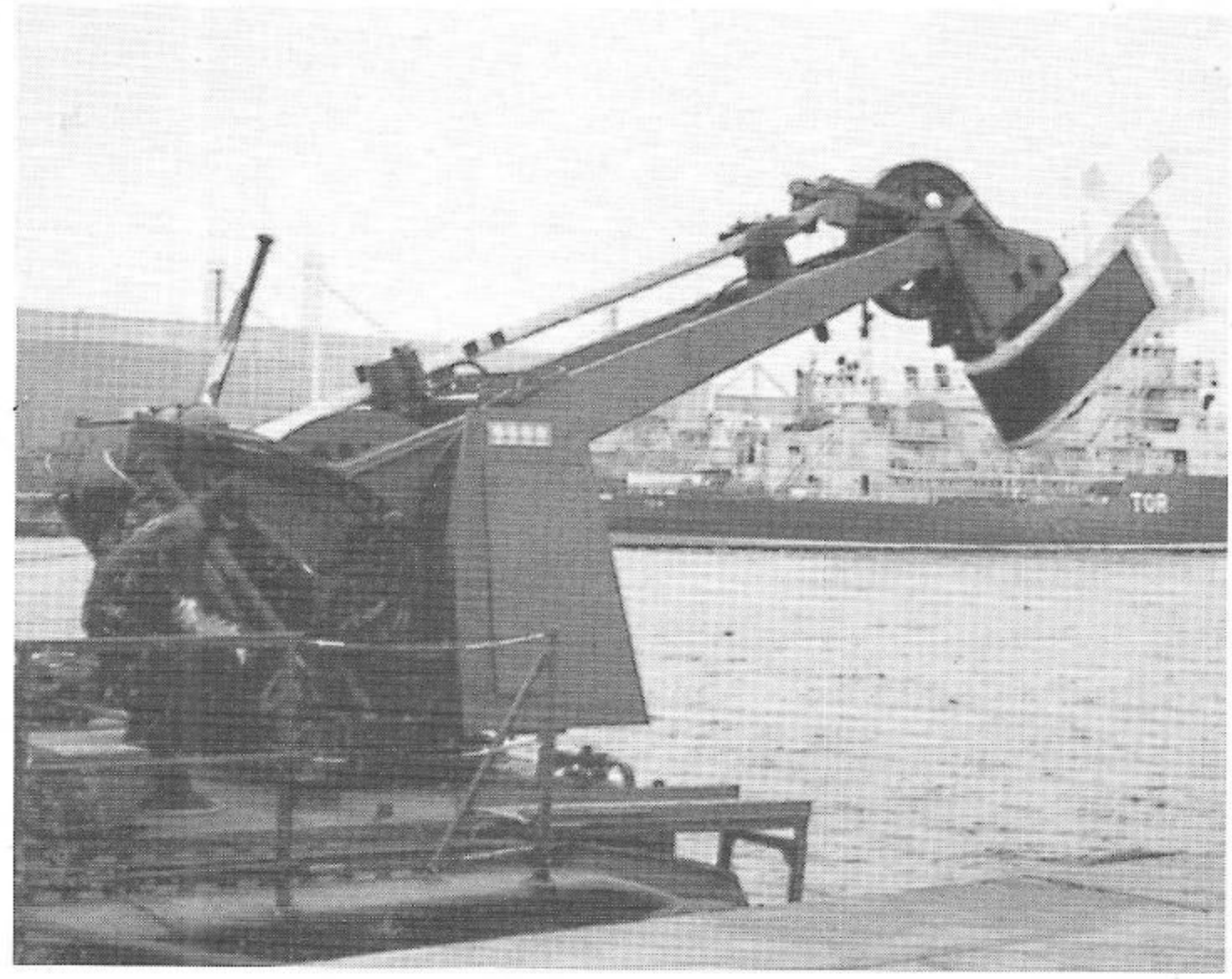
RADARS

Ericsson Sea Giraffe 150 HC
The Sea Giraffe is used for air and surface search, with the antenna sited at the masthead.

Specifications
Operating frequency: G/H-band
Output power: 60 kW; average power 1,200 W
Antenna rotation rate: 30/60 rpm
Instrumented range: 25, 50, 100 and 150 km
Tracking capacity: More than 30 automatically initiated air targets; more than 50 manually initiated surface targets
Antenna sidelobe levels: −45 dB
Beamwidth bearing: 1.8°
Elevation coverage: 0-70°
Accuracy: 20 m range; 0.3° azimuth

Manufacturer/Contractor
CelsiusTech, Sweden.

PN-612
PN-612 is one of the Skanter range of I-band navigation radars.



Thomson-CSF Salmon TSM 2643 VOS with the davit jib extended and the sonar vehicle ('fish') (CelsiusTech)

Manufacturer/Contractor
Terma Elektronik, Denmark.

SONARS

TSM 2643 Salmon
TSM 2643 Salmon is a compact, active, Variable-Depth Sonar (VDS), based on an acoustic array of 24 staves in a streamlined fish, with a towing winch, transmitter and receiver unit and operator console with colour display. Embedded facilities include passive listening, sound ray tracer, integrated onboard simulator and acoustic propagation prediction.

Specifications
Acoustic array: 24 identical staves of 7 transducers, weight 260 kg (573 lb)
Frequency: 19 kHz approximately.
Transmitter: Omnidirectional transmission in CW and FM modes
Receiver: 36 preformed beams; advanced processing coherent in FM with pulse compression and spectrum analysis (FFT) in CW

Manufacturer/Contractor
Thomson Sintra ASM, France.

Simrad SS 304
Simrad SS 304 was developed from one of Simrad's fish-finding sonars and is designed specifically for use in shallow waters. It is a hull-mounted, active sonar, with a transducer which can be rotated to cover the full 360°. The receiver uses 17 preformed receiving beams to cover an 85° arc.

Manufacturer/Contractor
Simrad, Horten, Norway.

PROPULSION

Specifications
System: Diesel
Main machinery: 3 MTU16V 396 TB94, 6.4 MW (8,700 hp)
Water-jets: 3 KaMeWa Type 80 S62/6 water-jets.

FURTHER INFORMATION

PROGRAMME
These four ships were ordered on 1 December 1985 as replacements for the 'Spica I' class.

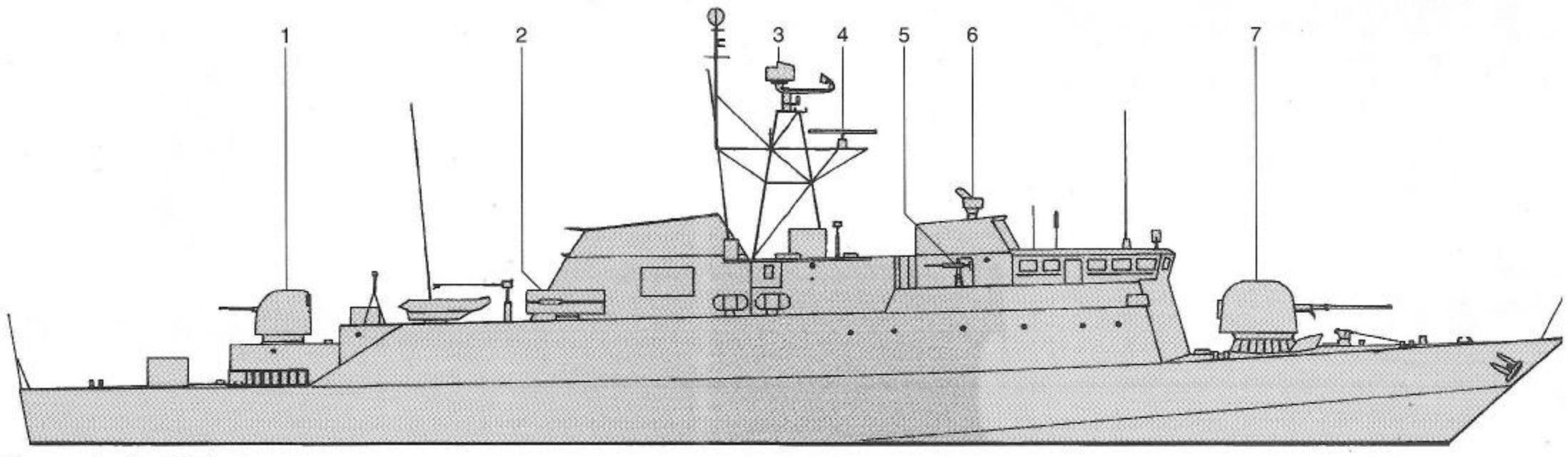
DESIGN
These are the latest corvettes to enter Swedish service and pack a great deal of firepower into a relatively small hull: eight SSMs, one 57 mm and one 40 mm gun, four ASW torpedo tubes and four rocket launchers on a full load displacement of 450 tonnes. There is also a very comprehensive package of sensors and a full command action information system.

Efforts have been made to reduce radar and IR signatures.

TRIALS
A Bofors Sea Trinity CIWS gun has replaced the 40 mm/70 in *Göteborg* for trials.

Galve is involved in a separate trial, testing an STN Atlas passive towed array streamed from the starboard quarter.

KHAMRONSIN



Khamronsin (Ian Sturton)
1 *OTOBREDA twin 30 mm/70 cannon* **2** *Plessey triple PMW 49A torpedo tubes (two sets)* **3** *Plessey AWS-4 air/surface search radar* **4** *Racal-Decca navigation radar* **5** *12.7 mm machine gun* **6** *BAe Sea Archer 1A Mod 2 optronic GFCS* **7** *OTOBREDA 76 mm/62 Mod 7 automatic gun*

GENERAL SPECIFICATIONS

Operator: Thailand
Type: Corvette

Class: KHAMRONSIN

Built: 3
Active: 3

Displacement:
normal: 337 t
full load: 475 t

Dimensions
Length: 62 m (203.4 ft) (oa); 56.7 m (186 ft) (wl)
Beam: 8.2 m (26.8 ft)
Draught: 8.2 m (26.8 ft)

Speed: 25 kts
Range: 2,500 n miles at 15 kts

Complement: 57 (6 officers)

SHIPS

KHAMRONSIN (531)

Builder	Ital Thai Marine, Bangkok, Thailand
Laid down	15 Mar 1988
Launched	15 Aug 1989
Commissioned	29 Jul 1992

THAYANCHON (532)

Builder	Ital Thai Marine, Bangkok, Thailand
Laid down	20 Apr 1988
Launched	7 Dec 1989
Commissioned	5 Sep 1992

LONGLOM (533)

Builder	Bangkok Naval Dockyard, Bangkok, Thailand
Laid down	15 Mar 1988
Launched	8 Aug 1989
Commissioned	2 Oct 1992

WEAPONS SYSTEMS

TORPEDOES

Plessey PMW 49A/STWS

Two triple Pedestal Mounted Weapons (PMW) launchers are mounted on the upper deck. Shipboard Torpedo Weapons System (STWS) consists of two triple tube launchers, a launch control and presetter unit which are linked to the launchers through local control panels. The launchers are manually trained to an angle of 45° using a training handle installed between the two lower tubes. They are then remotely operated.

PMW 49A is an export system compatible with the Mk 46, the Stingray and the A 244S lightweight torpedoes. The mountings are essentially those of the STWS 2 although the breech mechanism is attached to the tube by a hinged arm. The presetter/launch controller is the Ultra ATLAPS with distributed microprocessors and Coral 66-language software for greater flexibility. The main processor/command unit is in a console with environmentally sealed slave control units mounted close to the launchers. The system is compatible with a variety of databus systems including MIL-STD-1553R and RS 422.

Specifications
Length: 3.65 m (12 ft)
Height: 1.4 m (4.6 ft)
Width: 1.23 m (4 ft)
Weight: 1,560 kg (3,439 lb) (unloaded)

Manufacturer/Contractor
GEC-Marine, Waterlooville, UK.

Sting Ray lightweight torpedo

Sting Ray is capable of active/passive homing to 5.9 n miles (11 km) at 45 kts. Sting Ray has a 35 kg (77 lb) Torpex shaped charge warhead developed by Royal Ordnance and may be used in deep or shallow waters. It is equipped with a pumpjet propulsion system. The onboard sonar is reported to be multimode and narrow beam. The narrowband capability provide good Doppler discrimination against slow or quiet targets and the broadband capability gives good target discrimination range, and bearing resolution.

Khamronsin *(531), the first of three corvettes designed by Vosper Thornycroft in the UK and built by Ital Thai and Bangkok Naval Dockyard in Thailand* (Royal Thai Navy)

Specifications
Length: 2.59 m (8.5 ft)
Diameter: 324 mm
Weight: 267 kg (589 lb)(in air)
Warhead: 35 kg (77 lb)
Speed: 45 kts
Range: 5.9 n miles (11 km)
Depth: 750 m (2,460 ft)

Manufacturer/Contractor
GEC-Marine, Waterlooville, UK.

GUNS

OTOBREDA 76 mm (3 in)/62 Compact

There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air-defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications

Calibre: 76.2 mm
Length of barrel: 62 calibres
Traverse: 360° at 70°/sec
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,952 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

OTOBREDA 30 mm/70 Twin Compact

There is one OTOBREDA 30 mm/70 Twin Compact mounting aft, consisting of two Mk 30 Model F cannon using the 30 mm × 173 GAU 8/A round. Ammunition is fed into the guns from a magazine below the decks. The 1.99 m (6.5 ft) diameter cylindrical magazine feeds two belts from a total of 34 vertical lockers, each belt folding into half the lockers. The magazine rotates to bring each locker in turn under the hydraulically powered ammunition hoist on each side of the gun. The round is then conveyed into the platform from where it is transferred by flexible chute to the ammunition feed.

Specifications

Calibre: 30 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,040-1,220 m/s (3,411-4,000 ft/s) (HEI/APDS)
Traverse: Unlimited at 130°/s
Elevation: −13 to +85° at 75°/s
Rate of fire: 800 rds/min/barrel
Ammunition: 1.05 kg (2.31 lb) (TP, HEI, HEI-SD, API, APDS)
Mounting weight, with ammunition: 1,330 kg (2,932 lb)

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

M2HB 12.7 mm (0.50 in) machine guns

Two M2HB 12.7 mm machine guns are carried and can be mounted on flexible mounts.

Specifications

Calibre: 12.7 mm
Rate of fire: 450-550 rds/min
Muzzle velocity: 883 m/s (2,900 ft/s)
Max effective range:
anti-surface: 6,700 m (7,400 yd)
anti-air: 1,380 m (4,500 ft)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Nautis P action data automation system

The NAUTIS P action data automation system is based upon the NAUTIC (Naval AUTonomous Intelligent Console) multifunction intelligent workstation. This workstation module uses the Intel iAPX-86 processor with 3 Mbyte RAM together with 2 Mbyte non-volatile magnetic bubble memory. Dual iAPX-286 microprocessors are used in Multibus configurations, while iAPX-186 microprocessors are used for intelligent interfaces. The system capacity is 200 air, surface and submarine tracks and reference points with integral radar autotracking for up to 80 air and surface targets. The workstations are linked by a dual-redundant MIL-STD-1553B highway.

An extensive system database, replicated in each console, covers an area of 2,000 n miles square (3,700 km²) and can include radar and sonar tracks, route/search plans, user-designated tactical maps and synthetic charts. The database can include up to six user-designated tactical maps, 15 synthetic charts, 200 labelled reference points, 5,000 fully detailed underwater contacts and 32 labelled bearing lines. Manually initiated automatic radar tracking is possible for a minimum of 20 tracks.

Workstations accept various combinations of digital, synchro and analogue input/output for the whole range of sensors and weapons and interface options, including point-to-point, the data highway or a general purpose combat system highway. They also interface with optional elements, such as a chart table, plotter/printers and magnetic tape units, either through point-to-point interfaces or via the data highway, which complies with Military Standard-1553B data highway providing 1 MHZ of bandwidth, of which 300 kHz is used.

The 'Khamronsin' class corvettes have three-console systems which interface with the BAe Sea Archer 1 electro-optic fire-control system, Siemens Plessey ASW 4 search radar and STN Atlas DSQS-21C hull-mounted, medium/high frequency, active search/attack sonar.

Manufacturer/Contractor

GEC-Marine, Waterlooville, UK.

WEAPONS CONTROL

Sea Archer 1A Mod 2

Sea Archer 1A provides complete integration of a TV subsystem with below-decks control by joystick, giving improved surveillance capability and the option of a manned/unmanned director on deck. It also has provision for controlling two different types of gun-mounting alternately. The Mod 2 version in the 'Khamronsin' class corvettes includes a thermal imager and auto-track capabilities as in Mod 1 and dual-mode alternate ballistics.

The system comprises: the MSI-Defence Systems Optical Fire Director (OFD) (with combined electro-optic tracking sensors and a laser rangefinder) and a gun-control console containing a predictor operator control panel and system communications. To assist in target acquisition the system accepts information derived from the vessel's surveillance radar to slew the OFD onto the target bearing. Electro-optic sensors, 3.4/4.2 m (11.1/13.8 ft) IR or television tracking cameras are fitted in other configurations to give below-decks operation. The IR camera has a 1.5 × 3° field of view.

Information regarding the target range, training and elevation is automatically transmitted to the weapon control console. The computer, utilising ballistic and meteorological data already entered into the system, then calculates the gun aiming order. To reduce reaction time to a minimum, gun slew occurs as soon as the target is acquired and offset adjustments are then made when a valid prediction solution is computed, which typically takes two seconds.

There are three gun fire-control modes: air defence surface and naval gunfire support. In air defence mode the system is designed to achieve minimum reaction time against fast moving air targets. The director aimer acquires the target and activates the rangefinder. Target data is fed to the control console where the digital weapon controller calculates gun aiming signals. The gun slews into line with the computed data and when the target is within gun range the digital weapon controller indicates that the system is ready to engage the target. Firing can be achieved from the director or the control console. In surface mode the optical director is aimed at the target and the rangefinder is activated to establish the target range. Gun aiming orders are then computed from the target data transmitted by the director. Splash spotting corrections, observed by the director aimer, are applied via the control console. In the naval gunfire support mode the gun is used to bombard shore targets. The target co-ordinates are inserted manually at the control console and gun orders calculated and corrected for ship movement by dead reckoning. Spotting corrections, observed by a shore- or ship-based observer, are applied at the control console.

Specifications

Electro-optical fire director
Arc: Unlimited
Elevation: −20 to +70°
Laser: Nd:YAG
Beamwidth: 2 mrad
Repetition rate: 20 Hz
Console
Weight: 250 kg (551 lb)
Height: 1.48 m (4.8 ft)
Depth: 78.7 cm (2.5 ft) plus 30.4 cm (11.9 in) desk overhang
Width: 56.2 cm (22 in)
Power requirements: 440 V, 50/60 Hz, three phase 3-5 kVA; 24 V DC

Manufacturer/Contractor

BAe, Farnborough, UK.

RADARS

Set	AWS-4	Type 1007
Company	Siemens-Plessey	Kelvin Hughes
Role	Air search	Navigation
Band	D/E	I/J
Beam	1.9 × 30°	1.2°
Peak Power	—	25 kW
Gain	—	30 dB
Pulsewidth	1.0/0.3 µs	0.05/0.25/1.0 µs
PRF	680/1,360 pps	—
Scan rate	10/20 rpm	28 rpm
Typical ranges	55 n miles (101 km)	48 n miles (88 km)

SONARS

STN Atlas DSQS-21C

DSQS-21 is a hull-mounted, active search and attack sonar, featuring computer-aided detection and tracking, with the information being presented on colour CRT displays to permit Doppler coding and discrimination of data.

Specifications

Diameter of transducer arrays: 1 m (3.2 ft)
Number of preformed beams: 32

Manufacturer/Contractor

STN Atlas Elektronik, Germany.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 12V 1163 TB93 diesels, 7.34 MW (9,980 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The contract was signed on 29 September 1987 with Ital Thai Marine of Bangkok for the construction of three ASW corvettes for the Royal Thai Navy. The ship was designed by Vosper Thornycroft and three were built in Thailand, with Ital Thai Marine building the first two ships and then providing technical assistance with a third which was built by Bangkok Naval Dockyard. A fourth of the class, *Srinakarin* (1804), was ordered by the Thai Police in September 1989 and delivered by Ital Thai Marine in April 1992. This ship has the same hull, but a different superstructure and much lighter armament. There are no known plans for any more of the class.

DESIGN

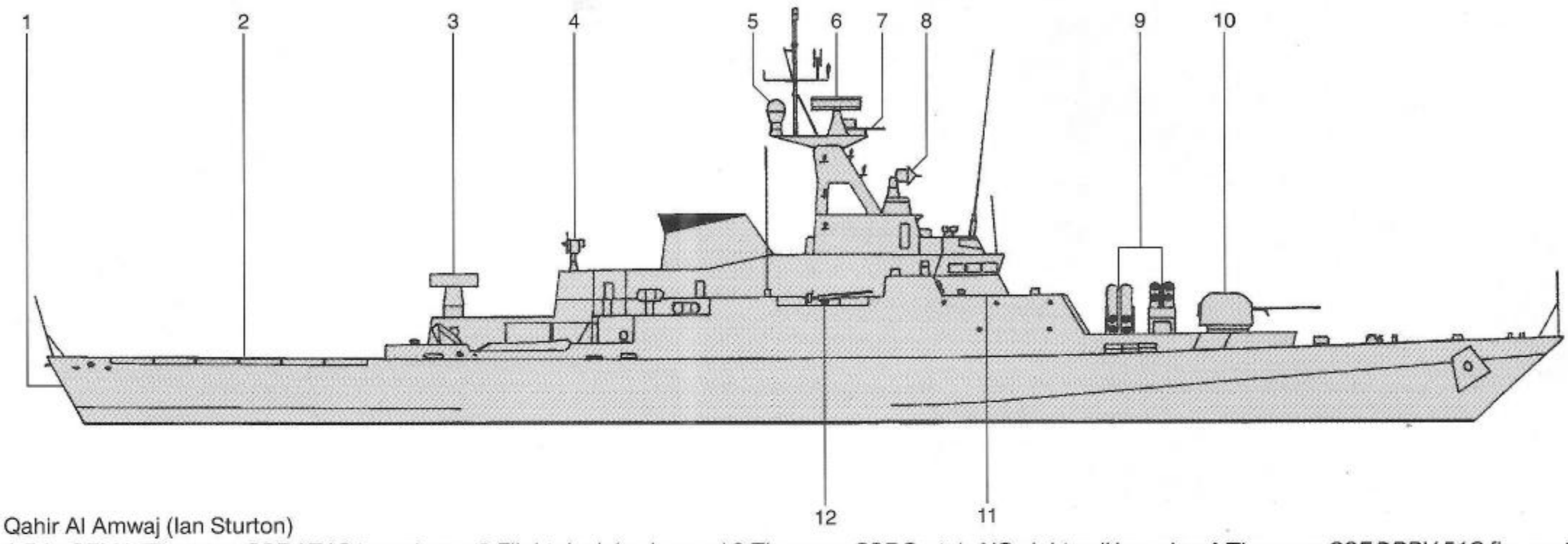
The design is based on the 'Vosper Thornycroft Dhofar' class 56 m design for the Oman. This was stretched by the simple expedient of increasing the frame spacing along the whole length of the hull.

MODERNISATION

Depth charge racks and mine rails may be added.

Longlom *(533). These fast corvettes are capable of 25 knots and are intended for ASW missions in the Gulf of Thailand* (Vosper Thornycroft)

QAHIR AL AMWAJ



Qahir Al Amwaj (Ian Sturton)

1 *BAe SEMA/Thomson-CSF ATAS towed array* **2** *Flight deck (no hangar)* **3** *Thomson-CSF Crotale NG eight-cell launcher* **4** *Thomson-CSF DRBV-51C fire control (for Crotale)* **5** *Thomson-CSF DR 3000 ESM/ECM* **6** *Signaal MW-08 air/surface search radar* **7** *Kelvin Hughes Type 1007 navigation radar* **8** *Signaal STING-EO radar/electro-optical fire controller* **9** *Aerospatiale MM 40 Exocet anti-ship missiles (eight)* **10** *OTOBREDA 76 mm (3 in)/62 Super Rapid* **11** *Barricade 12-barrel chaff/IR launcher* **12** *Oerlikon/Royal Ordnance SAB-01 20 mm cannon on open flexible mount (two)*

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: Oman

Class: QAHIR AL AMWAJ

Built: 2
Active: 2

Displacement:
full load: 1,450 t

Dimensions
Length: 83.7 m (oa); 76 m (wl) (274.6 ft, 249.3 ft)
Beam: 11.5 m (37.7 ft)
Draught: 3.6 m (11.8 ft)

Speed: 28 kts
Range: 1,500 n miles at 22 kts; 4,000 n miles at 10 kts

Complement: 76 (14 officers) plus 5 spare berths

SHIPS

QAHIR AL AMWAJ (Q 31)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down 21 May 1993
Launched 21 Sep 1994
Commissioned 27 Mar 1996

AL MUA'ZZER (Q 32)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down 4 Apr 1994
Launched 26 Sep 1995
Commissioned Nov 96

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Aerospatiale Exocet MM 40 medium-range anti-ship missile

There are eight MM 40 Exocet launchers in two groups of four mounted immediately before the bridge, firing across the ship. The missile is the MM 40 Block 2.

Specifications

MM 40 Block 2
Length: 5.80 m (19.0 ft)
Diameter: 35 cm (13.78 in)
Wing span: 1.13 m (3.71 ft)
Weight: 870 kg (1,918 lb)
Speed: Mach 0.9
Range: 2-40.5 n miles (4-75 km)
Warhead: 155 kg (342 lb) HE fragmentation
Fuze: Impact/proximity
Guidance: Inertial and active radar

Manufacturer/Contractor

Aerospatiale, France.

SURFACE-TO-AIR MISSILES (SAM)

Thomson-CSF Crotale NG

There is a single eight-cell launcher for Crotale VT1 missiles located aft in 'X' position. There are also eight reload missiles in a below-decks magazine. Crotale NG is based upon the new VT1 missile which can manoeuvre at up to 35 *g* and is stored in a new, slimmer, launcher container. The fire-control system, which can control two missile launchers and the 100 mm gun, is based upon the lightweight Castor radar director, which employs a 12-18 GHz J-band radar with four horn antenna on one side and a daylight TV camera with SAT-IR tracker on the other side. The launcher itself has six launch tubes on either side of the mounting and a 'TV escartometer' which helps automatically to bring the missile into line of sight with the target. The electronics fit weighs 2.6 tonnes while the loading system, which has only eight reloads, weighs 3.2 tonnes.

Specifications

VT-1 missile
Length: 2.34 m (7.68 ft)

Foredeck showing the OTOBREDA 76 mm Super Rapid and the securing apparatus for Exocet launchers (Vosper Thornycroft)

A stern view of Qahir al Amwaj *(Q 31) showing the eight-cell Crotale NG SAM launcher and the associated DRBV-21 51C fire director* (Vosper Thornycroft)

Diameter: 16.5 cm (6.5 in)
Wing span: n/k
Weight: 73 kg (161 lb)
Speed: Mach 3.5
Range: 5.4 n miles (10 km)
Altitude: 4,000 m (13,120 ft)
Fuze: RF proximity fuze
Warhead: 13 kg (29 lb) focused fragment

Manufacturer/Contractor
Thomson-CSF, Division Systèmes Electroniques, France.

TORPEDOES

Torpedo launchers are not currently mounted, but two triple 324 mm torpedo tubes may be fitted in due course.

GUNS

OTOBREDA 76 mm (3 in)/62 Super Rapid
There is one OTOBREDA 76 mm (3 in)/62 calibre Super Rapid gun in a single turret in 'A' position.

Specifications
Elevation: −15 to +85° at 35°/s
Training speed: 60°/s
Muzzle velocity: 925 m/s (3,034 ft/s)
Rate of fire: 120 rds/min
Weight of shell: 6 kg (13.23 lb)
Range: 8.5 n miles (15.75 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Oerlikon/Royal Ordnance 20 mm GAM-BO1
There are two single, unpowered GAM-BO1 mountings, one on either side of the superstructure immediately below the mast. GAM-BO1 is an unpowered, light, compact design for use in patrol operations. The ammunition box with 200 rounds is attached to the front of the mounting and the belt is fed from the right side of the gun. Spent cartridge cases are ejected between the sidewalls of the cradle into a separate compartment while the links are collected in a bag on the other side of the mounting. The GAM-BO1 mounting uses the Oerlikon KAA gun.

Specifications
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,150 m/s (3,444-3,772 ft/s)
Range:
anti-surface: 1.7 km (1,860 yd)
anti-air: 1.7 km (5,576 ft)
Rate of fire: 900 m/s (2,952 ft/s)
Round weight: 320-345 g (11.29-12.17 oz)
Projectile: 110-125 g (3.88-4.41 oz)

Manufacturers/Contractors
Oerlikon, Switzerland
Royal Ordnance, UK.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Thomson-CSF DR 3000S ESM receiver
The DR 3000S tactical ESM receiver conducts threat detection, direction finding, identification and target designation of enemy radars over the C to J frequency bands. It monitors the tactical situation in a given area, and performs Electronic intelligence (ELINT) functions. The system has a high sensitivity range with a detection capability of nearly 100 per cent, while direction finding accuracy is of the order of 6°. Highly automated operation includes the use of artificial intelligence and allows for very short reaction times. DR 3000S is available in two configurations; a single 40 kg (88 lb) masthead-mounted antenna or a two-unit hexagonal aerial, with six DF antennas.

Specifications
Frequency: C to J-bands
Azimuth coverage: 360°
Elevation coverage: −10 to +45°
Sensitivity: −68 dBm
Dynamic range: Up to 60 dB
Radar modes: 4,000 in library

Manufacturer/Contractor
Thomson-CSF, Radars and Countermeasures Division, Elancourt, France

DECOYS

ML Aviation Barricade countermeasures system
There are two MEL Barricade 12-barrelled chaff and infra-red (IR) launchers. Barricade provides ships with the means of deploying chaff and IR decoys to counter missile attacks using a layered defence against the various types of anti-ship missile. The system uses a 102 mm rocket and a redesigned launcher with four sets of triple-cell launchers. The system has a control unit and a tactical computer. The ammunition lockers each contain 24 rockets. There are four decoy modes: confusion, distraction, dump and centroid.

Manufacturer/Contractor
ML Wallop Defence Systems, Andover, Hampshire, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Tactical Information and Command System (TACTICOS)
TACTICOS is an automatic threat evaluation, weapon assignment and sensor allocation system which can also be used as a planning aid through inputs of intelligence data and decision support facilities. It is a distributed architecture system based upon SIGMA (SIGnaal Modular Architecture) multiprocessor nodes which uses SPARC architecture. These have two to seven SUN-1S type processor boards, each capable of 12.5 Mips and 16 Mbyte RAM. The nodes are housed in Multifunction Operator Consoles (MOCs) and Bus Terminal Servers (BTS). In addition to the SIGMA nodes there is a nodal resource module, a graphics host processor with R3000 32-bit CPU and R3010 FPU with 16 or 32 Mbyte RAM. There are also one or two 200 Mbyte Winchester disk drives and a 60 Mbyte tape streamer.

The package is known as the SIGMA3-S (SIGnaal Modular Architecture release 3) and the software is written in the Ada language but includes SPLICE (Subscription Paradigm for the Logical Interconnection of Concurrent Engines) distributed database and data communication software which operates alongside Unix. The hardware is linked through a dual Ethernet (IEEE 802.3) standard local area network although other standards may be used.

Some subsystems, such as the latest Thomson and Signaal sensors systems, may be linked directly to the local area network through a digital data interface bustap. Those which cannot be so linked use the BTS to interface with the local area network. The BTS has an interface board which will allow NTDS, Military Standard 1553B or other standard subsystem interface to link into TACTICOS. Every such subsystem will have its own BTS. The BTS will also have spare processing power which can be used automatically to compensate for failures in standard processor nodes.

Other hardware available includes an automatic on-line SPL plotting table with 93.5 × 65 cm plotting area, a keyboard/display unit and plasma display unit. It can track nine targets which may be manually entered and 54 from the TACTICOS sensors. There is also a General Support Station (GSS), a standard commercial workstation with 16 in (40.6 cm) raster scan display which is used for system monitoring, database support and training.

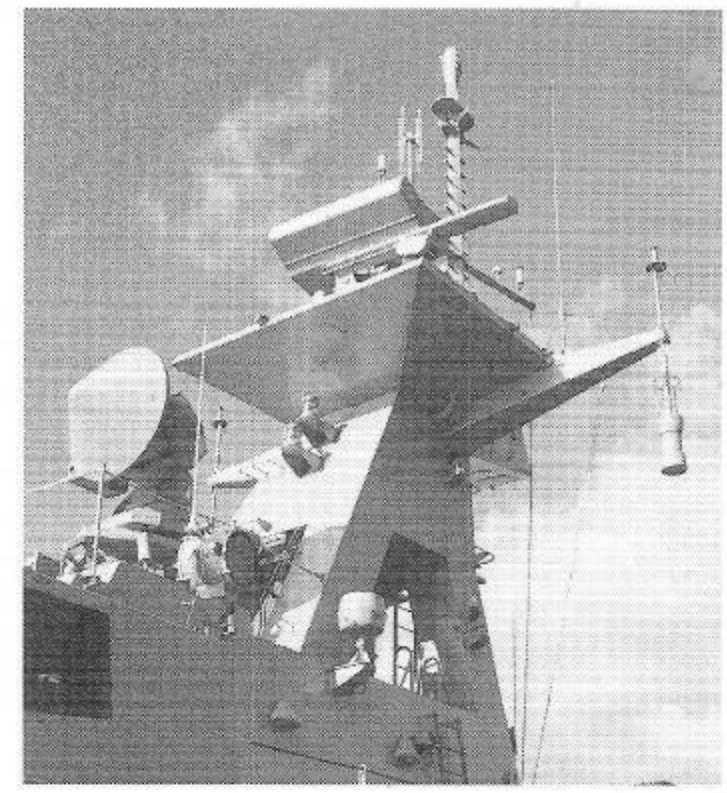
Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Bridge (Vosper Thornycroft)

Close-up of the STING-EO. This combines the target acquisition and tracking radar (right) with a TV camera, IR camera and laser rangefinder (left) (Signaal)

RADARS

Type	MW 08	STING	DRBV-51C	Type 1007
Maker	Signaal	Signaal	Thomson-CSF	Kelvin-Hughes
Role	Air/surface search (3D)	Fire control	Fire control (Crotale)	Navigation
Band	G	I/K	J	I
Beam	2 × 9°	I: 1.6° K: 0.4°	—	1.0 × 18°
Peak power	150 kW	I: 2.2 kW K: 30 kW	200 kW	25 kW
Gain	23 dB	—	—	31 dB
Pulsewidth	0.6 µs	I: 0.29 µs K: 0.14 µs	0.6 µs	0.08/0.3/0.8µs
PRF	3,800 pps	I: 1,800/3,600 pps K: 7,200 pps	varied	1,600/800/400 pps
Scan rate	27 rpm	—	30 rpm	26 rpm



The mainmast. On the platform is the Signaal MW-08 air/surface search radar and, immediately below, the Kelvin Hughes Type 1007 navigation radar. Forward of the mast is the Signaal STING-EO combined radar and electro-optic fire controller. The small radome below the forward leg of the mast is probably the jammer element of the Thomson-CSF DR 3000 ECM/ESM suite (Vosper Thornycroft)

COMMUNICATIONS AND DATALINKS

Link YO

The Royal Navy of Oman purchased Link YO, which was developed in the UK by Ferranti as a digital link suitable for sale to non-NATO countries for naval and aircraft use. Different users have versions tailored to their own needs; Link YB, for example, is exclusive to the Brazilian Navy. Link Y, generally, uses a standard message format of two 24-bit words and a transmission speed of 300-1,200 bits/s.

Satcom.

WEAPONS CONTROL

Signaal STING-EO radar fire-control system

STING is a derivative of Signaal's STIR system and has been designed to provide medium-range automatic target acquisition and tracking for a variety of gun and missile systems. The functions of the STING subsystem include:

- target acquisition based on 1D, 2D or 3D target designations
- automatic target tracking with an operator-selected sensor, or automatically with a multisensor combination
- slaving to external data
- direct target handover from another tracking system
- optical surveillance under operator control.

STING provides the capability of acquiring air or surface targets under all weather conditions. The radar tracking unit applies FFT processing and has automatic RF/PRF tuning for optimal target tracking. The system uses the proven combination of I and K-bands for target tracking. This feature provides image-free target tracking under severe clutter conditions. With the added electro-optic sensors STING is capable of tracking a target either with the I and K-band radar system, with the selected electro-optics, or with a combination of the available sensors, making active radar or passive electro-optics tracking possible.

The Omani ships are fitted with STING-EO, which has a dual-frequency band, tracking feature and a TV camera for observation, with an additional IR camera and laser rangefinder with a TV/IR auto-tracking unit.

Specifications

Basic version
Antenna: Single cassegrain, 1.2 m (4 ft) diameter
Polarisation: Vertical
Beams: I and K-band pencil beams, width 1.6° and 0.4°
Transmitter: I and K-band monopulse/TWT transmitter/receiver with FFT processing. Fully coherent chain
Peak power: 2.2 kW (I-band); 30 kW (K-band)
Weight: Total system 1,700 kg (3,748 lb)

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

AVIATION

HELICOPTERS

Helicopter: The flight deck will accommodate 1 medium-sized (Cougar) helicopter. The RNO does not operate any helicopters at the moment.

PROPULSION

Specifications

System: Combined diesel and diesel (CODAD)
Main machinery: 4 Crossley SEMT-Pielstick 16 PA6 V280 STC, 20.7 MW (28,160 hp)
Shafts: 2 cp
Ship's services: 3 350 kW; 1 70 kW

FURTHER INFORMATION

PROGRAMME

Vosper Thornycroft signed the Muheet Project contract for two corvettes on 5 April 1992 and the first steel was cut on 23 September 1992.

NAMES

Qahir al Amwaj = Conqueror of the Waves
Al Mua'zzer = The Supported

STRUCTURE

The ship is based on the 'Vigilance' class design, but is somewhat larger. It also includes extensive stealth features, with both careful shaping and sloping of the hull and superstructure and wide-scale use of RAM (Radar Absorbent Material). The ships are constructed from steel cut by laser-controlled machines, which explains the absence of dimpling on the skin, which was so evident in warships constructed in the 1970s and 1980s.

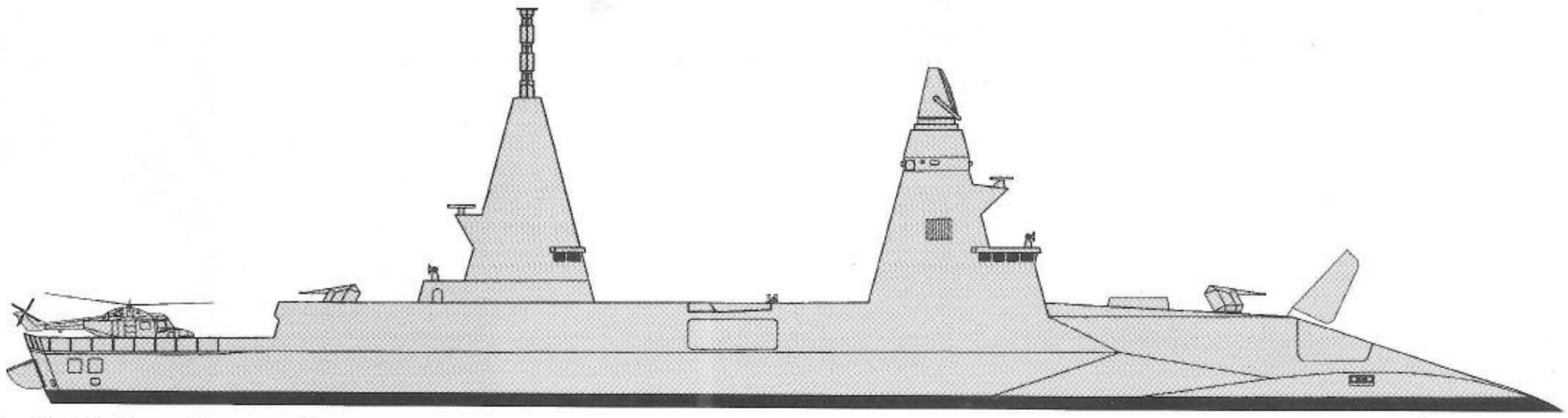
THE FUTURE

Future modifications may include fitting lightweight torpedo tubes and ATAS (Active Towed Array Sonar), which would add another 8 tonnes on the stern but would not affect the helicopter deck.

DEPLOYMENT

Sea trials for the first of class started in August 1995 and for the second in April 1996. The first of class arrived in Omani waters in September 1996.

SEA WRAITH



Sea Wraith (Vosper Thornycroft)

GENERAL SPECIFICATIONS

Country of orgin: UK

Class: SEA WRAITH

Built: Vosper Thornycroft is awaiting a first order before laying down the first of class

Dimensions
Length: 115.0 m (377.3 ft) (oa); 110.0 m (360.9 ft) (pp)
Beam: 15.5 m (50.85 ft)
Draught: 4.5 m (14.76 ft)

Speed:
Max: 28+ kts
Cruise: 15 kts
Range: 2,500+ n miles at 15 kts

Complement: 87 plus 18 spare berths

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Eight launchers mounted in the well between the two towers.

SURFACE-TO-AIR MISSILES (SAM)

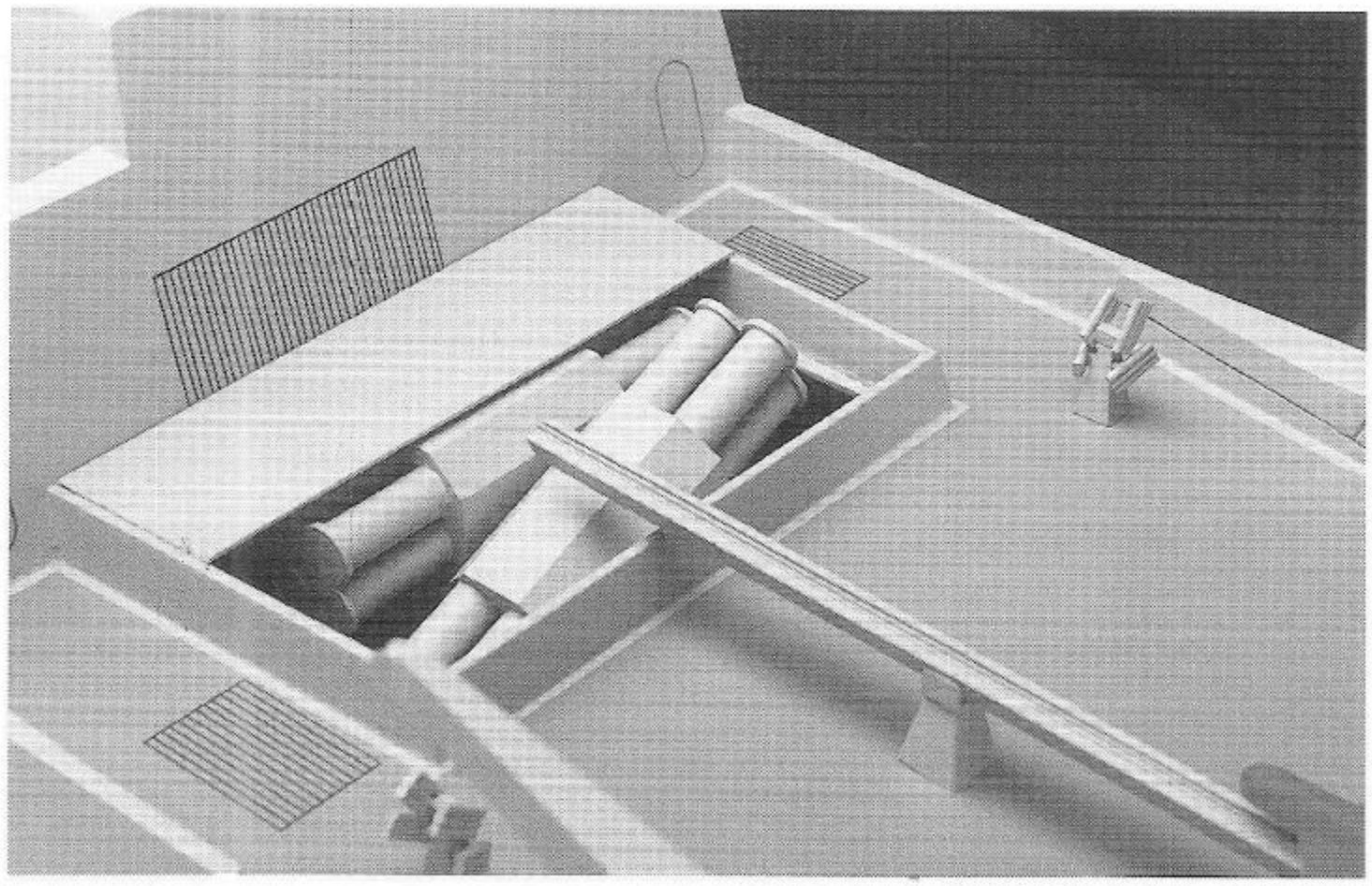
Sixteen vertical launch cells inset in foredeck.

GUNS

Medium calibre. Two with stealth turrets, one in 'A' position, one in 'X' position offset to port.
Small calibre. Two.

ARTILLERY ROCKETS

Two multicell rocket launchers in the well between the towers.



Anti-ship missile launchers are mounted on an elevator which raises them to the firing position (Vosper Thornycroft)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

ESM system integrated with static, four-faced ECM system.

ECM
Water fog system.

DECOYS

Above-water chaff and infra-red decoy system

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

An integrated command and control system will be fitted.

COMMUNICATIONS AND DATALINKs

Two datalinks will be fitted:
- Tactical datalink (for example, Link 11 or Link Y)
- Helicopter datalink (for example, Signaal Vesta)

WEAPONS CONTROL

Two radar fire-control directors.

RADARS

Radars will include:
- Phased-array surveillance radar
- FMCW surface-search radar
- Navigation radar with helicopter transponder receiver.

SENSORS

Towed-array search sonar
Expendable bathythermograph (XBT)
ASW decoys (optional)

AVIATION

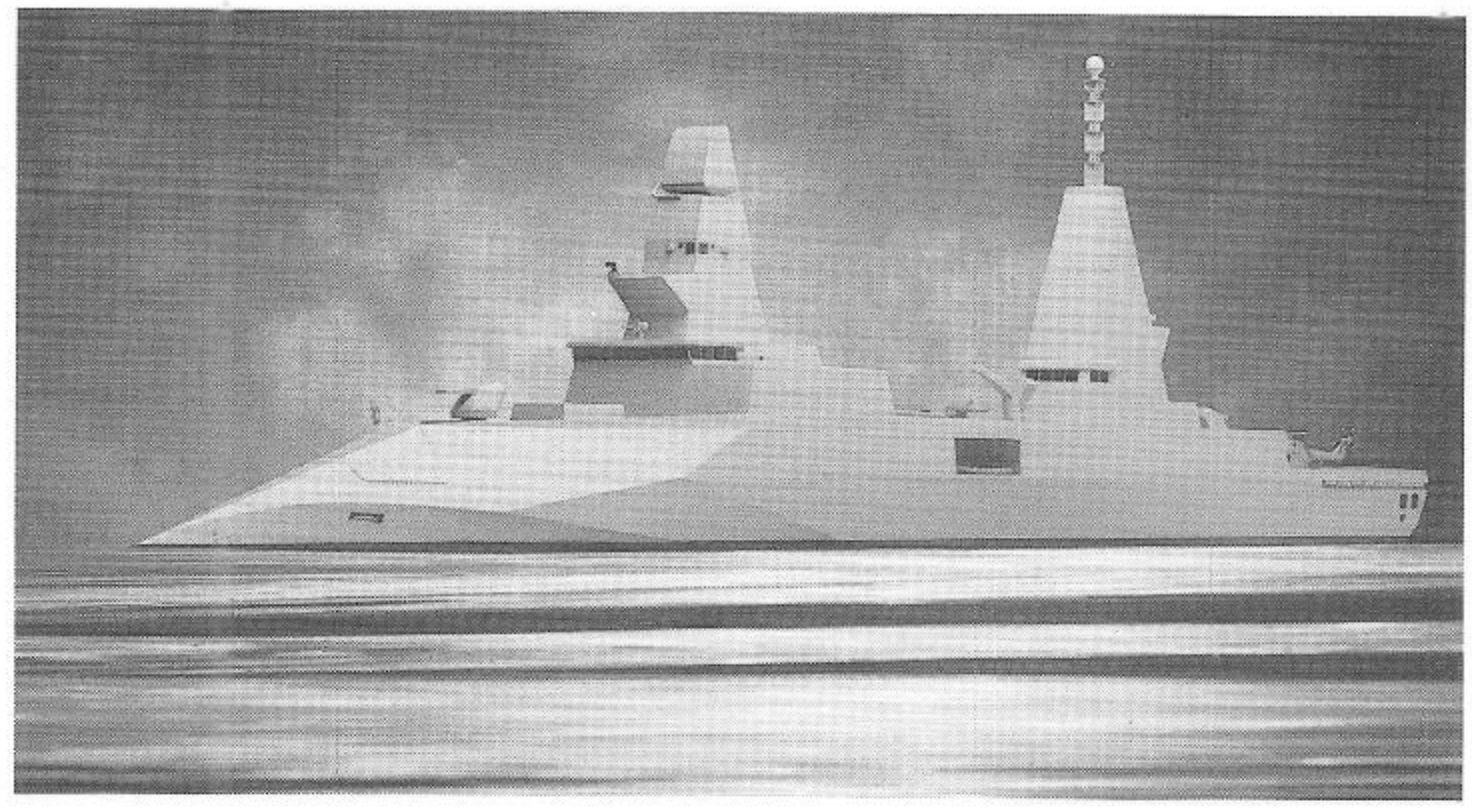
AVIATION FACILITIES

Specifications
Flight deck: 17.6 × 15.5 m (58 × 51 ft)
Hangar: Hangar for one medium/small helicopter

HELICOPTERS

One medium helicopter (for example, Lynx, SH-2, Panther).
Unmanned Aerial Vehicle (UAV)
Several ramp-launched, recoverable UAVs.

The extraordinary lines of Sea Wraith *could prove as revolutionary for ship design as the Lockheed F 117's Stealth fighter has been for aircraft design. Every feature of the ship's design is intended to enhance its stealth characteristics*
(Vosper Thornycroft)



PROPULSION

Specifications
System: Combined gas turbine and electric
Main machinery: 1 Westinghouse/Rolls-Royce WR-21 ICR gas turbine, 23.5 MW at 25° C; 2 electric motors, each 2.1 MW
Shafts: 2

FURTHER INFORMATION

DESIGN

Vosper Thornycroft has produced a unique design for a 'stealthy' corvette, which constitutes a fresh approach to several aspects of warship architecture. The aim is to produce a medium-sized warship in which Radar Cross-Section (RCS), and infra-red, noise and visual signatures have all been reduced to the minimum, thus introducing a high degree of uncertainty into hostile active and passive target acquisition systems. Among the features contributing to this are:

- A radical hull design with a wave-piercing bow, uncluttered topsides and two asymmetric towers.
- A deliberately ambiguous RCS to generate angular, range and automatic gain control disturbance within an attacking missile control system.
- A selectively variable RCS
- Radio antennas enclosed within the mast structure on the after tower, which can be raised and lowered to alter the ship's radar signature.
- A radar, atop the forward tower, that can radiate while the ship itself remains stealthy.
- A self-generated cloud of water fog to cover the ship when operating in low-thermal image diesel-electric propulsion mode.
- Large calibre weapons capable of long-range shore bombardment, naval gunfire support and anti-ship engagements.
- ASW capability, incorporating ship-mounted towed array sensor and helicopter-delivered weapons suitable for both littoral and ocean missions.
- A modern, multifunction combat suite controlling surface-to-surface missiles, surface-to-air defence systems and artillery rocket systems.
- Low manning levels afforded by a high degree of automation of the ship control and weapons command and control systems.
- Unmanned UAVs for long-range target classification and target spotting for fire missions.

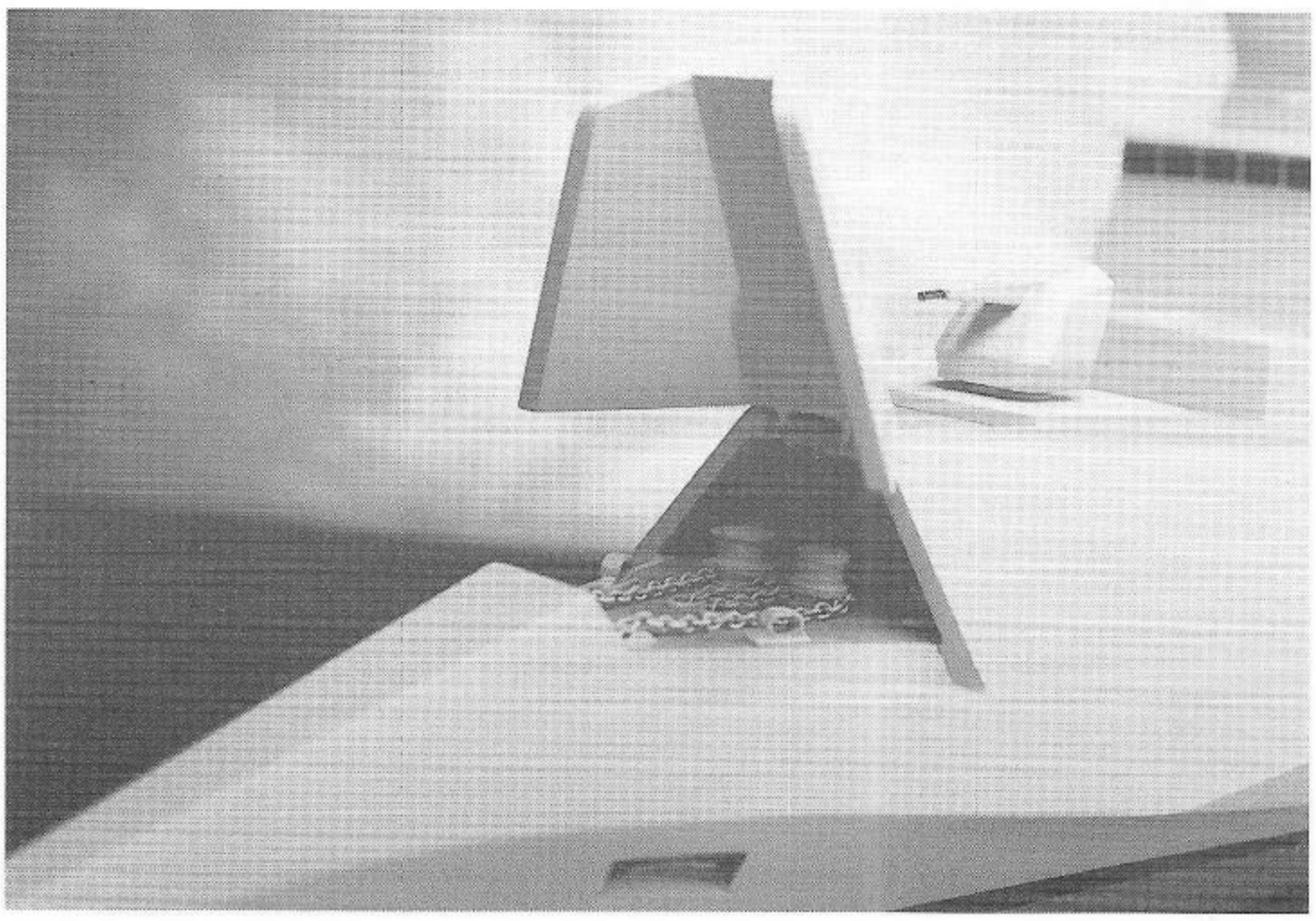
THE FUTURE

The design has been produced as a company-funded venture by Vosper Thornycroft and has been aimed at the light frigate/corvette market as being the most likely area to attract an order. The company foresees the primary roles which could be filled by the Sea Wraith as:

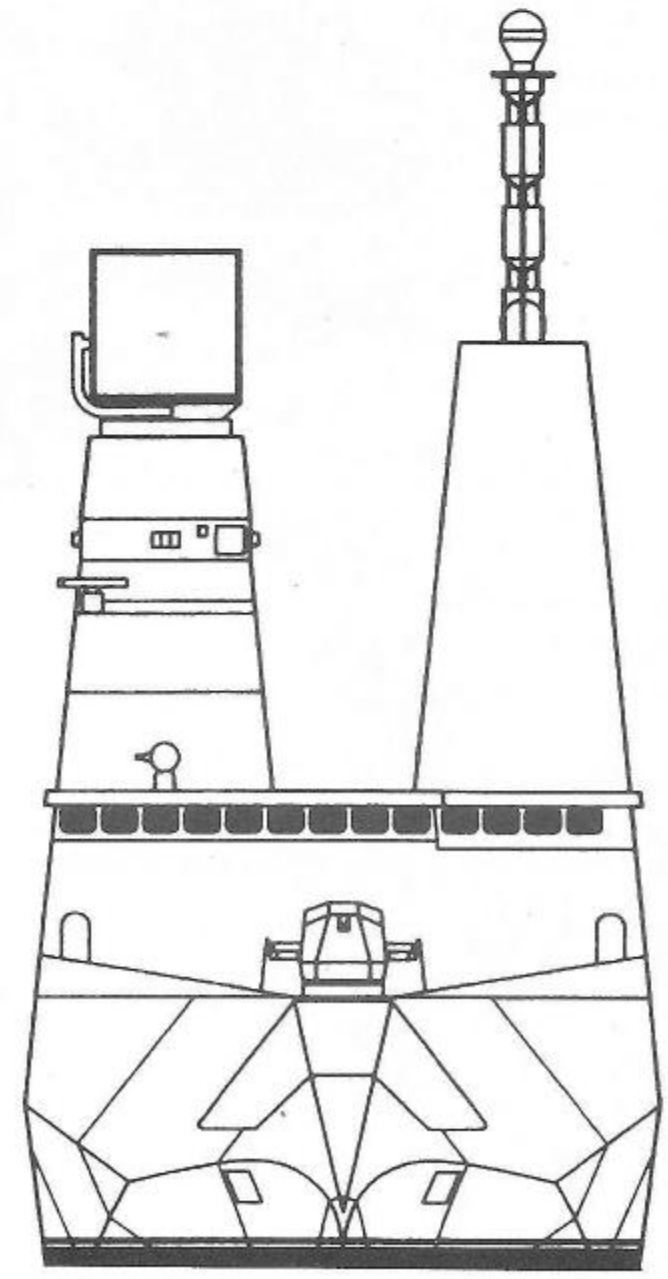
- Deterrent patrols and low-intensity operations
- Anti-submarine operations
- Naval gunfire support
- Command and control

Secondary roles could include:

- Anti-smuggling operations
- Fisheries protection
- Search and rescue
- Disaster relief

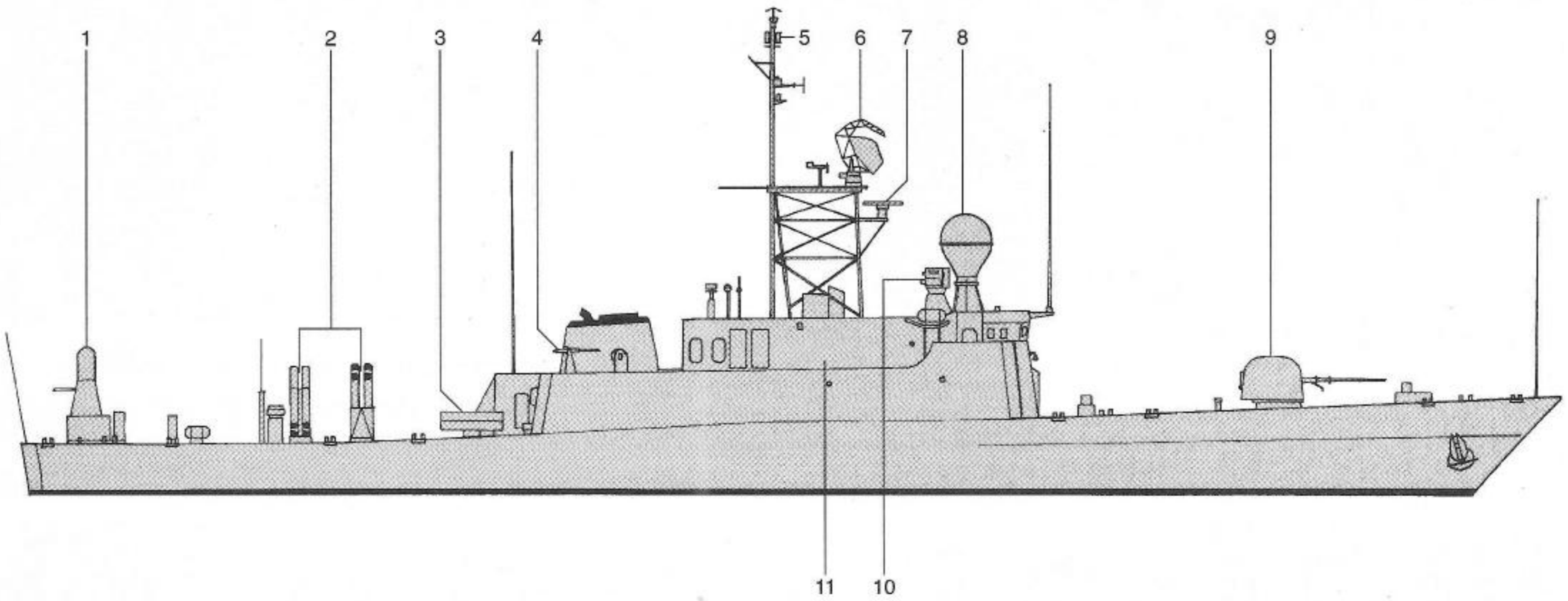


A forecastle hatch hides the capstans and chains (Vosper Thornycroft)



Sailors are used to symmetrical designs, as are the seekers in anti-ship missiles. Sea Wraith *is deliberately asymmetric to cause confusion*
(Vosper Thornycroft)

BADR (TACOMA CORVETTE)



Badr (Ian Sturton)
1 *Hughes Mk 15 20 mm Vulcan Phalanx CIWS* **2** *McDonnell Douglas Harpoon anti-ship missiles (eight)* **3** *US Navy Mk 32 324 mm torpedo tubes* **4** *Oerlikon 20 mm/80 cannon* **5** *AN/SLQ-32(V)1 radar intercept* **6** *Lockheed AN/SPS-40B air search radar* **7** *ISC Cardis AN/SPS-55 surface search radar* **8** *Sperry Mk 92 fire control* **9** *United Defense/OTOBREDA 76 mm (3 in)/62 Mk 75 Mod 0* **10** *Mk 24 optical director* **11** *Loral Hycor Mk 36 SRBOC chaff/IR launcher*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Saudi Arabia
Type: Tacoma Corvette

Class: BADR

Purchased: 4
Active: 4

Displacement:
standard: 870 t
full load: 1,038 t

Dimensions
Length: 74.7 m (245 ft)
Beam: 9.6 m (31.5 ft)
Draught: 2.7 m (8.9 ft)

Speed: 30 kts (gas turbines); 20 kts (diesels)
Range: 4,000 n miles at 20 kts

Complement: 58 (7 officers)

SHIPS

BADR (612)
Builder Tacoma Boatbuilding Co, Tacoma, Washington, USA
Laid down 6 Oct 1979
Launched 26 Jan 1980
Commissioned 30 Nov 1980

AL YARMOOK (614)
Builder Tacoma Boatbuilding Co, Tacoma, Washington, USA
Laid down 3 Jan 1980
Launched 13 May 1980
Commissioned 18 May 1981

HITTEEN (616)
Builder Tacoma Boatbuilding Co, Tacoma, Washington, USA
Laid down 19 May 1980
Launched 15 Sep 1980
Commissioned 3 Oct 1981

TABUK (618)
Builder Tacoma Boatbuilding Co, Tacoma, Washington, USA
Laid down 22 Sep 1980
Launched 18 Jun 1981
Commissioned 10 Jan 1983

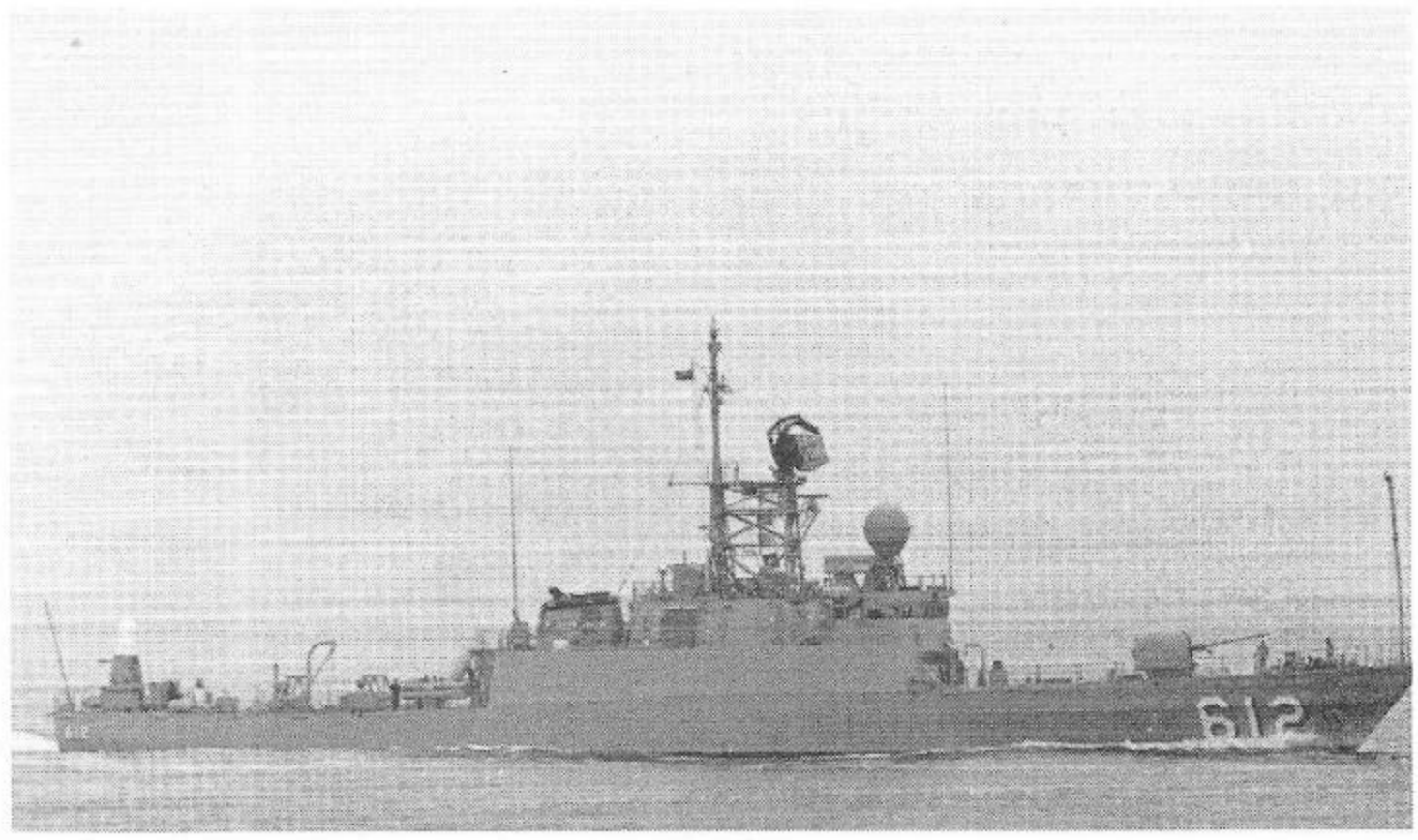
WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84C Block 1C Harpoon

Eight Harpoon anti-ship missile canisters are mounted on the quarterdeck. There are two groups of four launchers, with each group pointing across the ship to the opposite beam. The missiles are the Block 1C version, which has additional options, compared to previous blocks, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications
Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)



Badr *(612) one of four corvettes designed and constructed in the USA for the Royal Saudi Navy between 1979 and 1983. All are currently being refitted in Saudi Arabia with US help* (H & L van Ginderen Collection)

Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 kg)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

TUBES

US 324 mm Mk 32 torpedo tubes

Two Mk 32 triple torpedo launchers are carried.

TORPEDOES

Alliant Techsystems Mk 46 324 mm torpedo

The Mk 46 is a lightweight anti-submarine torpedo with active/passive homing to 11 km (5.9 n miles) at 40 kts. The Mk 46 is a deep diving high-speed torpedo fitted with active/passive homing head and is intented mainly for use against submarines. After water entry it uses a helical search pattern and is capable of multiple re-attacks if required. It has a maximum speed of 40 kts.

Specifications

Length: 2.59 m (8.5 ft)
Diameter: 324 mm (12.75 in)
Weight: 231 kg (509 lb)
Warhead: 44 kg (97 lb) PBXN-103 HE
Speed: 40 kts
Range: 5.94 n miles (11.0 km)

Manufacturer/Contractor

Alliant Techsystems, US.

GUNS

United Defense/OTOBREDA 76 mm (3 in)/62 Mk 75 Compact

There is one United Defense/OTOBREDA 76 mm (3 in) gun sited on the foredeck.

Specifications

Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres (4.72 m; 15.49 ft)
Traverse: 360° at 70°/sec
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,953 ft/s)
Max rate of fire: 85 rds/min
Range: 8.6 n miles (16 km)

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

Hughes 20 mm Mk 15 Phalanx

There is one Hughes 20 mm Mk 15 Phalanx Close in Weapon System (CIWS) situated at the stern. The mount consists of a 20 mm M61A1 Vulcan, six-barrel, Gatling-principle gun with a cylindrical magazine and feeding mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min (Block 0, Block 1 Baseline 0), 4,500 rds/min (Block 1 Baseline 1)
Range: 0.75 n miles (1.38 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA.

Oerlikon 20 mm/80

Two single Oerlikon 20 mm guns are mounted either side of the stack.

Specifications

Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range:
anti-surface: 1.5 km (4,920 ft)
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°

Manufacturer/Contractor

Oerlikon, Switzerland.

M252 81 mm mortar

This is usually an army weapon, but one is carried in each ship.

Specifications

Calibre: 81 mm
Max range: 5,775 m (6,316 yd)
Min range: 100 m (110 yd)
Rate of fire (sustained): 15 rds/min

Mk 19 40 mm Automatic Grenade Launcher

Two Mk 19 grenade launchers are carried in each ship. These are essentially close-range infantry weapons and it is assumed that they are used in close-quarter engagements with small, lightly-armed ships, such as blockade runners and smugglers. It is not particularly accurate and time of flight to 2,000 m (2,187 yd) is about 17 seconds.

Specifications

Range: 2,200 m (2,400 yd)
Muzzle velocity: 240 m/s (785 ft/s)
Rate of fire: 350-400 rds/min

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

AN/SLQ-32(V)1 ESM suite

AN/SLQ-32(V)1 detects all Band 3 radar frequency signals at all azimuths, covering all potential enemy radar-guided, anti-ship missiles and their associated supporting radars, and provides alert facilities to an attack on the ship and also allows for the control of the Mk 36 chaff rocket system.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launchers

There are two Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units.

Specifications

Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)
Barrels: 6

Rounds
Mk 182: 1,209 × 130 mm; 22.7 kg
Super Chaffstar: 1,209 × 130 mm; 20.9 kg
Super Gemini: 451 × 130 mm; 5.5 kg
Super Hiram III: 1,220 × 130 mm; 13.6 kg
Super Hiram IV: 467 × 130 mm; 3.8 kg
Super Loroc: 734 × 130 mm; 13.2 kg

Manufacturers/Contractors

Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Mk 24 optical director

There is one Mk 24 optical director.

Mk 309 Mod 1 anti-submarine fire-control system

Officially designated Control Panel Mk 309, this compact anti-submarine fire-control system was developed in the late 1960s and combines basic displays with the capabilities needed to direct anti-submarine operations involving tube-launched torpedoes. The bulkhead-mounted panel combines the functions of a target-bearing and range indicator, a repeater of own-ship heading, a torpedo presetter and a firing panel. It also displays attack recommendations, defining the direction of the torpedo track and the firing range most suitable for a given tactical situation, as well as generating course-to-steer orders for transmission to remote indicating equipment. Where interlocks are required they are related only to basic safety requirements. The panel does not have a computer but uses a memory based upon a series of shore-developed simulations incorporating the experience of 40,000 torpedo attack exercises, which have been analysed to produce a range of attack solutions for both ship and weapons. During an attack, data is fed to the panel from the gyrocompass and the hull-mounted sonar (range and bearing) and the data is then compared with the attack solutions in the memory to find the appropriate one. The Mk 309 recommends which courses to steer for interception then launching the torpedoes. It also indicates the minimum and maximum ranges at which the torpedo should be launched, based upon the tubes being at a 45° angle, and which angle-on-bow approach should be taken. It will also indicate when the ship should turn to unmask the launchers.

Mk 92 Mod 5 fire-control system

Mk 92 is an Americanised version of the Signaal WM28 system, produced under licence by Unisys. Mk 92, with its distinctive egg-shaped housing, together with the STIR (Signaal Track and Illuminating Radar), provides continuous air and surface search around a ship even in an ECCM environment. It has a fast reaction time and is capable of simultaneous engagement of up to four

surface targets, or two air and two surface targets. The system can engage air, surface or shore targets with guns or missiles. It is fully compatible with Naval Tactical Data Systems (NTDS) and interfaces with the Mk 13 Mod 4 missile handling/launching system, the Mk 75 gun and the Mk 15 Phalanx CIWS.

The Mk 92 consists of a combined antenna system, a separate track illuminating radar, a computer system, weapon control consoles and ancillary equipment, and has a crew of four. The Mk 53 Combined Antenna System (CAS) consists of a monopulse track radar with CW injection above and a track-while-scan radar. Their antennas share a stabilised mount with the monopulse antenna above and the TWS antenna below. The monopulse radar can detect, track and illuminate one target in the air or on the surface. The TWS radar can detect and track up to two surface or shore targets simultaneously, as well as low-altitude targets.

The Lockheed STIR (in American terminology Separate Track Illuminating Radar) is an I/K-band monopulse tracking radar with CW injection which is designed to provide an additional channel of fire for a single air or surface target. It consists of a Mk 54 director with antenna.

There are two 32-bit AN/UYK-7 computers, each with 256 k memory and an optimum operating speed of 667 kops, the second computer having been added to improve the processing of ASW data. There are two Weapons Control Consoles (WCC) in the Combat Information Centre (CIC) to provide a Human Computer Interface (HCI) for acquiring and tracking targets, engagement control, launcher assignment, missile firing and post-engagement evaluation. The Mk 106 WCC supports the CAS and the Mk 107 WCC supports the STIR, but both also receive video data from ship search radars. Between the WCCs are the CIWS and Harpoon control stations and the CIC also has five consoles from the AN/UYA-4 family.

RADARS

	AN/SPS-40B	AN/SPS-55	Mk 92
Company	Lockheed	ISC Cardion	Unisys
Role	Air search	Surface search	Fire control
Band	E/F	I/J (8-20 GHz)	I/J
Beam	11 × 19°	1.5 × 20°	1.5 × 4.7°
Peak Power	200 kW	130 kW	200 kW
Gain	21 dB	31 dB	33.5 dB
Pulsewidth	60 µs	1/12 µs	0.22/0.45 µs
PRF	300 pps	750/2,250 pps	3,600-1,800 pps
Scan rate	7.5/15 rpm	16 rpm	60 rpm
Range	175 n miles (320 km)	—	—

Manufacturer/Contractor
Unisys Corporation, Government Systems Group.

SONAR

AN/SQS-56 (DE 1160)
DE-1160 is a hull-mounted, active search and attack, medium frequency, digital sonar, which uses an active/passive pre-formed beam, panoramic echo ranging and panoramic (DIMUS) passive surveillance. All signal processing is accomplished with digital hardware. All signal data are presented on flicker-free, digitally refreshed television type raster scan CRT displays with symbol and alphanumeric facilities. A single operator can search for, track, classify and designate multiple targets from the active system while simultaneously maintaining anti-torpedo surveillance on the passive display.

Manufacturer/Contractor
Raytheon, USA.

PROPULSION

Specifications
System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 General Electric LM-2500 gas turbine, 17.2MW (23,000 hp); 2 MTU 12V 652 TB91 diesels; 2.55 MW (3,470 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These four corvettes were ordered from Tacoma in 1977 and were delivered between 1980 and 1983 at the start of a major programme to update the Royal Saudi Navy.

DESIGN

These were very similar in design and layout to the rather smaller 'Al Siddiq' class of fast attack craft, which were being built concurrently. Both types have an identical propulsion system and on double the displacement, the 'Badr' class carries only two more Harpoons and the twin 324 mm torpedo tubes.

It is a curious feature of both classes that their weapons fit includes an 81 mm mortar and two 40 mm grenade launchers. These are high-angle, low-velocity weapons, whose accuracy, particularly in a heavy sea, must be very low. The ships are fitted with roll dampers.

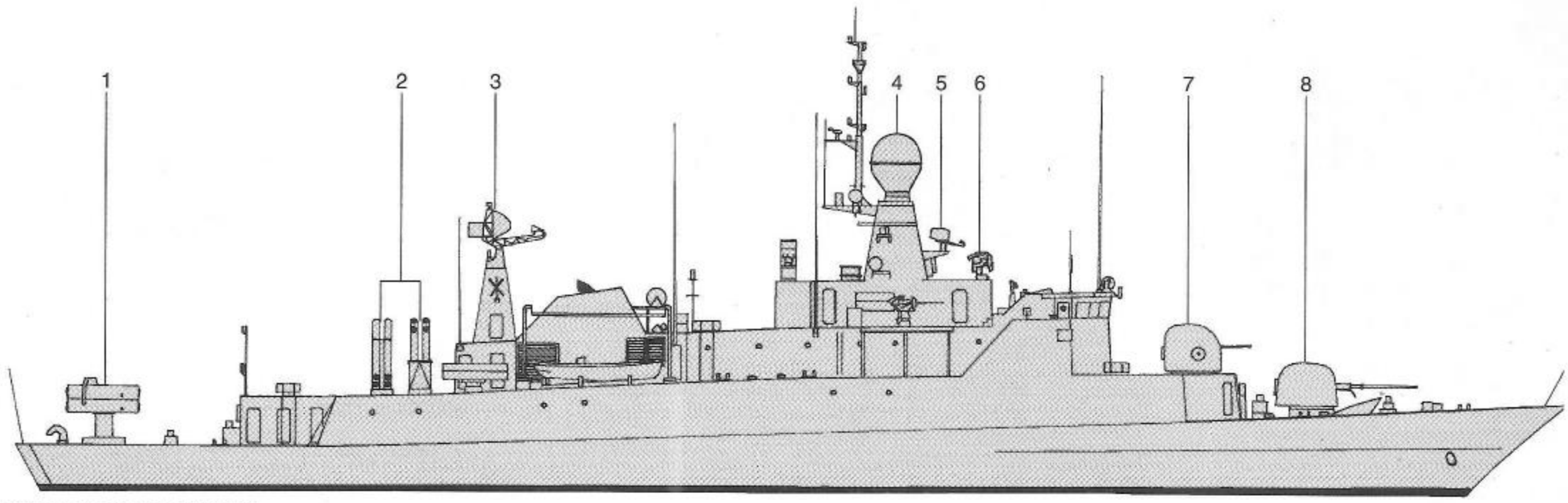
MODERNISATION

All four 'Badr' class ships are being refitted in Saudi Arabia with US assistance.

OPERATIONAL

All four are currently based at Al Jubail on the east coast.

RATTANAKOSIN



Rattanakosin (Ian Sturton)
1 *Alenia Albatros eight-cell launcher for Aspide SAM* **2** *McDonnell Douglas Harpoon anti-ship missiles (eight)* **3** *Signaal DA 05 air/surface search radar* **4** *Signaal WM 25/41 fire-control radar* **5** *Signaal ZW 06 surface search radar* **6** *Signaal LIROD 8 electro-optic director* **7** *OTOBREDA twin 40 mm/70 anti-aircraft mounting* **8** *OTOBREDA 76 mm (3 in)/62 Compact mounting*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Thailand

Class: RATTANAKOSIN

Purchased: 2
Active: 2

Displacement:
full load: 960 t

Length: 76.8 m (252 ft)
Beam: 9.6 m (31.5 ft)
Draught: 2.4 m (8 ft)

Speed: 26 kts
Range: 3,000 n miles at 16 kts

Complement: 87 (15 officers) plus Flag Staff

SHIPS

RATTANAKOSIN (441)

Builder	Tacoma Boatbuilders, Tacoma, Washington, USA
Laid down	6 Feb 1984
Launched	11 Mar 1986
Commissioned	26 Sep 1986

SUKHOTHAI (442)

Builder	Tacoma Boatbuilders, Tacoma, Washington, USA
Laid down	26 Mar 1984
Launched	20 Jul 1986
Commissioned	10 Jun 1987

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84D-1A Block 1C Harpoon

Eight Harpoon anti-ship missile canisters are mounted immediately abaft the mainmast; there are two groups of four launchers each, with one group pointing across the ship to the opposite beam. The missiles are the Block 1C version, which has additional options, compared to previous blocks, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications

(Block 1C)
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 kg)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st.
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s.
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

SURFACE-TO-AIR MISSILES (SAM)

The Albatros system comprises three elements:
Riva-Calzoni launcher
Aspide missile
WM 25 fire-control system

Riva-Calzoni Albatros launcher

The single, eight-cell Albatros launcher is located on the quarterdeck in 'Y' position. Produced by Riva-Calzoni, it has eight launch cells, four on each side of the mounting, each with a frangible front and rear cover. Each cell contains a loading guide to which the launching rail of the missile is electrically and mechanically connected. The 16 reload missiles are stored horizontally in a hydraulically-operated store and reload system in the deckhouse forward of the launcher; they are in four rows of four missiles each, their location corresponding to that of the launcher cells, and each storage cell has an autonomous missile travel device.

Specifications

(Albatros launcher)
Height: 2.98 m (9.8 ft)
Width: 3.82 m (12.5 ft)
Length: 3.82 m (12.5 ft)
Weight (loaded): 8.5 t
Traverse: 360° at 45°/s
Elevation: −5 to +80° at 25°/s.

Alenia Aspide missile

The system uses the Alenia Aspide SAM, a missile developed by Alenia from the US Sparrow. Targets are detected by the ship's primary search radar and then allocated to the Signaal WM 25 fire-control system. The target is acquired by the fire-control system radar and the CW transmitter group injects signals into the fire-control system tracker as the launcher slews in the target's direction. The missile control system selects the missile or missiles which the power supply units then prepare for launch. Total system reaction time is 8 seconds. When the decision is made to engage the target with missiles the reversible pre-launch commands are issued. The firing command itself can be issued automatically or manually, the operator also having the options of a single shot or salvo mode. In the latter, two missiles are launched sequentially against the same target, the maximum firing rate of the system being one missile every 2.5 seconds. Upon launch, the missile is gathered into the tracker-illuminator's beam through a direct signal to the rear receiver and homes on the reflected energy from the target. Up to three missiles at

once may be controlled by the tracker, according to the manufacturer. They also claim the system can engage horizontal targets at up to 8.1 n miles (15 km), vertical ones at 2.7 n miles (5 km) and lateral ones at 4.3 n miles (8 km). A short reaction time gives the system the ability to destroy anti-ship missiles even when detection is late.

Specifications
(Aspide missile)
Length: 3.7 m (1 ft)
Diameter: 20.3 cm (8 in)
Wing span: 80 cm (2.6 ft)
Weight: 220 kg (485 lb)
Speed: Mach 2.5
Range: 7 n miles (13 km)
Altitude: 15-5,000 m (49-16,400 ft)
Warhead: 33 kg (73 lb)
Guidance: Semi-active radar

Manufacturers/Contractors
Alenia Elsag Sistemi Navali, Rome, Italy (system/ missile).
Riva-Calzoni, Bologna, Italy (launcher).

TUBES

Six 324 mm US Mk 32 torpedo tubes in two triple mounts are located on the after superstructure immediately ahead of the Harpoon launchers.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width: 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

TORPEDOES

Sting Ray lightweight anti-submarine weapon
The 'Rattanakosin' class carries British Sting Ray torpedoes. Sting Ray features active/passive homing to 5.9 n miles (11 km)at 45 kts and a 35 kg (77 lb) Torpex shaped charge warhead developed by Royal Ordnance and may be used in deep or shallow waters. It is equipped with a pumpjet propulsion system. The onboard sonar is reported to be multimode and narrow-beam. The narrowband capability provides good Doppler discrimination against slow or quiet targets and the broadband capability gives good target discrimination, range and bearing resolution.

Sukhothai *(442). Two of these corvettes were built for the Royal Thai Navy by Tacoma, Washington in 1984-87* H & L van Ginderen Collection)

Specifications
Length: 2.59 m (8.5 ft)
Diameter: 324 mm
Weight: 267 kg (588 lb) (in air)
Warhead: 35 kg (77 lb)
Speed: 45 kts (estimated)
Range: 6 n miles (11 km) (estimated)
Endurance: Approximately 8 minutes
Depth: 750 m (2,460 ft)

Manufacturer/Contractor
GEC-Marconi Underwater Weapons Systems Ltd, Waterlooville, Hampshire, UK.

GUNS

OTOBREDA 76 mm (3 in)/62 Compact
There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence and anti-surface roles. If the weapon is designated to the air-defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications
Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres
Traverse: 360° at 70°/sec
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,952 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Oerlikon 20 mm
Two single Oerlikon 20 mm guns are mounted on the upper deck either side of the foremast.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range:
anti-surface: 1.5 km (4,920 ft)
anti-air: 1,150 m (3,770 ft)
Rate of fire: 450 rds/min
Round weight: 241 g (8.5 oz)
Projectile: 122 g
Elevation: −15 to +55°

OTOBREDA 40 mm/70 Compact (Type 70) twin mounting
One twin 40 mm turret is mounted forward in 'B' position.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13 to +85° at 60°/s
Rate of fire: 600 rds/min/mount)
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (13,120 ft)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Elettronica Newton EW suite
These ships carry the Elettronica Newton EW suite, which consists of an ESM section and an ECM section, with the related antennas, controlled from an operator console. The ESM section (ELT/211 receiver) provides 100 per cent intercept probability, passive surveillance, automatic instantaneous warning of programmed threat, automatic analysis of threat parameters, automatic identification and tracking of threats, a synthetic data display, instantaneous Direction Finding (DF) and broad frequency coverage. The ECM section provides self-protection by noise jamming using the ELT/318 jammer.

Manufacturer/Contractor
Elettronica SpA, Rome, Italy.

DECOYS

CSEE DAGAIE Mk 2 countêrmeasures system
The decoy system uses French CSEE DAGAIE Mk 2 ten-barrelled, trainable launchers. These can be loaded with either infra-red (IR) or chaff rockets. The firing sequence runs automatically once triggered by a missile alarm from a variety of sources, such as radar, ESM systems, or optical sights, thus providing a very short reaction time. The firing direction is optimised in accordance with the threat bearing, wind speed and direction, ship heading and speed data.
The launching of radar and IR decoys is so arranged that advanced mixed-guidance missile systems cannot discriminate them and thus collocation of both decoys is achieved. The installation is a double mounting and comprises two trainable mountings carrying 10 replaceable containers (suitcases), each of which is loaded with either IR or I/J-band chaff projectiles.

A wide range of ammunition is provided by Etienne Lacroix Defense providing seduction, distraction and seduction/ dissimulation modes. The electromagnetic decoys are normally based upon aluminised fibreglass chaff with rapid bloom time and they cover the I and J frequency bands. The infra-red decoys cover both the 3-5 and the 8-14 µm bands.

Specifications
Traverse: 330° at 21°/s
Average reaction time: Within 4 s
REM rocket dimensions: 850 × 127 mm (33.5 × 5 in)
Rocket weight: 13 kg (28.66 lb)
Container dimensions: 900 × 130 mm (35.4 × 5.1 in)
Container weight: 20 kg (44.1 lb)
LIR/LEM container dimensions: 780 × 630 × 134 mm (30 × 24.8 × 5.3 in)

Manufacturer/Contractor
CSEE Dèfense, Paris, France.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Sensor Weapon Control and Command System (SEWACO)
The export version of Signaal's SEWACO system is named FORESEE (Command, Communications, Control and Co-ordination or 4C), with the version for Thailand being designated 'FORESEE TH'. At the heart of the system is the C^2 system (FORESEE) which is designed to present raw and/or processed sensor data from search and fire-control radars together with IFF, sonar, electronic warfare and electro-optic systems to create a picture of the tactical situation. This data is provided by onboard or offboard sensors through a tactical datalink. The data may also be used to designate

targets to weapon systems and to assist in operations with auxiliary functions such as ASW helicopter direction and tactical navigation.

The C² systems of the 1980s feature a mainframe architecture which uses up to three Signaal computers of the SMR family. The SMR is a mainframe computer designed to be plugged into standard 19 in racks and in a variety of memory sizes, originally 8 to 64 k. In this SMR the maximum capacity of the main memory was 65,538 24-bit words and memory access time was 0.625 µs. The SMR family has been improved to reduce physical size and to increase memory and speed leading to the SMR-MU micro-mainframe computer for general purpose, real-time, processing.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Signaal LIROD 8 optronic director
LIROD (Lightweight Radar Optronic Director) is a lightweight fire-control system based upon a K-band tracking radar and a TV camera and is designed for simultaneous control of two dual-purpose guns while tracking one air and one surface target. The system reaction time from detection to the beginning of the engagement is about 4.5 seconds. It is based upon a 0.6 m (1.97 ft) diameter parabolic antenna with monopulse cluster. It has a very narrow pencil beam and is resistant to clutter through the application of pulse Doppler tracking combined with FFT techniques. There are also sophisticated Electronic Counter-CounterMeasures (ECCM) facilities. The radar can track fighter-size targets up to 9.7 n miles (18 km) away and is capable of tracking targets with a maximum speed of 1,000 m/s (3,280 ft/s). In addition to the radar there is a militarised TV camera with CCIR standard video format, which can detect fighter-size targets at about 5.44 n miles (10 km) and large surface ships at about 10.9 n miles (20 km).

Specifications
Director
Traverse: 360°/s at 120°/s

RADARS

Type	DA-05	ZW-06	Type 1226	WM 25/41
Manufacturer	Signaal	Signaal	Racal-Decca	Signaal
Role	Air/surface search	Surface search	Navigation	Fire control
Band	E/F	I	I	H/I
Beam	1.5 × 8°	0.9 × 19°	1.2°	Search: 1.5 × 7.0° Track: 2.4°
Peak power	1,200 kW	60 kW	25 kW	200 kW
Gain	32.2 dB	32 dB	30 dB	33.5 dB
Pulsewidth	1.3/2.6 µs	0.06/0.6 µs	0.05/0.25/1.0 µs	0.22/0.45 µs
PRF	1,000/500 pps	4,000/2,000 pps	3,600/1,800 pps	–
Scan rate	10/20 rpm	24 rpm	28 rpm	60 rpm
Typical range	Air target: 2 m² at 84 n miles (156 km) at 60,000 ft (18,000 m)	14 n miles (26 km)	48 n miles (89 km)	25 n miles (46 km)

Elevation: −25 to +150° at 80°/s
Radar: K-band
Field of view: TV camera: 3-30° (2-20°)
IR camera: 3°

Laser rangefinder
Pulse length: 20 ns
Max repetition frequency: 10 Hz
Beam divergency: 1.2-1.5 mrad

Laser tracker
Max repetition frequency: 25 Hz
Beam divergency: 1.5 and 6 mrad

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Netherlands.

SONARS

STN Atlas DSQS-21C
DSQS-21C is a hull-mounted, active search and attack sonar operating at medium frequency. The DSQS-21 features computer-aided detection and tracking and the information is presented on colour CRT displays to permit Doppler coding and discrimination of data.

Specifications
Diameter of transducer arrays: 1 m (3.28 ft)
Number of preformed beams: 32

Manufacturer/Contractor
STN Atlas Elektronik, Bremen, Germany.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 20V 1163 TB83, 10.83 MW (14,730 hp)

Shafts: 2
Propellers: 2 KaMeWa

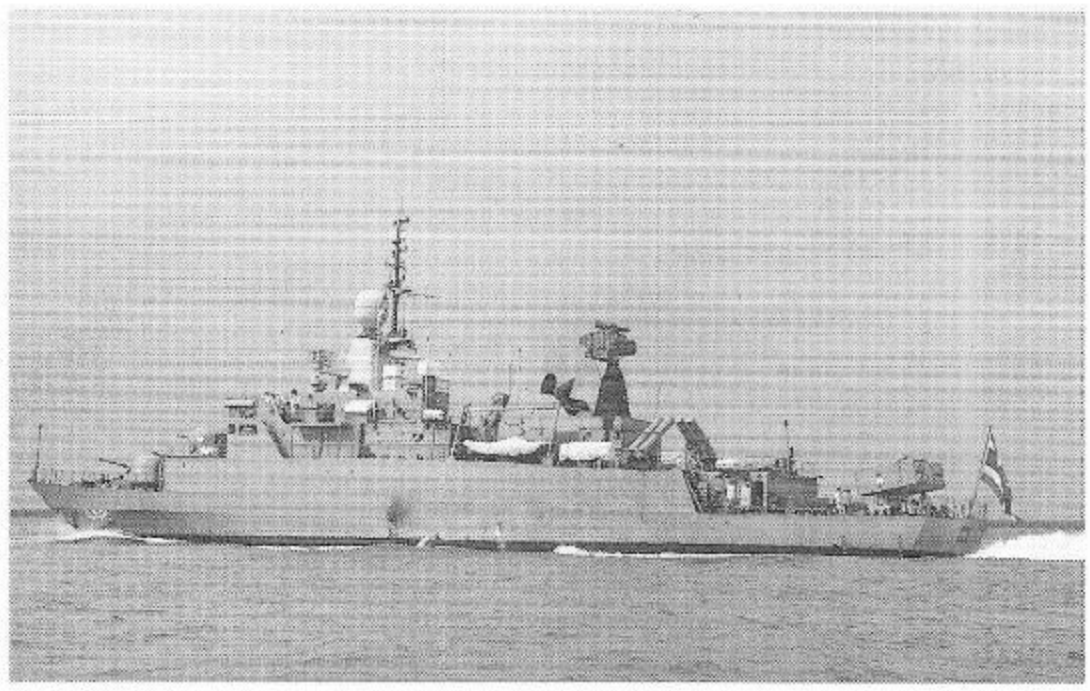
FURTHER INFORMATION

PROGRAMME
The contract with Tacoma was signed on 9 May 1983, but the initial intention to build a third was overtaken by the decision to order the 'Khamronsin' class (Vosper) corvettes. The first of class was laid down on 6 February 1984 and launched on 11 March 1986, followed by the second which was laid down on 26 March 1984 and launched on 20 July 1986.

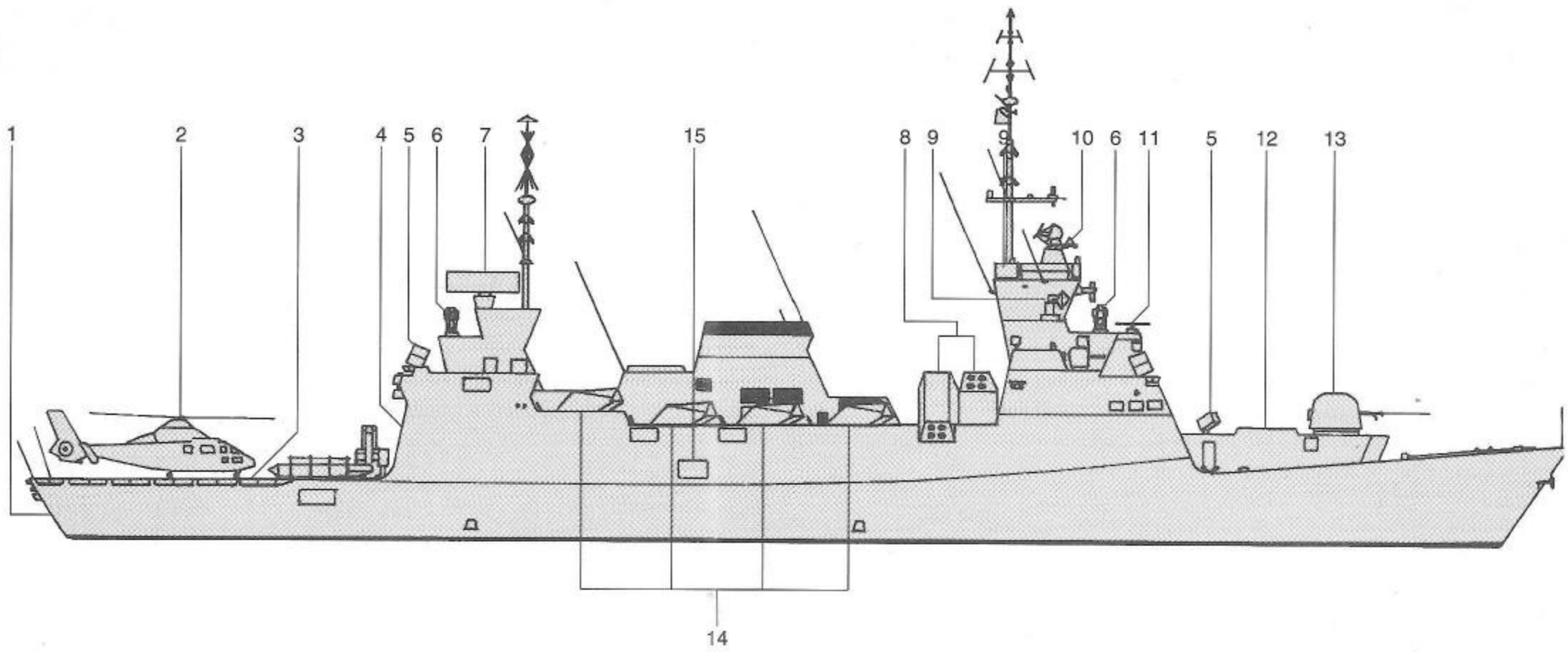
DESIGN
These ships are very similar in size to the 'Badr' class ships built by Tacoma for Saudi Arabia, which were launched in 1980-81, although they have a much more substantial superstructure. Also the Saudi ships have CODAG propulsion, while these Thai ships have two diesels.

One of the features of these ships is the multisourcing of systems and subsystems, which must have led to some problems of integration when working up, and cause maintenance and supply problems to this day. Thus, the ships were built in the USA but have German engines, American SSMs, Italian SAMs, Italian and Swiss guns, US torpedo tubes firing British torpedoes, French decoys triggered by an Italian ESM system and a German sonar, all tied together by a Dutch command system.

FUTURE
Weight has been allowed for a Phalanx system, for which space has already been earmarked on the roof of the deckhouse aft of the Harpoon launchers.



EILAT (SA'AR 5)



Eilat (Ian Sturton)
1 *Rafael towed array (FFBNW)* **2** *Aerospatiale Dauphin SA 366G* **3** *Flight deck* **4** *Hangar* **5** *Deseaver chaff/IR launcher* **6** *Elop MSIS electro-optic director* **7** *Elta EL/M-2218S air search radar* **8** *McDonnell Douglas Harpoon anti-ship missiles (eight)* **9** *Elta EL/M-2221 GM STGR fire-control director* **10** *Cardion SPS-55 surface search radar* **11** *Navigation radar* **12** *IAI Barak I vertical launch SAM (64 cells)* **13** *OTOBREDA 76 mm (3 in)/62 compact* **14** *IAI Gabriel II anti-ship missiles (eight)* **15** *US Navy triple Mk 32 324 mm torpedo tubes (two sets; behind hatch)*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Israel
Type: Sa'ar 5

Class: EILAT

Built: 3
Active: 3

Displacement:
standard: 1,075 t
full load: 1,227 t

Dimensions
Length: 86.4 m (283.5 ft)
Beam: 11.9 m (39 ft)
Draught: 3.2 m (10.5 ft)

Speed: 33 kts on gas turbines; 20 kts on diesels
Range: 3,500 n miles at 17 kts
Endurance: 20 days

Complement: 64 (16 officers) plus 10 aircrew (4 officers)

SHIPS

EILAT (501)	
Builder	Ingalls, Pascagoula, Missouri, USA
Laid down	24 Feb 1992
Launched	9 Feb 1993
Completed	24 May 1994

LAHAV (502)	
Builder	Ingalls, Pascagoula, Missouri, USA
Laid down	25 Sep 1992
Launched	20 Aug 1993
Completed	23 Sep 1994

HANIT (503)	
Builder	Ingalls, Pascagoula, Missouri, USA
Laid down	5 Apr 1993
Launched	4 Mar 1994
Completed	7 Feb 1995

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas RGM-84D-1A Block 1C Harpoon

Eight Harpoon anti-ship missile canisters are mounted immediately abaft the forward superstructure; there are two groups of four launchers, with each group pointing across the ship to the opposite beam. There appear to be two types of launch container, one with four individual cylindrical containers, the other with a single squared box containing four missiles.

The missiles are the Block 1C version, which has additional options, compared to previous blocks, one of which is to fly at a relatively high altitude for the first part of its path to avoid friendly ships or intervening low landmasses. A second option is to approach the target indirectly, using up to three preselected waypoints, where course can be changed at angles greater than 15°. Block 1C missiles can also use selectable seeker search expansion patterns, and for the terminal phase have the alternatives of a sea-skimming approach or a low-apogee 'pop-up' trajectory.

Specifications

Block 1C
Length:
with booster: 4.63 m (15.19 ft)
without booster: 3.84 m (12.59 ft)
Diameter: 34 cm (1.12 ft)
Wing span: 83 cm (2.72 ft)
Weight:
with booster: 681.9 kg (1,503 kg)
without booster: 519.3 kg (1,145 lb)
Max speed: Mach 0.85
Range: 67 n miles (124 km)
Propulsion: Teledyne CAE J402-CA-4000 single-spool turbojet; 2.92 kN st
Booster: Thiokol or Aerojet rocket; 5,400 kg thrust for about 2.9 s
Warhead: 221.6 kg (488.5 lb) semi-armour-piercing
Fuze: Contact delay
Guidance: Inertial and active radar

Manufacturers/Contractors

McDonnell Douglas Aerospace, St Louis, Missouri, USA (prime and missile).
US Naval Weapons Center, China Lake, California, USA (warhead).
Thiokol, Elkton, Maryland, USA (booster).

Gabriel II

Eight single Gabriel launchers are located in the waist, four on each side. The Israeli missile complements Harpoon and uses radar or optical guidance and semi-active homing out to a range of 19.4 n miles (36 km) at a speed of Mach 0.7. The earlier Gabriel I has a semi-active seeker and is powered by a booster producing 3,600 kg (7,937 lb) of thrust for 3 seconds and a sustainer which burns for 100 seconds, while Gabriel II has improved guidance and a larger sustainer which burns for 200 seconds.

The Gabriel system consists of the fire-control radar, a Display Control and Processing Unit (DCPU), a vertical reference unit, a remotely-operated optical sight and a launcher switch. It requires two operators, one for the DCPU and the other for the optical sight. In addition to this hardware, the system includes a bridge control unit which also indicates missile status and a helmsman unit which indicates which course to steer in order to bring the selected launcher to the correct bearing.

The DCPU consists of a computer, target/missile tracking, missile guidance and missile selection/firing units, power supply and operating panel. The launching system is linked to the DCPU by a launcher switch and a launcher power unit. The missile is mounted on a rail inside a hermetically sealed, steel container with a hydraulically-operated container door.

Targets acquired by the ship's search radar are presented on the DCPU display screen. The operator then selects a missile or missiles, provides target range and bearing, sets the cruise-phase height then initiates the launch sequence. When this occurs the launcher opens, the booster is ignited and then carries the missile away from the ship and towards the target at a height of 35 m (115 ft), enabling the system to gather the missile within the radar beam which controls

direction. At about the same time the sustainer ignites and the missile enters the cruise phase, dropping to a height of 17 to 20 m (56 to 66 ft). It informs the ship of its location through the downlink and the DCPU controls its direction through the uplink, the radio altimeter ensuring that it maintains the correct height.

When the seeker acquires the target through reflected energy, the missile then descends lower for the low-level terminal phase at a height of 2.5 to 3.5 m (8.2 to 11.5 ft).

There is an alternative manual/optical control system for use in severe ECM conditions, in which the optical periscope operator aligns the missile to the target manually using a joystick to control the missile. In addition Gabriel II is reported to have a home-on-jam capability to meet the same conditions.

Specifications
Gabriel II
Length: 3.42 m (11.2 ft)
Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)
Weight: 522 kg (1,151 lb)
Speed: Mach 0.7
Range: 19 n miles (35 km)
Warhead: 150 kg (330 lb)
Guidance: Semi-active radar and manual

Manufacturer/Contractor
Israel Aircraft Industries (IAI), Ben Gurion International Airport, Israel.

SURFACE-TO-AIR MISSILES (SAM)

Barak-I point defence system
Each ship has two Barak-1 vertical launch units, each containing 32 missiles: one is mounted aft of the stack, the other on the fordeck immediately forward of the bridge screen. The Barak-1 point defence missile system is designed to protect ships against both manned aircraft and anti-ship missiles; it has a quick reaction time, typically 3 seconds, which includes 0.6 seconds to turn-over in the anti-missile role. The Barak-1 missile is powered by a triple-thrust rocket motor, giving it a speed of approximately Mach 2.

The fire-control system is based upon the Elta EL/M-2221GM I/J and K-band monopulse coherent tracking and illumination radar which is supplemented, on its right-hand side, by a Rafael thermal imager. The radar has a dish antenna with front feed on four 'legs', with an elevation of −25 to +85°. Search acquisition and tracking may be conducted in either I/J (8-20 GHz) or K-bands (20-40 GHz) and it can track the target or targets while controlling two missiles. The system can also be used to control guns, possibly with the assistance of a separate ballistic computer. The Fire-Control Console (FCC) is used to control both the Barak weapon system (through the missile control unit) and also guns (through the gun control unit) and it acts as interface between the Barak weapons system and other ship systems. Upon acquisition of the target/targets by the ship's search radar, the fire-control radar designates the targets and the system automatically calculates the level of threat from each target, allocates a missile or missiles and automatically launches them. In the anti-ship missile role the Barak-1 leaves the launcher vertically and is then 'turned over' towards the target by the thrust vector control system which is automatically discarded, presumably by explosive bolts, upon completion of the task. The missile is acquired and controlled by the fire-control radar which then guides it towards the target. The missile is capable of engaging targets 2 m (6.56 ft) above the sea and can manoeuvre at 25 *g*.

Specifications
Length: 2.17 m (7.12 ft)
Diameter: 17 cm (6.7 in)
Wing span: 68.4 cm (27.0 in)
Weight: 97.9 kg (215.8 lb)
Speed: Mach 2 (580 m/s (1,900 ft/s))
Range:
anti-aircraft: 500 m to 12 km (6.5 n miles)
anti-missiles: approximately 5 km (16,000 ft)
Guidance: Command/line of sight or optical
Warhead: 22 kg (48.5 lb) HE fragmentation

Eilat *(501) with Phalanx, Barak and Harpoon weapons installed* (Ingall's Shipbuilding)

Manufacturers/Contractors
Israel Aircraft Industries (IAI), Ben Gurion International Airport, Israel (prime).
Rafael, Haifa, Israel (launch unit).

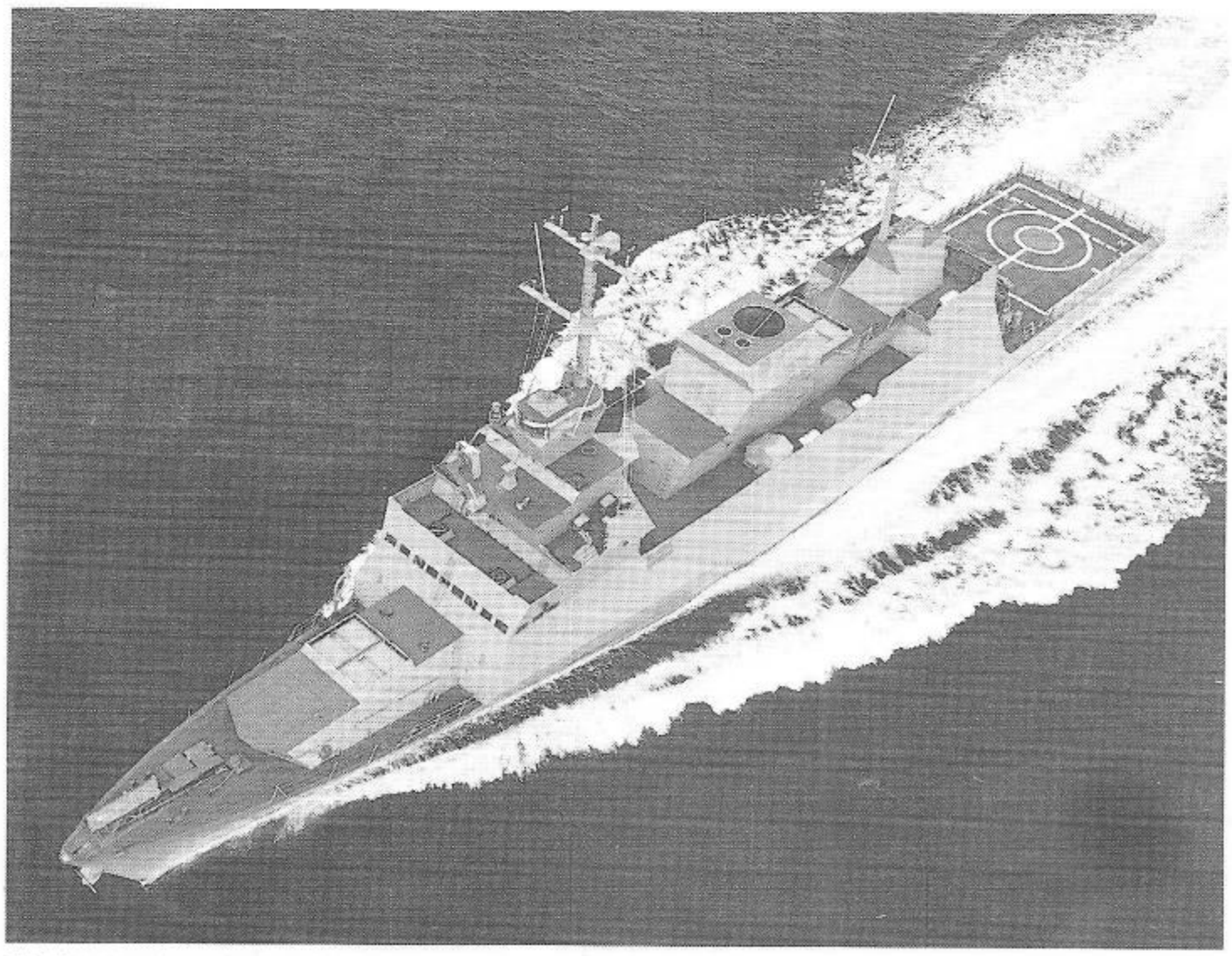
TUBES

324 mm Mk 32 torpedo launcher
Two triple 324 mm US Mk 32 Mod 9 torpedo tubes are located in the waist; each group of three is inside the superstructure and launches the torpedoes through a hatch in the ship's side.

TORPEDOES

Alliant Techsystems Mk 46 324 mm torpedoes

Specifications
Length: 2.59 m (8.5 ft)
Diameter: 324 mm (12.75 in)
Weight: 230 kg (507 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,510 ft) (estimated)



Eilat *(501) prior to the installation of weapons. The forward deckhouse has a mounting for the gun module (76 mm, 57 mm or 30 mm CIWS) and a housing for the 64-round Barak I vertical launcher. Note the profusion of angles and the IR filters on the stack, all designed to reduce the ship's image to hostile radars and IR seekers* (Ingall's Shipbuilding)

GUNS

These ships have a unique facility, in that in 'A' position there is a special deck mounting which enables the actual mount to be rapidly changed between an OTO-BREDA 76 mm main gun, a Bofors 57 mm and a Phalanx close in weapons system. This ability to change the mount appears to be exercised and it is thus impossible to predict which of the three weapons the ships will be armed with at any one time. It is also not known what tactical criteria would be applied by the Israeli Navy in selecting any one system or how long a change would take.

OTOBREDA 76 mm (3 in)/62 Compact
The OTOBREDA 76 mm (3 in) gun is for use in either air defence or anti-surface roles. If the weapon is designated to the air-defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications
Calibre: 76.2 mm (3.0 in)
Length of barrel: 62 calibres
Traverse: 360° at 70°/sec
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,952 ft/s)
Max rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Hughes MK 15 CIWS Phalanx

The second alternative in 'A' position is a single Hughes Mk 15 Phalanx Close In Weapons Systems (CIWS) to provide the innermost layer of defence against anti-ship missiles. The 20 mm M61A1 Vulcan, six-barrel, Gatling-principle gun has a cylindrical magazine with the feed mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.38 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA.

Bofors SAK 57 L/70 Mk 2

The third alternative in 'A' position is the Bofors SAK 57 L/70 Mk 2, which is intended to engage air and surface targets and to provide gunfire in support of troops ashore. It is house inside a 'stealthy' shield.

Specifications

Calibre: 57 mm
Length of barrel: 70 calibres
Traverse: 360° at 55°/s
Elevation: −10 to +77° at 40°/s
Crew: 3
Range: 9 n miles (17 km)
Rate of fire: 220 rds/min
Projectile weight: 2.4 kg (5.3 lb)

Manufacturer/Contractor

Bofors Weapon Systems, Sweden.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Elisra NS-9003A ESM system

The NS-9003A naval ESM system operates in a dense environment to carry out ESM and is able to cope with frequency agility, frequency-hopping, and staggered or wobbulated PRI emitters. The system automatically receives, analyses and identifies over-the-horizon radar signals with a 100 per cent probability of intercept over the frequency range from 2 to 18 GHz (0.5 to 40 GHz optional). The direction of arrival is instantaneously measured per pulse, using an accurate multibeam antenna array. This instantaneous direction finding enables the system to locate any exotic-type radar signal in the reception range within a fraction of a second. The analysed information is presented on a 19 in graphic situation display in several operator-selected modes for various EW tasks. The system has built-in power management provisions for ECM and chaff/flare activation. The NS-9003A antenna assembly includes a multibeam static antenna array with associated RF video and digital DF processing hardware, and an omni-directional antenna array. Other units in the system are: receiving and processing equipment and an operator console. Interface to radar blankers, gyro equipment, weapon system, ECM jamming and deception system, chaff/flare equipment and satellite navigation system can also be provided.

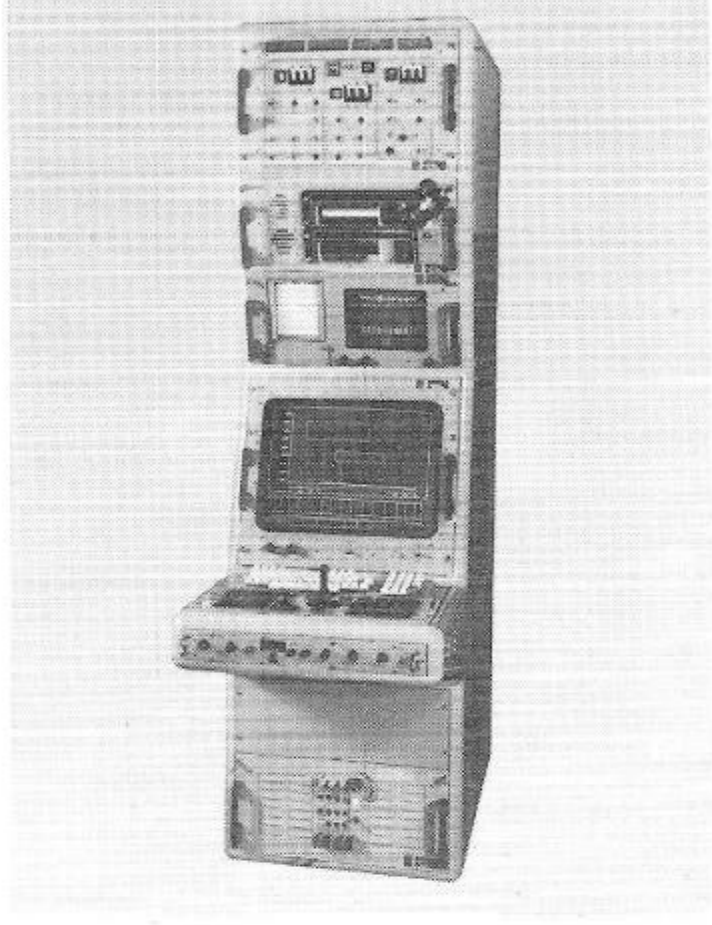
Although an integrated EW suite consisting of the NS-9003A and the NS-9005 jamming and deception system is available the Israeli Navy has selected the Rafael RAN-101 jammer for this installation (see next entry).

Specifications

Frequency range: 2-18 GHz (0.5-40 GHz optional)
DF accuracy: 1° I- and J-bands; 2° E/F- and G/H-bands
Sensitivity: −70 dBm
Frequency measurement: Instantaneous 2 MHz resolution

Manufacturer/Contractor

Elisra Electronic Systems, Bene Baraq, Israel.



NS-9003A naval ESM system

ELECTRONIC COUNTERMEASURES (ECM)

Rafael RAN-1010 jammers

There are two RAN-1010 jammers. RAN-1010 is a multi-beam array transmitter, designed to provide very high Effective Radiated Power (ERP), ultra-high speed electronic beam steering and the capability for jamming several signals simultaneously. This enables the jamming system to provide protection against simultaneous threats from a number of different directions in a multimissile attack. The use of LENS technology for a beam forming network enables the equipment to provide a wide frequency beamwidth and instantaneous azimuth coverage, as well as very high ERP and beam-steering.

Specifications

Frequency coverage: 7.5-18 GHz
ERP: 78 dBm typical
Instantaneous azimuth coverage: 360°
Beamwidth: Azimuth 6° min; elevation 25°
Number of beams: 32
Beam switching time: 150 ns

Manufacturer/Contractor

Rafael, Haifa, Israel.

DECOYS

Elbit Deseaver decoy control and launching system

There are four Deseaver launchers. Deseaver is a decoy control and launching system which responds to data received from the ship's command and control system and/or its sensors. The system then launches a barrage of expendable decoys with precise priority and timing. The Deseaver system performs the following tasks:

- evaluates the threat picture and selects appropriate passive countermeasures in conjunction with the EW defence system
- computes deployment procedures
- recommends preferred ship's course and speed as part of the anti-missile defence procedures
- launches defence decoys
- controls up to six types of EW rockets (chaff and IR)
- allocates resources and launches rockets according to selected programmes
- deploys tactical decoys
- provides the commanding officer with a display of the threat and decoy environment

Deseaver has three operating modes: automatic, semi-automatic and manual. In the latter, most functions are still performed automatically, but operator approval is required for target designation and rocket launch.

The stabilised rocket launching unit coverage is ±170° relative to a preset azimuth heading line. In elevation, coverage is according to the selected launch angle, from +15 to +55° relative to the horizon. Velocity in azimuth traverse is 180° in four seconds, and in elevation is 45° in up to 1.5 seconds.

Manufacturer/Contractor

Elbit Ltd, Haifa, Israel.

AN/SLQ-25 Nixie noisemaker

One AN/SLQ-25 Nixie (Phase 1), a solid-state, modular design electro-acoustic countermeasures decoy system is used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming/recovering the towed bodies and a coaxial switching unit which selects the appropriate cable or load and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body. The winch and two towed bodies are located in a stern compartment, with the towed bodies being deployed through the transom or in a partially or totally enclosed location on the main deck. Immediately forward of the winch compartment is the Nixie electrical room where the winch motor controller, the coaxial switching unit dummy loads and the transmitter are located. Each winch can stream and recover the 488 m (1,600 ft) of cable at 30.5 m/min (100 ft/min), each cable weighing 408 kg (900 lb). The towed bodies, streamlined to prevent cavitation and with all exposed aluminium parts anodised for corrosion resistance, are 95 cm long (3.10 ft), 15.24 cm (6 in) in diameter and weigh 18 kg (40 lb). They receive amplifier outputs, convert them into acoustic signals and project them. Usually one towed body is deployed at a time.

Manufacturer/Contractor

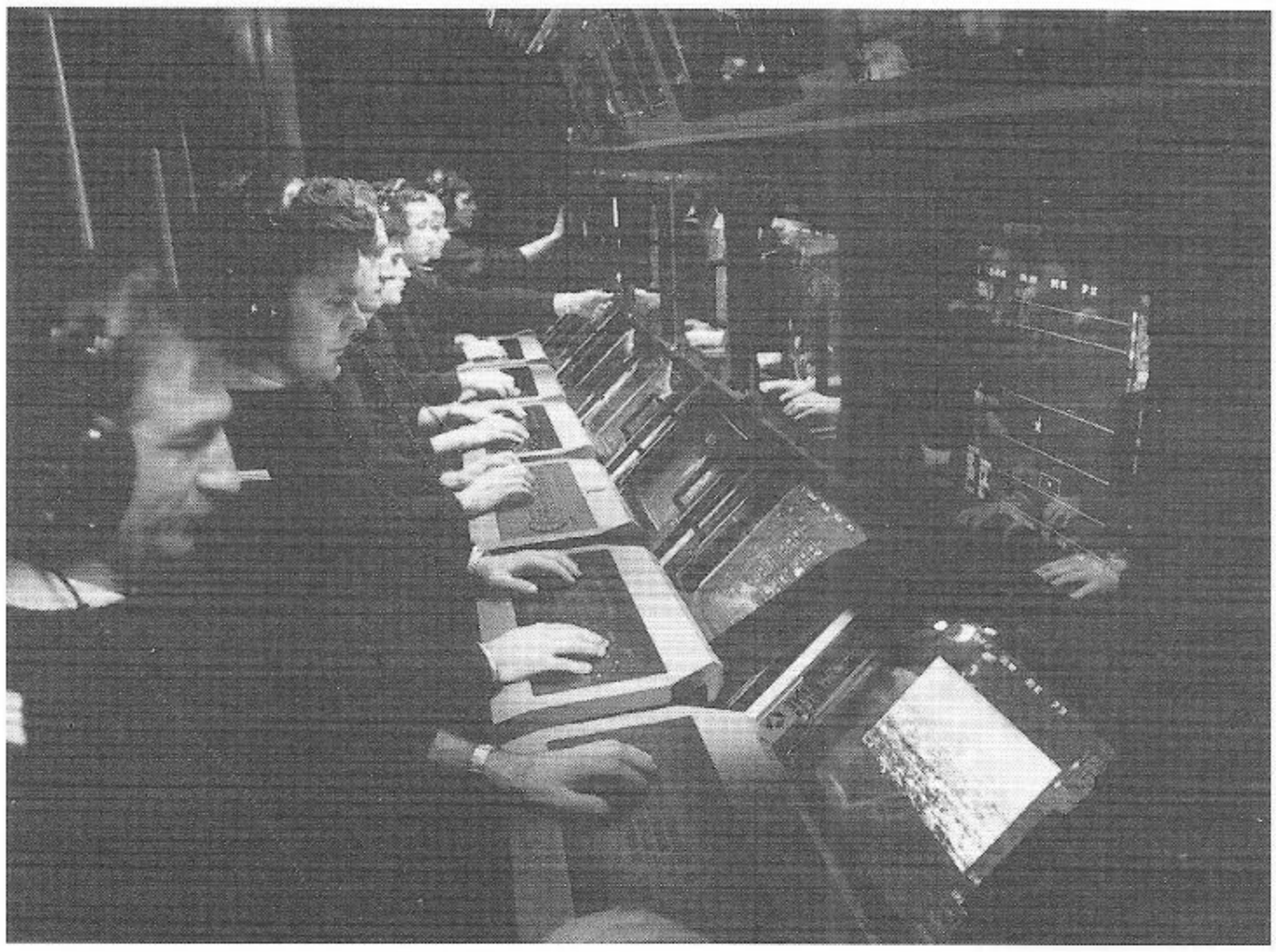
Aerojet ElectroSystems, Sacramento, California, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

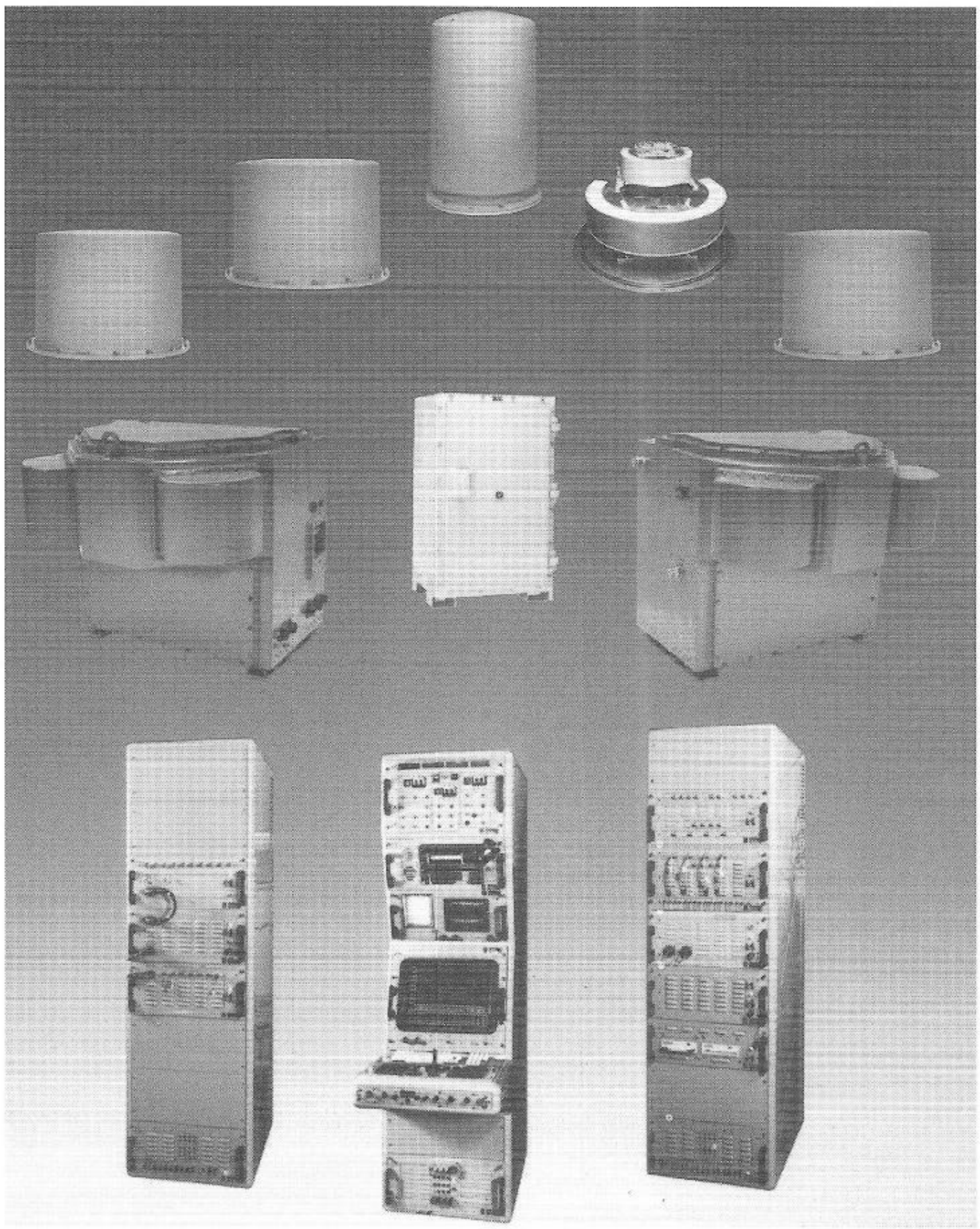
Elbit AIO III (NTCCS)

The latest version of Elbit's Action Information Organisation (AIO) system is AIO III, which entered service in the 'Sa'ar 5' class corvettes. AIO III accelerates the decision-making process by providing data on potential targets, friendly forces and weapon system status using inputs from shipborne sensors and those of friendly forces. System highlights include extracting and updating target data, track-while-scan operation, the ability to process two radars simultaneously with real-time handling of up to 50 air and surface targets. It also processes and displays navigation data, exchanges messages with shore-based headquarters and records tactical data for future debriefing.

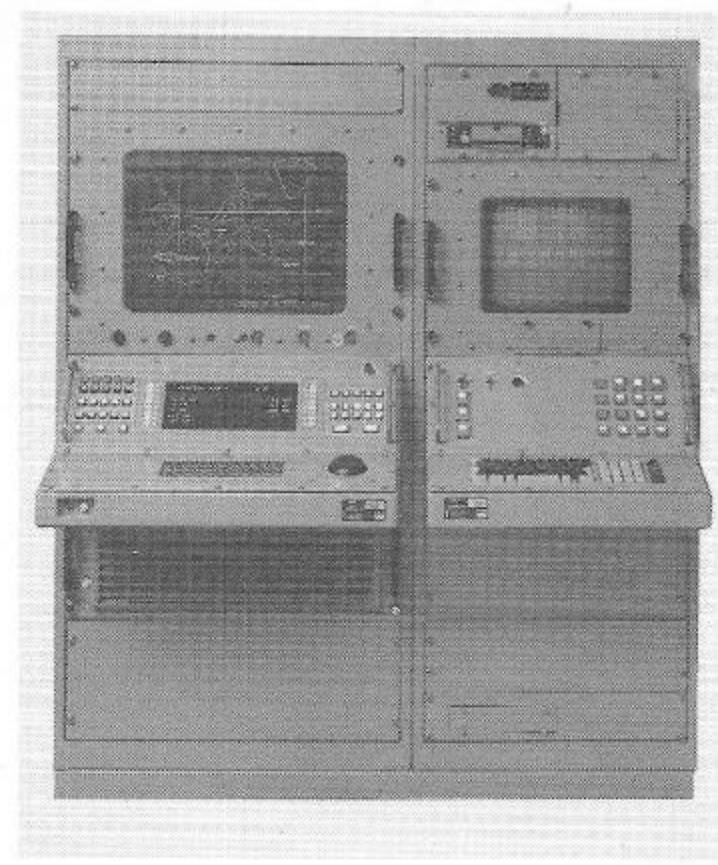


EI-Op MSIS

AIO III features a distributed architecture but with two Elta EL/S-9000 computers for system support (one is redundant). The EL/S-9000 are based upon Motorola 68040 microprocessors and use Ada software language using the 2167A development standard. They are linked to workstations by the Tadiran Shipboard Databus (SDB-2) local area network which uses Ethernet (10 Mb/s) or RS-232C (19.2 Kb/s) or RS-449 (38.4 Kb/s) interfaces and a number of parallel databuses. They are linked through Bus Interface Nodes (BIN) consisting of a VME-based processor (Motorola 68020). The workstations are the Astronautics Corporation of America's Operator Control Console (OCC). This has three processors based upon the Motorola 68020 as display, console and MMI processors each capable of 5-6 mips. The display and MMI processors use the



Elements of the NS-9003A system



Elbit AIO console

MTOS-UX operating system and are linked by a common memory with a combined 2 Mbyte Erasable Programmable Read-Only Memory (EPROM) and 2 Mbyte RAM. The console processor has two graphics engines each with three high-speed processors operating in parallel to provide a true rate of 6 million pixel/s random draw and 48 million pixel/s rectangle fill. The generator can accept 40 MHZ digital, and RS-170, RS-343A and RS-412 standard analogue video inputs. The MCI consists of two displays, a QWERTY standard keyboard, function keys, rollerball and joystick. The prime display is a 19 in (48.26 cm) raster scan screen with 1,280 × 1,024 pixel resolution. This may be supplemented either by another 19 in screen or two 9 in (22.86 cm) medium resolution (640 × 512 pixel) displays. The 'Sa'ar 5' class has a Combat Information Centre (CIC) subdivided into 'attack' and 'defence' areas with the former including positions for the ship commander and navigation officer. The 'attack' area is designed to provide target designation and engagement functions with integrated weapon assignment and to monitor the progress of an engagement. The 'defence' area provides threat engagement data and priorities, designates the appropriate systems and is responsible for the exchange of threat reports via datalink.

Manufacturer/Contractor
Elbit Computers Ltd, Israel.

COMMUNICATIONS AND DATALINKS

There is a datalink, designation unknown.

WEAPONS CONTROL

EI-Op MSIS

There are three electro-optic directors in each ship. MSIS is a multisensor electro-optic system which is used for day/night surveillance, target recognition, passive target tracking and for fire control of guns up to 76 mm. There is a four-axis gimballed platform with line of sight stabilisation of 20 rad, and a sensor package consisting of an 8-12 micron FLIR, TV camera and Nd:YAG laser rangefinder capable of engaging targets as close as 300 m (984 ft). The below decks element consists of an electronic unit, a power supply unit, a video tracker and a command/display unit.

The sensors are in a lightweight, ball-shaped turret, which provides low wind resistance, enhancing resolution and tracking accuracy. Detection ranges quoted for the FLIR include 9 n miles (17 km) against an FAC and 10 n miles (18.5 km) for an aircraft (with atmospheric visibility at 8.1 n miles (15 km) while for the TV camera the ranges are 7.56 n miles (14 km) and 9.2 n miles (17 km), respectively (meteorological visibility at 12.4 n miles (23 km). In similar meteorological conditions recognition ranges quoted for the FLIR are 5.94 n miles (11 km) and 4.32 n miles (8 km) against FACs and aircraft while for the TV camera they are 5.4 n miles (10 km) and 3.24 n miles (6 km).

The command and display unit consists of a small monochrome TV screen, six function switches and a similar number of buttons. There is also a small joystick.

Specifications
Turret
Height: 65 cm (25.6 in)
Diameter: 55 cm (21.7 in)
Weight: 60 kg (132 lb)
Elevation: −15 to +85°
Azimuth: 360° (nominal)
Slewing rate: 60°/s
Fields of view: 25.7 × 9.2, 7.4 × 5.5, 2.1 × 1.57°

Manufacturer/Contractor
El-Op, Rehovot, Israel.

RADARS

Elta EL/M-2218S
The EL/M-2218S is a 3D version of Elbit's 2200 series of naval radars and is used for air/surface search.

Manufacturer/Contractor
Elta, Israel

Cardion AN/SPS-55
The cardion AN/SPS-55 is used as the surface search radar.

Specifications
Band: I
Beam: 1.5 × 20°
Peak power: 130 kW
Gain: 31 dB
Pulsewidth: 0.12/1 µs
PRF: 2,250/750 pps
Scan rate: 16 rpm

Manufacturer/Contractor
Cardion, Woodbury, New York, USA.

Elta EL/M-2221 GM STGR
The EL/M-2221 GM STGR is the I/K/J-band radar used in the fire-control system for the Gabriel missiles. There is only one fitted initially but it is planned to fit three eventually.

Manufacturer/Contractor
Elta, Israel.

SONARS

EDO Type 796 Mod 1
A hull-mounted medium-frequency search and attack sonar, one of a family of modular sonars with simultaneous active/passive search, tracking and classification. Operating at around 7 kHz, the Type 796 sonar enables the operator to conduct 360° active/passive search operations while automatically tracking and analysing targets of interest. Display formats include panoramic B-scan detection, panoramic B-scan tracking and identification, expanded range versus speed target Doppler indicator, expanded range versus bearing sector scan indicator, 360° passive bearing versus time search and numerous others. The Mod 1 version of the Type 796 has been adapted to use a customer-furnished console and also features automatic multiple target tracking, multicolour display, increased target capacity, and flexible software-based display formats.

Manufacturer/Contractor
EDO Corporation, USA.

Rafael towed array sonar
The ships are currently fitted for but not with (FFBNW) a Variable Depth Sonar (VDS), which, if installed, is likely to be the Rafael CORIS-TAS, low frequency, critical angle towed array, which is based on a towed array with wide aperture hydrophones.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 20 × 11.9 m (66 × 39 ft)
Hangar: There is a large hangar, with full refuelling and rearming facilities
Helicopter: The helicopter operated from these ships is currently the Aerospatiale SA 366G Dauphin, although it is planned to operate the Sea Panther in due course

Dauphin SA 366G

Specifications
Dimensions:
main rotor diameter: 11.94 m (39.17 ft)
fenestron diameter: 1.10 m (3.61 ft)
length, overall, rotor turning: 13.68 m (44.88 ft)
length, fuselage: 12.11 m (39.73 ft)
height (top of rotor head): 3.52 m (11.55 ft)
Weights:
empty (standard aircraft): 2,262 kg (4,987 lb)
max take-off: 4,250 kg (9,370 lb)
Radius of action:
anti-shipping mission:
four missiles: 135 n miles (250 km)
two missiles: 150 n miles (278 km)
search-and-rescue: 130 n miles (241 km)
Performance (at average mission weight of 4,000 kg; 8,818 lb):
never-exceed speed (VNE): 160 kts (296 km/h)
cruising speed at sea level: 148 kts (274 km/h)
max rate of climb at sea level: 420 m (1,380 ft)/min
hovering ceiling:
in ground effect: 2,600 m (8,530 ft)
out of ground effect: 1,860 m (6,100 ft)
Power plant: 2 Turbomeca Arriel 1M1 turboshafts, each giving 558 kW (749 shp) for take-off and 487 kW (653 shp) continuously
Accommodation: 12 (pilot, co-pilot. The cabin can hold up to 10 passengers).

Manufacturer/Contractor
Aerospatiale Helicopters, France.

PROPULSION

Specifications
System: Combined diesel or gas turbine (CODOG)
Main machinery: 1 General Electric LM-2500 gas turbine, 22.38 MW (30,000 hp); 2 MTU 12V 1163 TB82 diesels, 4.86 MW (6,600 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

One of the most unusual of current warships, the Sa'ar 5 design was prepared by John J McMullen Associates Inc for Israeli Shipyards, Haifa, in conjunction with Ingalls Shipbuilding Division of Litton Corporation, which was authorised to act as main contractor using FMS funding. The contract was awarded on 8 February 1989.

It was originally planned to order eight, but this was then reduced to four and an order for three was placed with an option on a fourth. In the event, the option has not been taken up and only three have been built.

All three ships are built and run trials in the USA, but are then delivered to Israel for the combat systems to be installed. The latter has proceeded much more slowly than expected, but should complete in 1997.

DESIGN

These ships have a steel hull and aluminium superstructure, with particular requirements being a heavy armament and a strong emphasis on stealth features. The latter include very dramatic shaping of the hull and superstructure, Prairie Masker Bubbler system, infrared filters on 'hot-spots' and resilient mounts for main machinery.

The 'Eilat' class is described as being ' . . . tonne for tonne, the most heavily armed ship in the world' and is referred to in some quarters as a 'pocket cruiser.' However, one of the consequences of so much weaponry is a reported top weight problem and although this may be eased by keeping the tanks fully topped up as far as possible, there could be problems in severe weather.

A secondary operations room is fitted aft.

OPERATIONAL

The main role of the 'Eilat' class is to counter threats in main shipping routes.

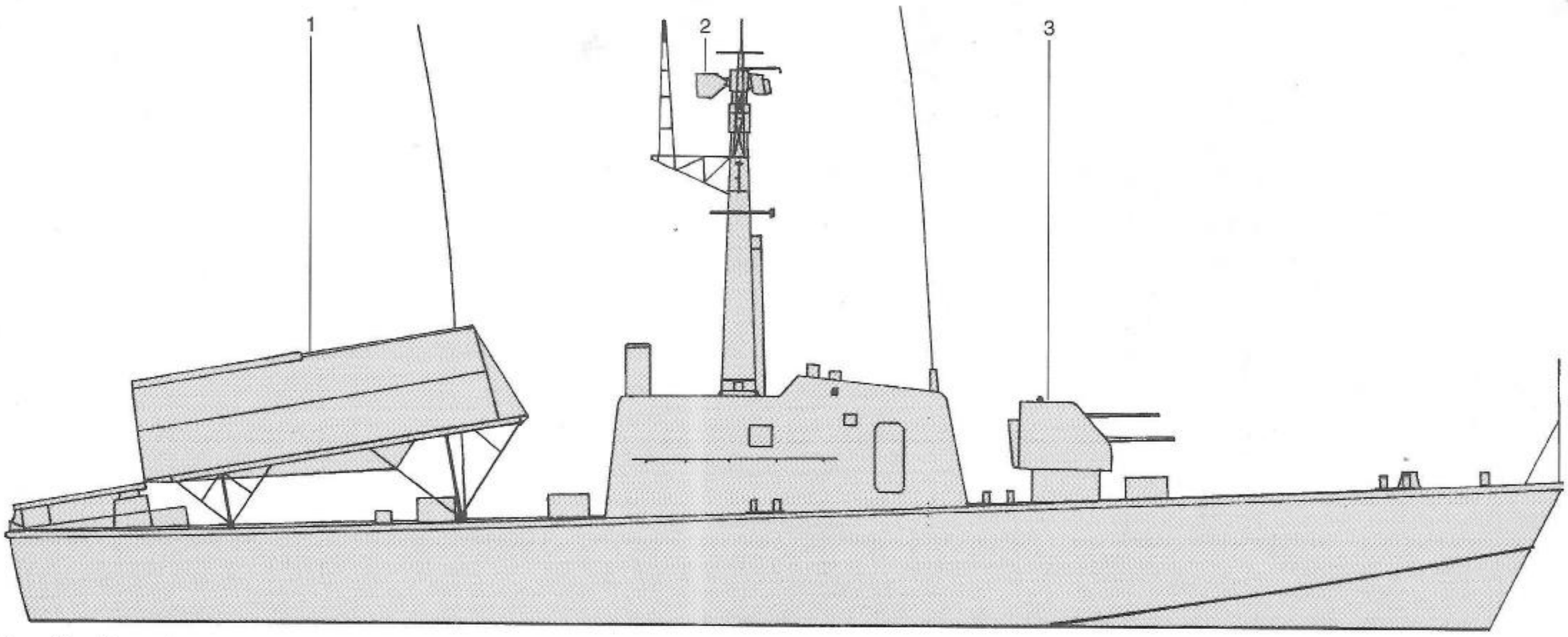
FAST ATTACK CRAFT (FAC)

INTRODUCTION

The term Fast Attack Craft (FAC) was coined in the 1970s in an attempt to provide a comprehensive description for small, heavily armed, high-speed warships and especially those armed with anti-ship missiles. Over the years, however, the term has been extended to include a much wider range of small warships including those also called Fast Patrol Boat, Missile Boat, Torpedo Boat, Motor Torpedo Boat, Motor Gun Boat and PT Boat. Moreover, the term has become so diluted as to lose almost all meaning, indeed sometimes a class described as a Fast Attack Craft, Gun by one navy may be referred to by another as a patrol boat.

For this reason, vessels armed only with a medium calibre (35 mm to 76 mm) gun are excluded and the basic definition of FACs has been used. On this basis an FAC is defined as a warship of less than 499 tonnes displacement, which is designed to conduct offensive anti-surface warfare (ASuW) operations against larger vessels using missiles or torpedoes.

HEGU/HEMA (TYPE 024)



Hegu (Ian Sturton)
1 *SY-1 (CSS-N-1) anti-ship missiles (two)* **2** *Type 331 (Square Tie) in some; Pot Head in others* **3** *Norinco twin 25 mm cannon (23 mm in Egyptian boats)*

GENERAL SPECIFICATIONS

Country of Origin: China, People's Republic
Operators: Bangladesh ('Durbar'), China, Egypt, Pakistan ('Haibat')
Type: FAC, Missile

Class: HEGU/HEMA (TYPE 024)

Built: 85
Active: 59

Displacement:
standard: 68 t
full load: 79.2 t

Dimensions
Length: 27 m (88.6 ft) ('Hegu'); 28.6 m (93.8 ft) ('Hema')
Beam: 6.3 m (20.7 ft)
Draught: 1.3 m (4.3 ft)

Speed: 37.5 kts
Range: 400 n miles (740 km) at 30 kts

Complement: 17 (2/4 officers)

SHIPS

Bangladesh: *Durbar* (P 8111); *Duranta* (P 8112); *Durvedya* (P 8113); *Durdam* (P 8114); *Uttal* (P 8141)

China: 48 (+35 in reserve)

Egypt: 609, 611, 613, 615, 617, 619

Pakistan: *Haibat* (P 1021); *Jalalat* (P 1022); *Jurat* (P 1023); *Shujaat* (P 1024)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

SY-1 (CSS-N-1 'Scrubbrush')

These ships carry two forward-facing launchers for Shang Yao 1 (SY-1) anti-ship missiles on the quarterdeck, angled slightly outboard.

Specifications

Length: 5.8 m (19 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.8 ft)
Weight: 2,300 kg (5,071 lb), excl 570 kg (1,257 lb) boosters
Speed: Mach 0.9
Range: 21.5 n miles (40 km)
Warhead: 454 kg (1,000 lb)
Guidance: Autopilot and active radar

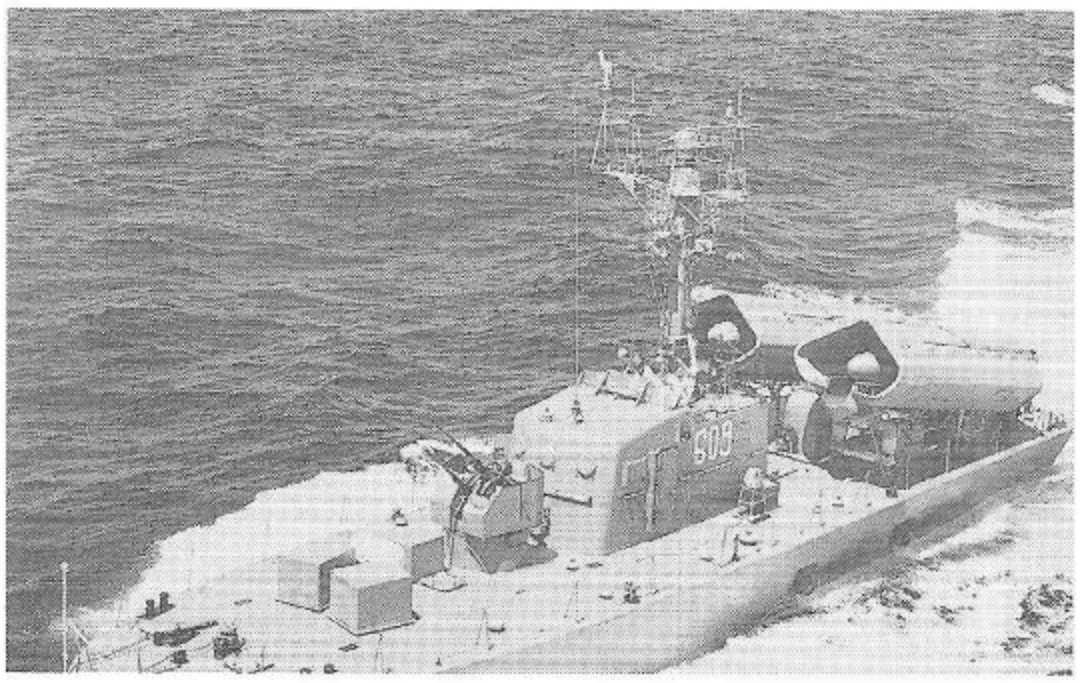
Manufacturer/Contractor

China Precision Machinery Import and Export Corporation, Beijing, China.

GUNS

Type 61

A Type 61 twin 25 mm gun mounting is installed forward of the bridge. In the Egyptian vessels there is a twin 23 mm mount, which consists of two Egyptian-made 23 mm cannons (possibly copies of the Russian 23 mm/81) in a Russian 2-M-3 mount, which is normally used for 25 mm weapons. The 'Hema' class has two Type 61 mountings.



'Hegu' class FAC of the Egyptian Navy. The mounting on the foredeck consists of a Russian mount designed for 25 mm guns, but with Egyptian-made 23 mm guns

Pakistani 'Hegu' class FAC, Jalalat (Pakistan Navy)

Specifications
Calibre: 25 mm
Length of barrel: 80 calibres
Muzzle velocity: 910 m/s (2,980 ft/s)
Rate of fire: 270 rds/min
Range: 1.5 n miles (3 km)

Calibre: 23 mm
Length of barrel: 81 calibres
Muzzle velocity: 970 m/s (3,180 ft/s)
Rate of fire: 200 rds/min/barrel
Range (effective): 2,800 m (3,000 yd)

Mounting
Weight: n/k
Traverse: 360°
Elevation: −10 to +85°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

These vessels use 'High Pole A' IFF systems but details of other ESM systems are not known. Egyptian vessels have the Litton Triton ESM system of which no details are available.

ELECTRONIC COUNTERMEASURES (ECM)

Not known.

COMMAND AND CONTROL SYSTEMS

RADARS

Type 331 (Square Tie)

Specifications
Role: Surface search and missile fire control
Band: I-band
Peak power: 20 kW
PRF: There are believed to be three modes; search (1,000 pps), target acquisition (2,000 pps) and target tracking (4,000 pps)
Scan rate: 5 or 15 rpm
Typical range: 25 n miles (46 km) against destroyer-size targets

Pot Head

Specifications
Pakistan
Role: Surface search
Band: I-band
Beam: 3°
Peak power: 100 kW
Pulsewidth: 0.25-1 µs
PRF: 1,600-1,650, 3,200-3,300 pps
Scan rate: 2.5/4 or 5/6 rpm

Note
The Russian designation for 'Pot Head' is Reya.

PROPULSION

Specifications
System: Diesel
Main machinery: 4 Type L-12V-180 diesels; 3.53 MW (4,800 hp)
Shafts: 4

FURTHER INFORMATION

The 'Hegu' class was built for the PLAN as a successor to the imported Russian 'Komar' class, but with steel instead of wooden hulls. The launchers were re-sited clear of the bridge and further inboard to eliminate sponsons, and the lattice mast was replaced by a pole.

The single 'Hema' was a hydrofoil derivative with a longer hull and a semi-submerged foil forward.

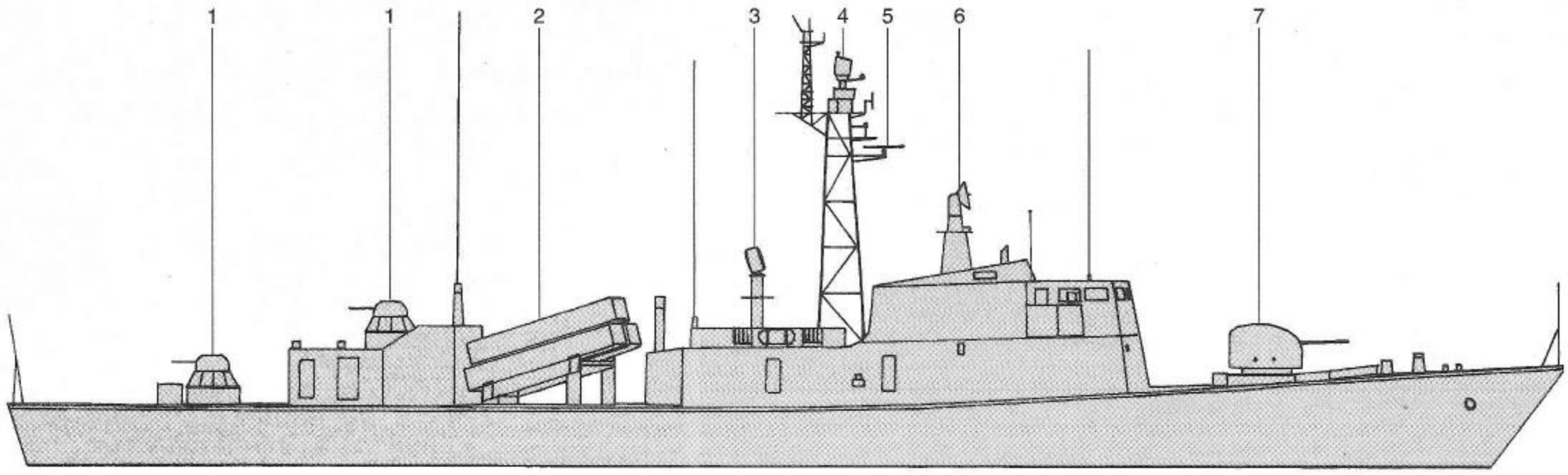
The 'Durbar' class was built for Bangladesh and commissioned between 1983 and 1992.

The Egyptian vessels were transferred in 1984.

'Hegu' class FAC of the PLAN (A Sheldon Dupleix)

Duranta, *a 'Hegu' class FAC of the Pakistani Navy. Note the efflux guides for the missiles, designed to carry the flames and heat clear of the stern* (G Jacobs)

HOUJIAN (TYPE 037/2)



Houjian (Ian Sturton)
1 *Type 69 twin 30 mm/65 cannon* **2** *YJ-1 (C-801) anti-ship missile (six)* **3** *Type 88C fire control (for Type 69 mounts)* **4** *Square Tie surface search radar* **5** *Type 765 navigation radar* **6** *Rice Lamp fire-control radar* **7** *Type 76A twin 37 mm/63 cannon*

GENERAL SPECIFICATIONS

Operator: China, People's Republic
Type: FAC, Missile

Class: HOUJIAN (TYPE 037/2)

Built: 2
Active: 2

Displacement:
standard: 520 t

Dimensions
Length: 65.4 m (214.6 ft)
Beam: 8.4 m (27.6 ft)
Draught: 2.4 m (7.9 ft)

Speed: 33.5 kts
Range: 1,800 n miles (3,335 km) at 18 kts

Complement: 75

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

YJ-1 (C-801) (CSS-N-4 'Sardine')

There are two triple launchers for the YJ-1 (C-801) anti-ship missile amidships, between the superstructure and the deck house. They are trained forward and outboard.

Specifications
Length: 5.81 m (19.5 ft)
Diameter: 36 cm (14.17 in)
Wing span: 1.18 m (3.87 ft)
Weight: 815 kg (1,797 lb)
Speed: Mach 0.9
Range: 4.5-23 n miles (8-42 km)
Warhead: 165 kg (364 lb)
Guidance: Inertial and active radar

Manufacturer/Contractor
China Precision Machinery Import and Export Corporation, Beijing, China.

GUNS

One Type 76A twin 37 mm is mounted forward of the bridge, with two Type 69 twin 30 mm gun mountings on the rear superstructure. The export version is being offered with a single OTOBREDA 76 mm (3 in)/62 Compact in place of the Type 76A twin 37 mm.

Type 76A

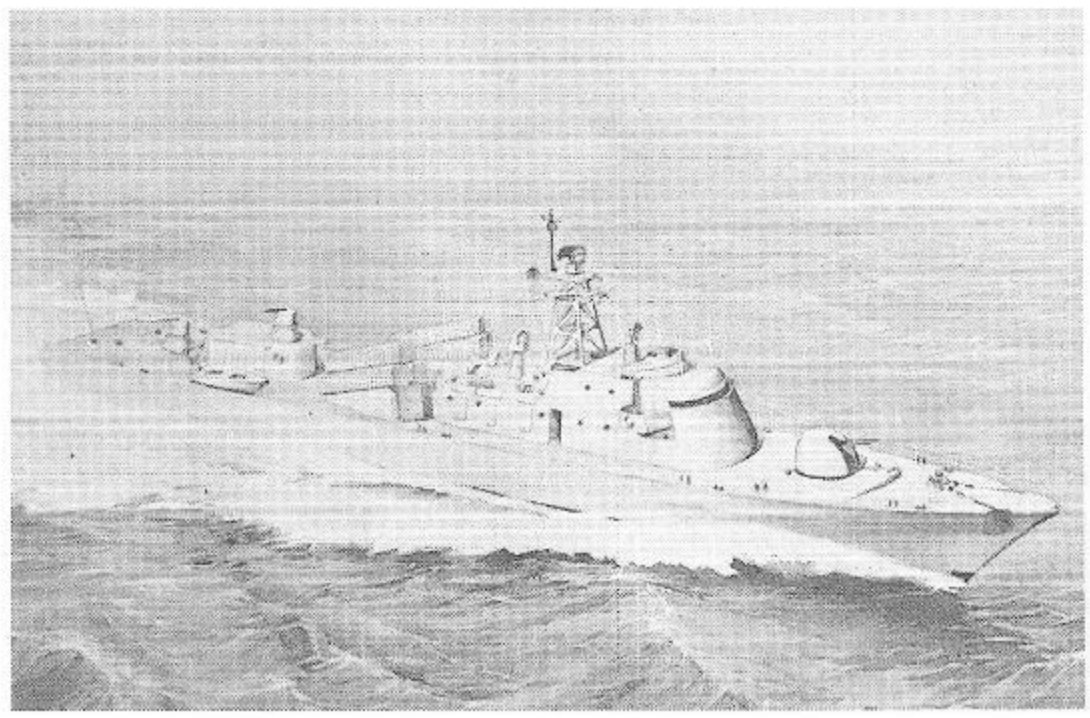
Specifications
Gun
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 880 m/s (2,887 ft/s)
Range: 2.2 n miles (4 km)

Type 69

Gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,445 ft/s)
Rate of fire: 1,000 rds/min (per gun)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)

Mounting
Weight: 1.9 t
Traverse: 360°
Elevation: −12 to +87°

Manufacturer/Contractor
Norinco, Beijing, China.



An artist's impression of a 'Houjian' class FAC as offered for export. This is identical with the PLAN version, except that it has an OTOBREDA 76 mm gun in place of the twin 37 mm (CSSC)

'Houjian' class FAC of the PLAN

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

An unidentified system is installed.

ELECTRONIC COUNTERMEASURES (ECM)

An unidentified system is installed.

COMMAND AND CONTROL SYSTEMS

RADARS

	Type 331	Type 341	Type 756
US/NATO designation	Square Tie	Rice Lamp	–
Role	Search	Gun control	Navigation
Band	I	I	I
Beam	n/k	n/k	1.3 × 20°, 0.8 × 18°, 2 × 22°
Peak power	20 kW	n/k	50 kW
Gain	n/k	n/k	27-32 dB
Pulsewidth	n/k	n/k	0.08, 0.5, 1 µs
PRF	1,000, 2,000, 4,000 pps	n/k	500, 1,000, 2,000 pps
Scan rate	5, 15 rpm	n/k	18-22 rpm
Typical range	25 n miles (46 km)	n/k	n/k

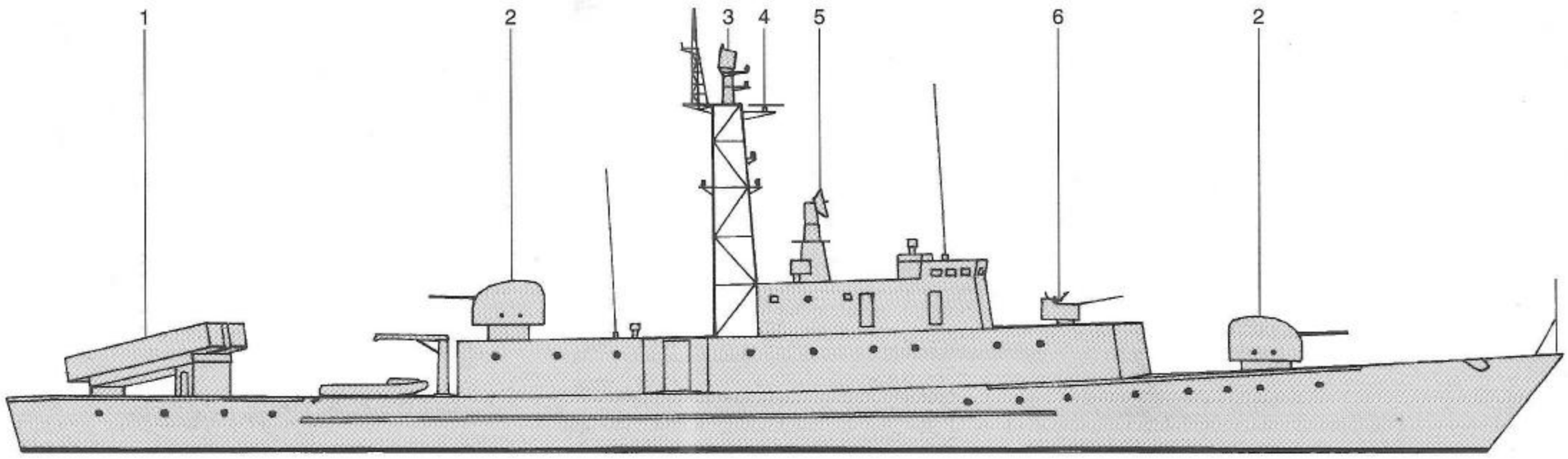
PROPULSION

Specifications
System: Diesel
Main machinery: 3 SEMT-Pielstick 12 PA6V 280 MPC; 12.7 MW (15,840 hp)
Shafts: 3

FURTHER INFORMATION

Laid down in 1989 these FACs (sometimes called the 'Huang' class) were originally designed for the export market but then attracted the interest of the PLAN, and at least two more are being built. An OPV version is reported to be in production for the export market as Type 037/1. The export version is being offered with an OTOBREDA 76 mm (3 in)/62 gun in place of the twin 37 mm mount currently in the PLAN version. The export version also specifies SEMT-Pielstick engines and it is assumed that these are also in the PLAN vessels.

HOUXIN



Houxin (Ian Sturton)
1 *Chinese YJ-1 (C-801) anti-ship missiles (four)* **2** *Chinese Type 76A twin 37 mm cannon* **3** *Chinese Type 331 (Square Tie) surface search/target designation radar* **4** *Chinese Type 756 navigation radar* **5** *Chinese Type 341 (Rice Lamp) fire-control radar (for guns)* **6** *Twin 14.5 mm machine guns (two open mounts)*

GENERAL SPECIFICATIONS

Operator: China, People's Republic
Type: FAC, Missile

Class: HOUXIN

Built: 15
Active: 15

Displacement:
full load: 430 t

Dimensions
Length: 62.0 m (203.4 ft)
Beam: 7.2 m (23.6 ft)
Draught: 2.3 m (7.5 ft)

Speed: 32 kts
Range: 750 n miles (1,390 km) at 18 kts

Complement: 60

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

YJ-1 (C-801) (CSS-N-4 'Sardine')

These vessels carry two twin launchers with the YJ-1 (C-801) anti-ship missile on the quarterdeck, the launchers being trained forward and outboard.

Specifications
Length: 5.81 m (19.5 ft)
Diameter: 36 cm (14.17 in)
Wing span: 1.18 m (3.87 ft)
Weight: 815 kg (1,797 lb)
Speed: Mach 0.9
Range: 4.5-23 n miles (8-42 km)
Warhead: 165 kg (364 lb)
Guidance: Inertial and active radar

Manufacturer/Contractor
China Precision Machinery Import and Export Corporation, Beijing, China.

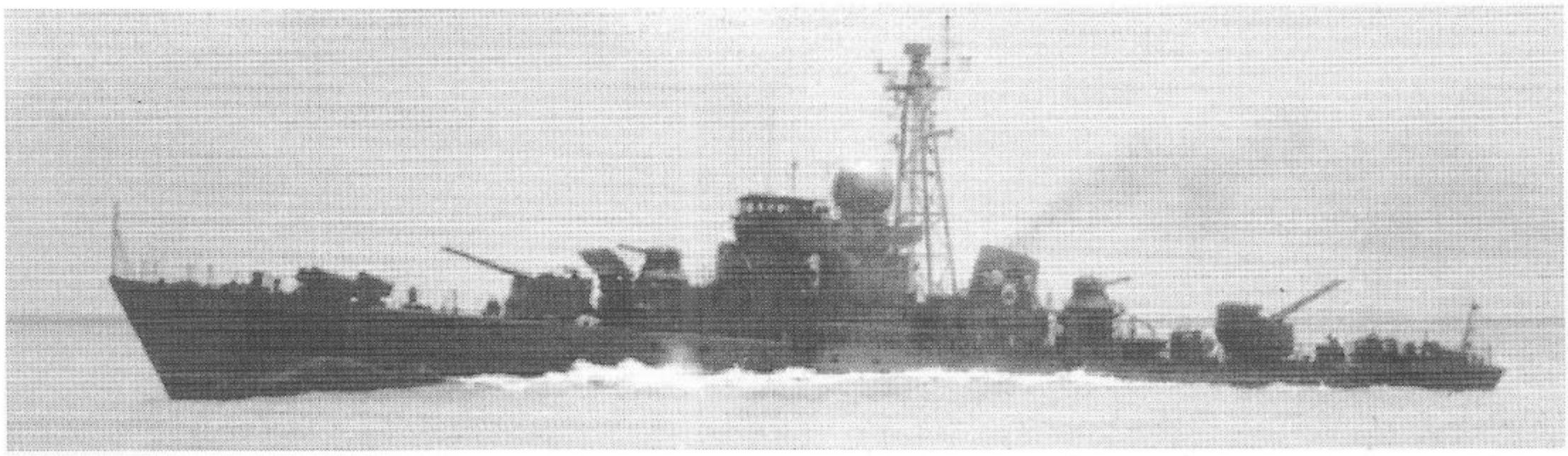
A group of 'Houxin' class FACs (Paul Beaver)

GUNS

Type 76A

There are two Type 76A twin 37 mm, one forward of the superstructure and the other on the rear of the superstructure. There are also two twin 14.5 mm machine gun mountings on the superstructure forward of the bridge.

Specifications
Gun
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 880 m/s (2,887 ft/s)
Rate of fire: n/k
Range: 2.2 n miles (4 km)



Four ships of the 'Haijui' class were built in the early 1980s. They appear to have served as prototypes for the 'Houxin' class and were essentially lengthened 'Hainan' class vessels with a revised armament and a Round Ball radome on the bridge roof. One of the class was also seen with two missile launchers on the foredeck in place of the 57 mm mount (CSSC)

ELECTRONIC WARFARE SYSTEMS

(ESM)

An unidentified system is installed.

ELECTRONIC COUNTERMEASURES (ECM)

An unidentified system is installed.

COMMAND AND CONTROL SYSTEMS

RADARS

	Type 331	Type 341	Type 756
US/NATO designation	Square Tie	Rice Lamp	—
Role	Search	Gun control	Navigation
Band	I	I	I
Beam	n/k	n/k	1.3 × 20°, 0.8 × 18° 2 × 22°
Peak power	20 kW	n/k	50 kW
Gain	n/k	n/k	27-32 dB
Pulsewidth	n/k	n/k	0.08, 0.5, 1 µs
PRF	1,000, 2,000, 4,000 pps	n/k	500, 1,000, 2,000 pps
Scan rate	5, 15 rpm	n/k	18-22 rpm
Typical range	25 n miles (46 km)	n/k	n/k

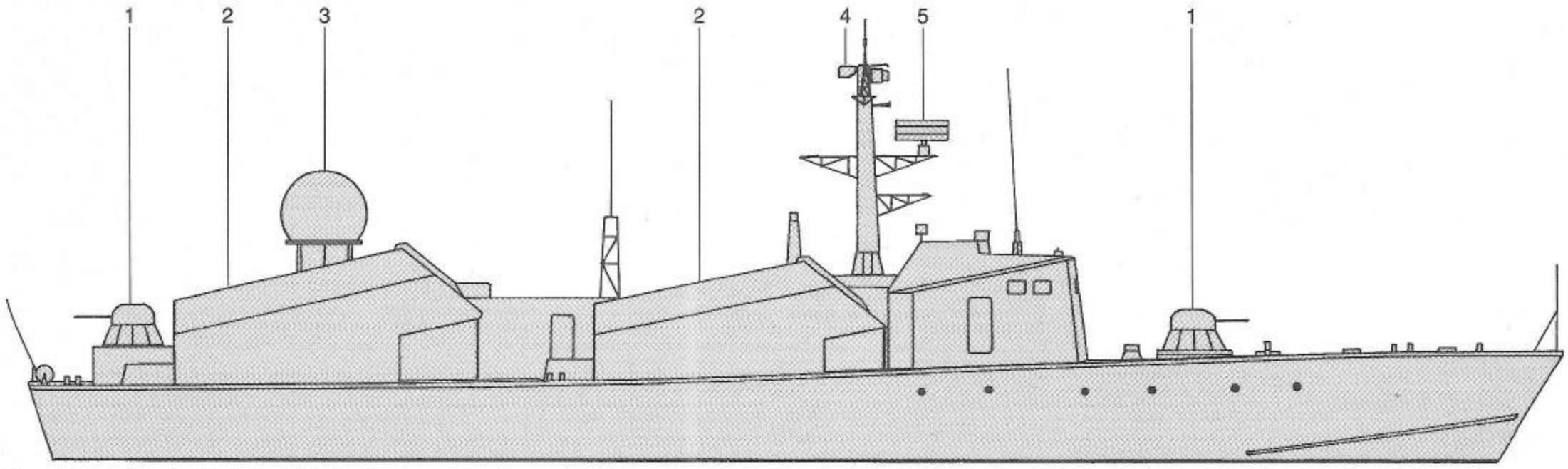
PROPULSION

Specifications
System: Diesel
Main machinery: 4 of unknown make/type; 9.7 MW (13,200 hp)
Shafts: 4

FURTHER INFORMATION

Construction of this class, designed to replace the 'Hegu' class, began circa 1990 and three per year are currently being built by the Qiuxin Shipyard. It is based upon a prototype 'Haijui' class and later ships have a revised bridge superstructure.

HUANGFEN (TYPE 021)/HOLA/HUDONG



'Huangfen' class (China) (Ian Sturton)
1 *Chinese Type 69 twin 20 mm automatic cannon* **2** *Chinese HY-2 (CSS-N-3 'Seersucker') anti-ship missiles (four)* **3** *Round Ball fire-control radar (for 30 mm cannon)* **4** *Square Tie surface search/target designation* **5** *Square Head IFF*

GENERAL SPECIFICATIONS

Country of origin: China, People's Republic
Operators: Bangladesh ('Huangfen'), China, North Korea, Pakistan, Yemen ('Durdarsha'), China ('Hola'), Iran ('Hudong').
Type: FAC, Missile

Class: HUANGFEN (TYPE 021)/HOLA/HUDONG

Built: 130 ('Huangfen'); 1 ('Hola'); 10 ('Hudong')
Active: 83 ('Huangfen'); 1 ('Hola'); 10 ('Hudong')

Displacement:
standard: 171 t
full load: 205 t

Dimensions
Length: 33.6 m (110.2 ft) ('Huangfen', 'Hudong'); 42 m (137.8 ft) ('Hola')
Beam: 7.6 m (24.9 ft) ('Huangfen', 'Hola'); 6.8 m (22.3 ft) ('Hudong')
Draught: 2.7 m (8.9 ft)

Speed: 35 kts
Range: 800 n miles (480 km) at 30 kts

Complement: 28 (3 officers)

SHIPS

Bangladesh: Five

China: 'Huangfen' class — 67 (+35 reserve); 'Hola' class — 1

Iran: 10

Pakistan: 4

Yemen: 3

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

The 'Huangfen' class carry four Hai Ying-2 (HY-2) anti-ship missiles in the rear half of the vessel, although Yemeni vessels have C-801 (YJ-1). The 'Hudong' class carry four anti-ship missile launchers in the stern with either C-801 (YJ-1) or C-802 (YJ-2).

Some export vessels have four launchers for the YJ-1 anti-ship missile.

HY-2 (CSS-N-3 'Seersucker')

Specifications
Length: 7.36 m (24.1 ft)
Diameter: 76 cm (30 ins)
Wing span: 2.4 m (7.8 ft)
Weight: 2,500 kg (5,512 lb) without 570 kg (1,257 lb) boosters
Speed: Mach 0.9
Range: 51 n miles (95 km)
Warhead: 454 kg (1,001 lb)
Guidance: Autopilot and active radar

YJ-1 (CSS-N-4 'Sardine' or C-801)

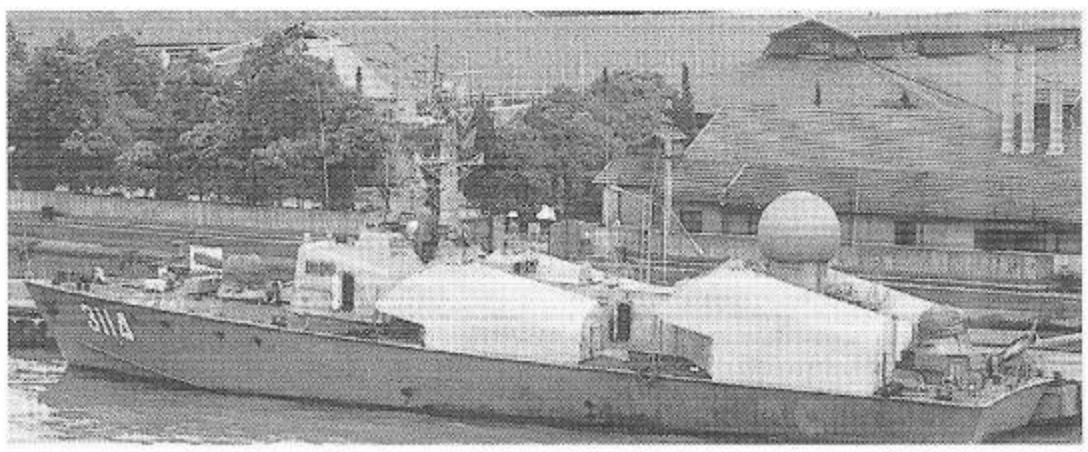
Length: 5.81 m (19.5 ft)
Diameter: 36 cm (14.17 in)
Wing span: 1.18 m (3.87 ft)
Weight: 815 kg (1,797 lb)
Speed: Mach 0.9
Range: 4.5-23 n miles (8-42 km)
Warhead: 165 kg (364 lb)
Guidance: Inertial and active radar

Manufacturer/Contractor
China Precision Machinery Import and Export Corporation, Beijing, China.

YJ-2 (CSS-N-8 'Saccade' or C-802)

Length: 6.39 m (12.10 ft)
Diameter: 36 cm (14.17 in)
Wing span: 1.18 m (3.87 ft)
Weight: 715 kg (1,576.5 lb)
Speed: Mach 0.9
Range: 8-65 n miles (15-120 km)
Warhead: 165 kg (364 lb)
Guidance: Inertial and active radar

Manufacturer/Contractor
China Precision Machinery Import and Export Corporation, Beijing, China.



'Huangfen' class FAC of the PLAN. This is the later version with Round Ball fire-control radar and twin 30 mm cannon, but with the same HY-2 missiles as the earlier vessels

An export version of the 'Huangfen' class with the Yemeni Navy. This has YJ-1 anti-ship missiles and Rice Lamp fire-control radar (CSSC)

GUNS

The 'Huangfen' class has two gun mountings which are either the Type 61 twin 25 mm (China, Yemen) or the Type 69 twin 30 mm (Bangladesh) mountings forward of the bridge and in the stern. The 'Hudong' class has one Type 69 mounting forward of the bridge. The 'Hola' class has no guns.

Type 69

Specifications
Gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,445 ft/s)
Rate of fire: 1,000 rds/m (per gun)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)

Mounting
Weight: 1.9 t
Traverse: 360°
Elevation: −12 to +87°

Manufacturer/Contractor
Norinco, China.

Type 61

Specifications
Gun
Calibre: 25 mm
Length of barrel: 80 calibres
Muzzle velocity: n/k
Rate of fire: 270 rds/m
Range: 1.5 n miles (3 km)

Mounting
Traverse: 360°
Elevation: −10 to +85°

Manufacturer/Contractor
Norinco, China.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

These ships have the domestically produced BM/HZ 8610 emitter direction-finding and analysis system as well as either the 'Square Head' or 'High Pole A' IFF systems. The BM/HZ 8610 has two antennas each with eight monopulse ports covering E/I and H/J-bands with sufficient accuracy to cue both radar and optical weapon control systems.

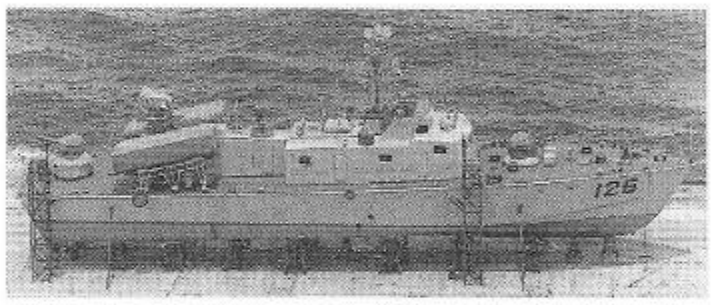
ELECTRONIC COUNTERMEASURES (ECM)

Not known.

COMMAND AND CONTROL SYSTEMS

RADARS

The 'Huangfen' class has Type 331 surface search radar, 'Round Ball' gun fire-control radar (not in the Bangladeshi FACs) or 'Rice Lamp' weapon control radar in ships with YJ-1 anti-ship missiles. It should be noted that Russian Osas have a Drum Tilt fire-control radar for the guns, which is lacking in the earlier Chinese 'Huangfens'. Round Ball clearly makes up this deficiency.



'Huangfen' class FAC on delivery voyage to Yemen in 1995. This version has four YJ-1 anti-ship missiles and twin 25 mm cannon. In other versions of the 'Huangfen', 20 mm mounts are accompanied by Round Ball radar, whereas 25 mm mounts have no radar; in this vessel, however, there is clear evidence of a radar aft, although the protective packaging prevents clear identification (92 Wing RAAF)

'HUANGFEN' CLASS

Chinese designation	Type 331	Type 341	—
US/NATO designation	Square Tie	Rice Lamp	Round Ball
Role	Surface search/ target designation	Gun control	Gun control
Band	I	I	I
Peak power	20 kW	n/k	n/k
PRF	1,000, 2,000, 4,000 pps	n/k	n/k
Scan rate	5, 15 rpm	n/k	n/k
Typical range	25 n miles (46 km)	n/k	n/k

'HUDONG' CLASS

	SR-47A	**Type 341**	**FM-1070**
Role	Search	Gun control	Navigation
Band	I	I	I

PROPULSION

Specifications
System: Diesel
Main machinery:
'Huangfen', 'Hola': 3 Type 42-160; 8.8 MW (12,000 hp)
'Hudong': 3 of unknown type; 7.94 MW (8,025 hp)
Shafts: 3

FURTHER INFORMATION

PROGRAMME

Four 'Osa I' class FACs were delivered by the (then) USSR to China in the mid-1960s, following with China producing its own version: the 'Huangfen' class. Approximately 100 'Huangfen' class boats were built, of which most were for the PLAN, but the type was also exported: Pakistan — 4 (1984); Bangladesh — 4 (1988), North Korea — 4 (1980); and Yemen — 3 (1995). A further ten of a modified 'Hudong' design have been sold to Iran; five in 1994 and five in 1996.

DESIGN

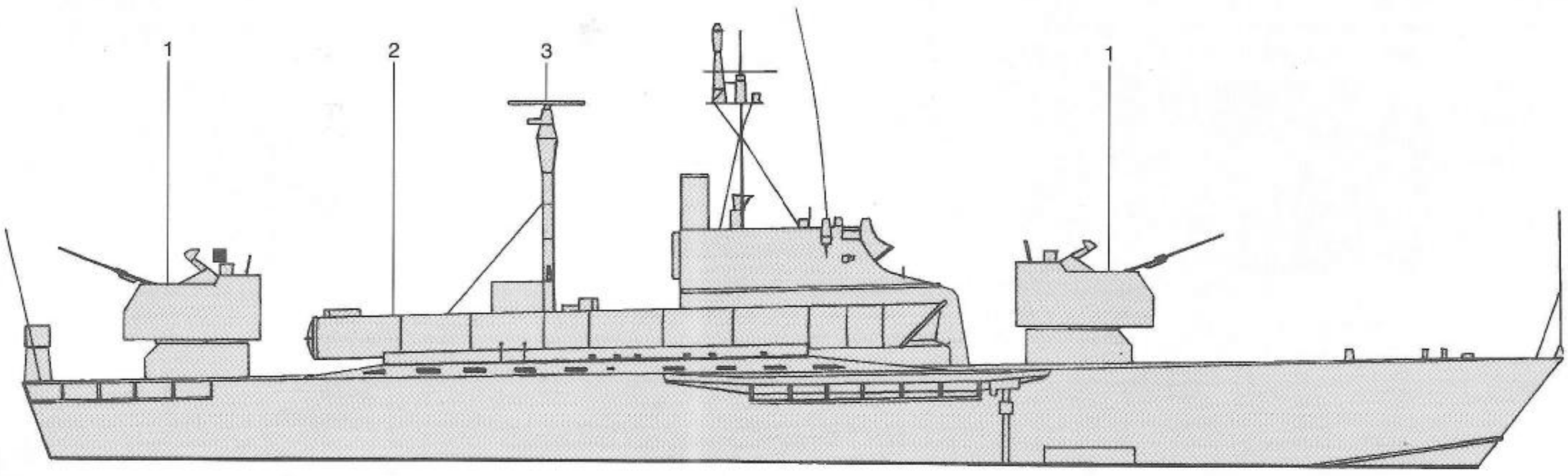
The design is essentially similar to that of the Russian 'Osa I', but in such a lengthy production run there have, inevitably, been changes. The standard missile in the PLAN boats in the HY-2 (CSS-N-2 'Seersucker'), with four missiles in individual launch bins. Most PLAN boats are armed with two twin 25 mm mounts; one forward of the bridge, the second aft. In recent boats, however, these are replaced by two twin 30 mm mounts, accompanied by a large spherical radome, currently designated 'Round Ball' as its Chinese designation is not known.

The export versions to Pakistan, Bangladesh and North Korea are standard PLAN versions. The boats recently sold to Yemen, however, have a longer superstructure and are fitted with four YJ-1 missile launchers and a Rice Lamp fire director.

The Iranian 'Huangdong' boats have the same hull as the 'Huangfen' class but are armed with four YJ-1 missiles set further back on the stern than with the Yemen's boats, displacing the aft twin 30 mm AK-230 mount. There is also a short lattice mast, supporting two I-band radars.

Only one 'Hola' class was produced which was slightly longer (42 m) (137.8 ft), and had a large spherical radome on the bridge roof and a folding mast aft.

HUCHUAN (TYPES 025/026)



Chinese Huchuan (newer version) (Ian Sturton)
1 *Twin 14.5 mm machine gun* **2** *533 mm (21 in) torpedo tubes (two)* **3** *Chinese Type 753 radar*
Note: *Two versions exist with minor variations in weapons and radar. In the other version the after machine gun mount is in the same position at the stern but the forward mount is abaft the bridge and the radar antenna is mounted on the top of the small mast*

GENERAL SPECIFICATIONS

Country of origin: China, People's Republic
Operators: Albania, Bangladesh, China, Romania, Tanzania
Type: FAC, Hydrofoil, Torpedo

Class: HUCHUAN (TYPES 025/026)

Built: 160
Active: 56

Displacement:
standard: 39 t
full load: 45.8 t

Dimensions
Length: 21.8 m (71.5 ft); 22.5 m (73.8 ft) (Bangladesh)
Beam: 6.3 m (20.7 ft); 5 m (16.4 ft) (Bangladesh)

Draught: 3.6 m (11.8 ft) (hullborne); 2.1 m (6.9 ft) (Bangladesh, foil)

Speed: 50 kts (foilborne)
Range: 500 n miles (925 km) at 30 kts

Complement: 23 (3 officers)

SHIPS

Albania: 24

Bangladesh: 8

China: 60

Romania: 20

Tanzania: 4

WEAPONS SYSTEMS

TUBES

Two 533 mm (21 in) torpedo tubes are carried outboard of the superstructure. These are reputed to launch the Russian SAET 60 torpedo.

TORPEDOES

SAET 60

Specifications
Length: 7.8 m (25.6 ft)
Diameter: 533 mm (21 in)
Weight: 1,600 kg (3,528 lb)
Propulsion: Electric
Speed: 40 kts
Range: 8.1 n miles (15 km)
Warhead: 400 kg (882 lb)
Guidance: Passive sonar

GUNS

14.5 mm machine guns
All versions are armed with two twin 14.5 mm machine guns in open 'tub' mounts. In some, both mounts are aft of the bridge, in others there is one mount forward of the bridge and one at the stern.

DEPTH CHARGES

The Romanian version only is fitted with rails for depth charges.

Number 55 of the Romanian Navy. Note the forward twin machine gun mounting is ahead of the bridge. This is the only version to carry depth charges

S 208 of the Albanian Navy

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

These FACs have the domestically produced BM/HZ 8610 emitter direction-finding and analysis system. This has two antennas each with eight monopulse ports covering E/I and H/J-bands with sufficient accuracy to cue both radar and optical weapon control systems.

ELECTRONIC COUNTERMEASURES (ECM)

Not known.

COMMAND AND CONTROL SYSTEMS

RADARS

Type 753

Specifications
Role: Surface search/fire control
Band: F
Beam: 17°
Peak power: 80 kW
Gain: n/k
Pulsewidth: 1 μs
PRF: 400 pps
Scan rate: n/k
Typical range: 17 n miles (31.5 km)

Note
The Type 753 is the Chinese version of the Russian 'Skin Head' or Zarnista radar.

PROPULSION

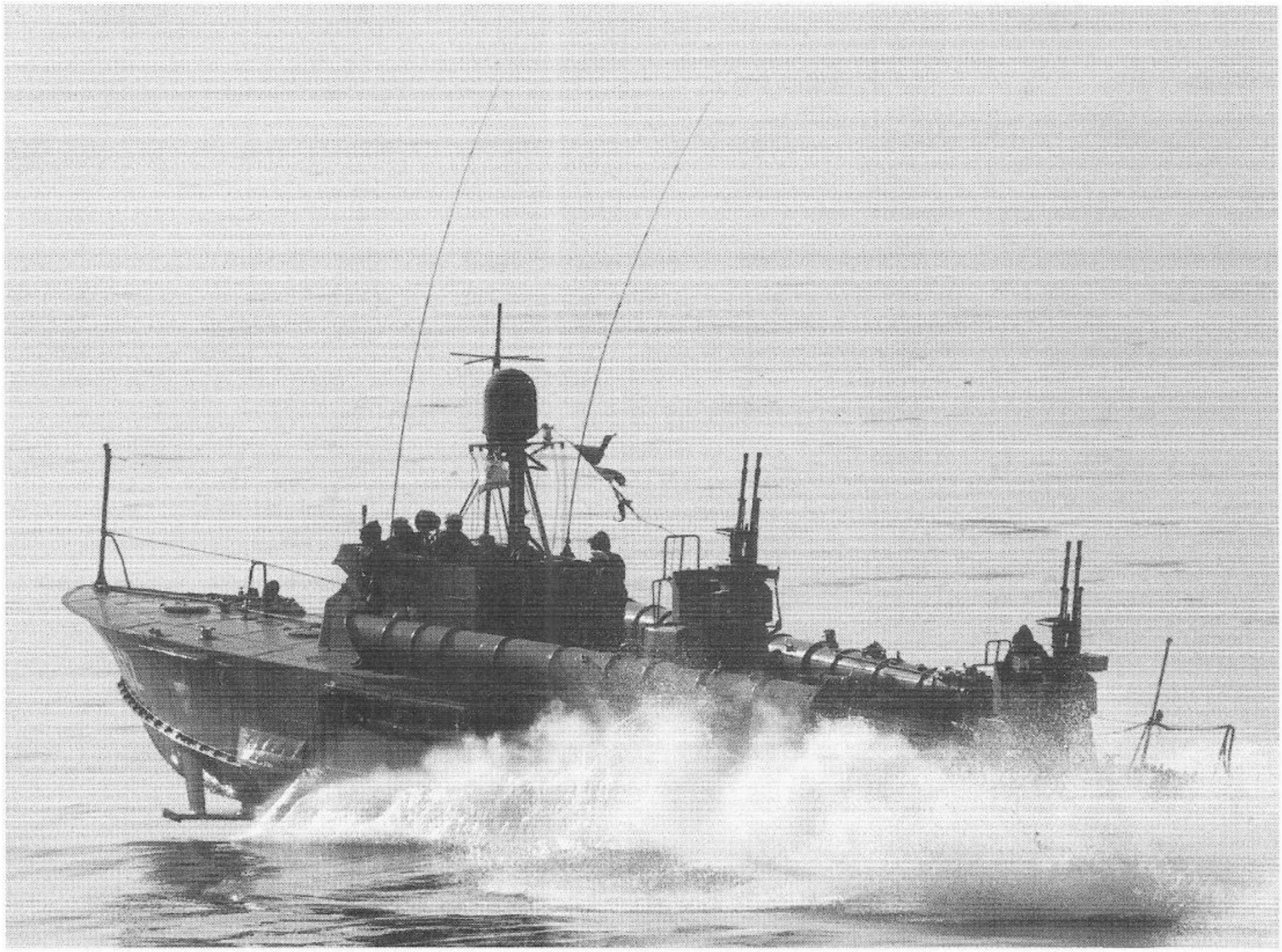
Specifications
System: Diesel
Main machinery: 3 Type M 50F; 2.4 MW (3,300 hp)
Shafts: 3

FURTHER INFORMATION

These vessels were built at the Hudong Shipyard, Shanghai and were formerly known as the 'Hu Chwan' class. They are of all-metal construction and the forward pair of hydrofoils may be recessed into the hull, although some vessels do not have hydrofoils.

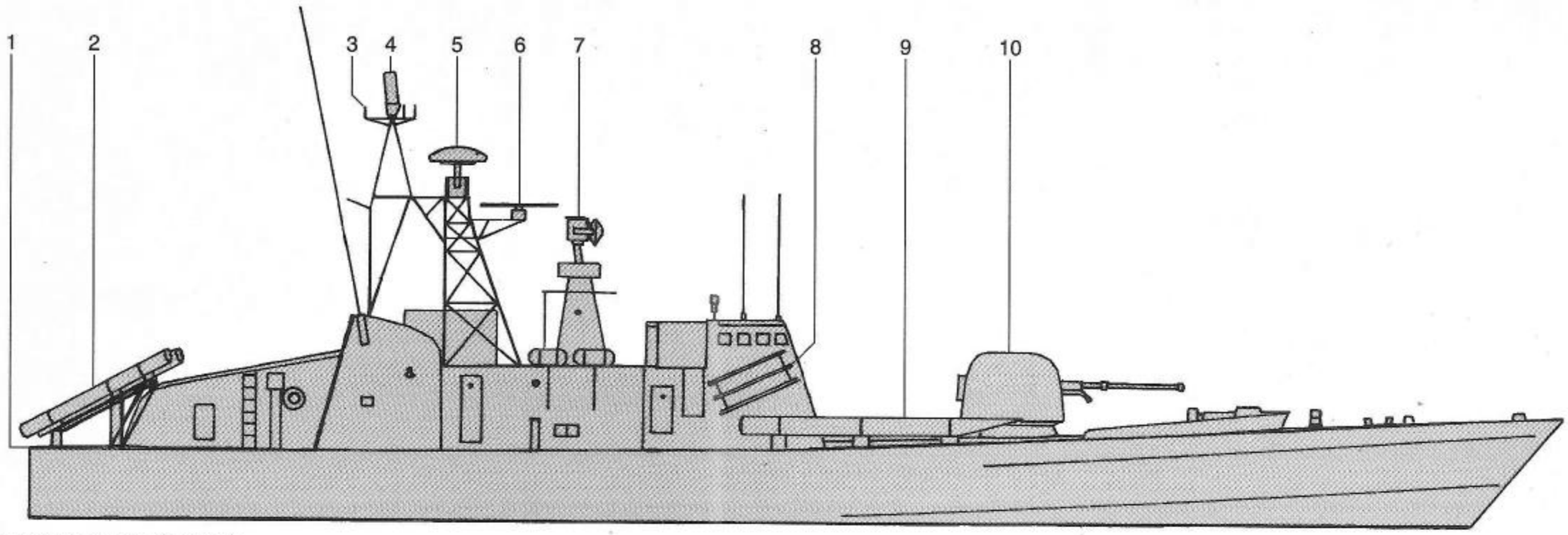
Two versions exist, the Type 025 has the bridge forward of the torpedo tubes' forward edge and the gun mountings amidships and astern while the Type 026 has the bridge about level with the tubes' forward edge, the midships gun mounting moved forward of the bridge and a radome replacing it.

Albania received 32 between 1968 and 1974. Some do not have hydrofoils, but those that do, have the foils near the bow and use the stern for planing.



Huchuan hydrofoil FAC of the PLAN. Using the forward hydrofoils and the planing stern these ships are capable of a speed of 50 knots. Note the two twin 14.5 mm machine guns, two 533 mm (21 in) torpedo tubes and the Skin Head surface-search radar

WILLEMOES



Willemoes (Ian Sturton)
1 *Minerails for 20 mines (in place of Harpoon launchers)* **2** *McDonnell Douglas Harpoon anti-ship missiles (maximum of eight)* **3** *Racal-Decca Cutlass ESM* **4** *DASA Telegon HF/DF* **5** *CelsiusTech 9GA 208 air/surface search radar* **6** *Terma Elektronik 20T 48 Super navigation radar* **7** *CelsiusTech 9LV200 fire-control radar* **8** *103 mm flare launchers (six in total)* **9** *533 mm (21 in) torpedo tubes* **10** *OTOBREDA 76 mm (3 in) compact automatic gun*

GENERAL SPECIFICATIONS

Operator: Denmark
Type: FAC, Missile

Class: WILLEMOES

Built: 10
Active: 10

Displacement:
standard: 232 t
full load: 260 t

Dimensions
Length: 46 m (151 ft)
Beam: 7.4 m (24 ft)
Draught: 2.5 m (8.2 ft)

Speed: 38 kts; 12 kts on diesels
Range: n/k

Complement: 25 (4 officers)

SHIPS

BILLE (P 540)
Builder Frederikshavn Vaerft, Frierdikshavn, Denmark
Commissioned 1 Oct 1976

BREDAL (P 541)
Builder Frederikshavn Vaerft, Frierdikshavn, Denmark
Commissioned 21 Jan 1977

HAMMER (P 542)
Builder Frederikshavn Vaerft, Frierdikshavn, Denmark
Commissioned 1 Apr 1977

HUITFELD (P 543)
Builder Frederikshavn Vaerft, Frierdikshavn, Denmark
Commissioned 15 Jun 1977

KRIEGER (P 544)
Builder Frederikshavn Vaerft, Frierdikshavn, Denmark
Commissioned 22 Sep 1977

NORBY (P 545)
Builder Frederikshavn Vaerft, Frierdikshavn, Denmark
Commissioned 22 Nov 1977

RODSTEEN (P 546)
Builder Frederikshavn Vaerft, Frierdikshavn, Denmark
Commissioned 16 Feb 1978

SEHESTED (P 547)
Builder Frederikshavn Vaerft, Frierdikshavn, Denmark
Commissioned 19 May 1978

SUENSON (P 548)
Builder Frederikshavn Vaerft, Frierdikshavn, Denmark
Commissioned 10 Aug 1978

WILLEMOES (P 549)
Builder Frederikshavn Vaerft, Frierdikshavn, Denmark
Commissioned 21 Jun 1976

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Harpoon 1C
Between four and eight launchers for the McDonnell Douglas Harpoon 1C may be embarked on the quarter-deck pointing forward.

Specifications
Length: 4.63 m (15.18 ft) (with booster)
Diameter: 34 cm (13.38 in)
Wing span: 83 cm (32.67 in)
Weight: 681.9 kg (with booster)
Speed: Mach 0.85
Range: 67 n miles (124 km)
Warhead: 221.6 kg (500 lb)
Guidance: Inertial navigation and active radar

Manufacturer/Contractor
McDonnell Douglas Missile Systems Company.

TUBES

Either two or four 533 mm (21 in) torpedo tubes may be embarked. These are for Bofors Tp 617 torpedoes.

TORPEDOES

Tp 617

Specifications
Length: 6.98 m (23.0 ft)
Diameter: 533 mm (21 in)
Weight: 1,860 kg (4,101 lb)
Propulsion: Hydrogen peroxide/alcohol
Speed: 45 kts
Range: 10.75 n miles (20 km)
Warhead: 240 kg (529 lb)
Guidance: Wire and active/passive sonar

GUNS

OTOBREDA 76 (3 in)/62 Compact
The 'Willemoes' class has a single OTOBREDA 76/62 Compact gun mounting almost amidships, forward of the bridge.

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Weight: 8.5 t (loaded)
Traverse: 360°
Elevation: −15 to +85°

The foredeck of Hammer *P 425 showing the OTOBREDA 76 mm gun and 533 mm torpedo tubes* (Jane's/David Miller)

Hammer *(P 542). Sensors above the bridge are: 9LV200 fire control (lowest); Terma 20T 48 Super navigation (slotted reflector just above 9LV200); 9GA 208 air search; and Telegon HF/DF (masthead)* (Jane's/David Miller)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

MINES

If the missile launchers are removed, rails carrying up to 20 mines can be mounted, instead.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-Thorn Cutlass
Cutlass uses the same antenna as RDL and provides bearings, CW bearing and instantaneous frequency measurement over the E/J-band. The system can incorporate a responsive noise jammer as well as providing spot or barrage noise. It may also be integrated with decoy launchers.

DASA Telegon
There is a DASA Telegon High-Frequency Direction-Finding (HF/DF) set.

Manufacturer/Contractor
DASA, Ulm, Germany.

DECOYS

Danish Aerotech DL-6T
These ships have the Danish Aerotech DL-6T decoy launcher system with two six-tube launchers. The 130 mm tubes have different angles.

Manufacturer/Contractor
Danish Aerotech, Denmark.

Flare launchers
There are two sets of three 103 mm flare launchers either side of the bridge.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Terma Tactical Date System (TDS)
These ships have the Terma Tactical Data System (TDS). The TDS is a distributed architecture system based upon Motorola 68020 processors with three display systems and it can track 50 targets simultaneously.

CelsiusTech 9LV200 Mk 2
The 9LV200 Mk 2 is a radar-based weapon control system of mainframe architecture using the Philips P800 minicomputer for the control of one medium- and one light-calibre gun mounting as well as surface-to-surface missiles. There is a tactical display system and two gun control displays, for ASuW and AAW operations.

RADARS

	9GA 208	9GR600	20T48
Maker	CelsiusTech	CelsiusTech	Terma
Role	Search	Weapon control	Navigation
Band	I	I	I
Beam	1 × 3°	1.1 × 7°	1°
Peak power	200 kW	200 kW	20 kW
Gain	38 dB	35.5 dB	30 dB
Pulsewidth	0.25, 1.0 µs	0.25, 1.0 µs	0.06, 0.6 µs
PRF	1,000, 3,000 pps	1,000, 3,000 pps	2,200, 4,400 pps
Scan rate	60 rpm	60 rpm	20/48 rpm

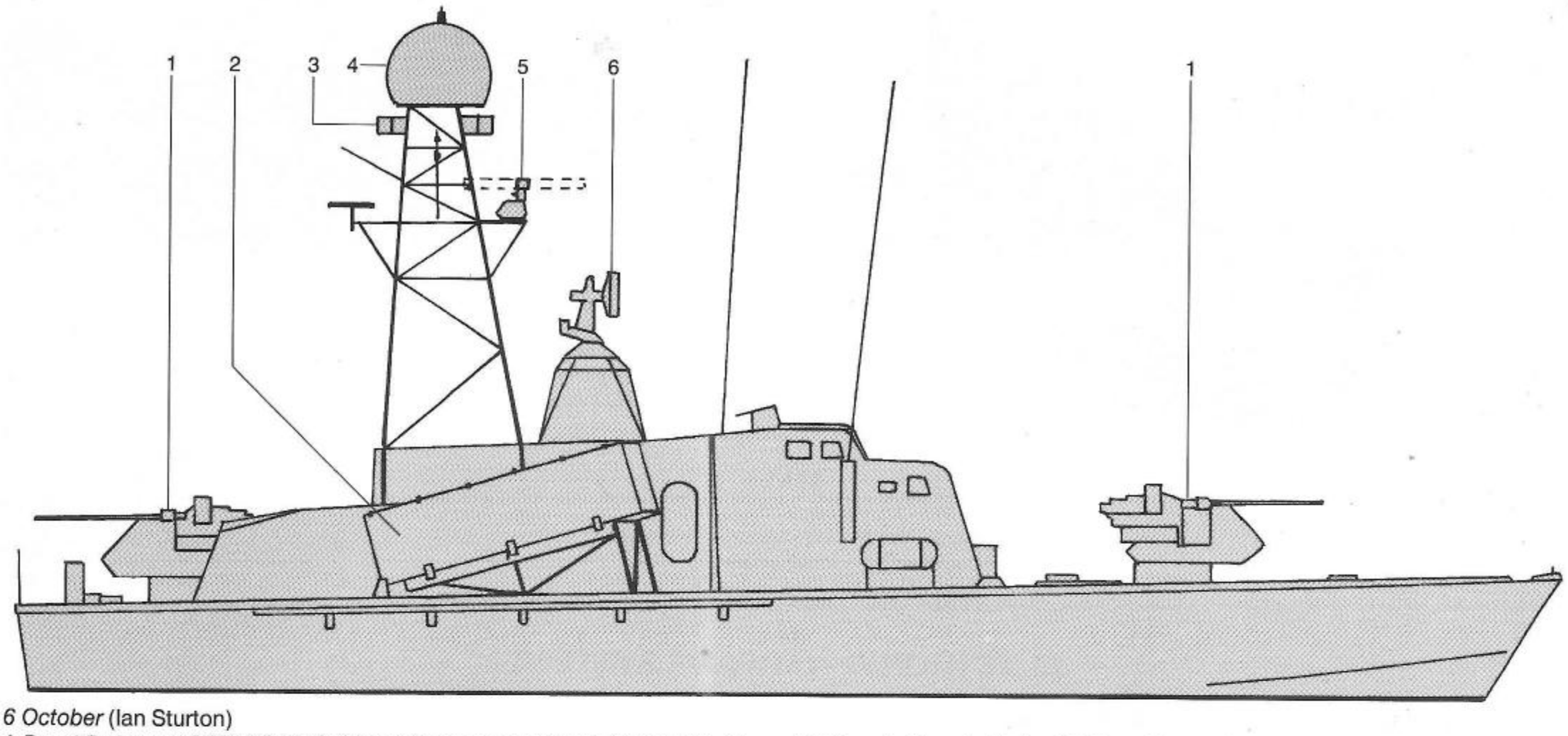
PROPULSION

Specifications
System: Combined diesel or gas turbine (CODOG)
Diesel engines: 2 General Motors 8V-71, 343 kW (460 hp)
Gas-turbine engines: 3 Rolls Royce 52M/544; 9.51 MW (12,750 hp)
Shafts: 3
Propellers: Controllable pitch

FURTHER INFORMATION

These vessels have long forecastles and, for their size, a particularly heavy armament. The design was prepared by Lürssen and was based on that of the 'Spica II' of the Royal Swedish Navy, which was also a Lürssen design. The lead ship was laid down in 1974 and commissioned in 1976 while the last ships were commissioned in 1978. The weapons mixture matches the mission, which rarely exceeds 36 hours.

6 OCTOBER (KOMAR)



6 October (Ian Sturton)
1 *Royal Ordnance GCM-AO1 twin 30 mm/75 cannon* **2** *Alenia/Matra BAe Otomat Mk 1 anti-ship missile (two)* **3** *Racal-Decca Cutlass ESM* **4** *GEC-Marconi S 810 air/surface search radar* **5** *Navigation radar (unidentified)* **6** *GEC-Marconi ST802 fire-control radar*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Egypt
Type: FAC, Missile

Class: 6 OCTOBER (KOMAR)

Built: 6
Active: 6

Displacement:
standard: 71 t
full load: 82 t

Dimensions
Length: 25.5 m (84 ft)
Beam: 6.1 m (20 ft)
Draught: 1.3 m (5 ft)

Speed: 40 kts
Range: 400 n miles (740 km) at 30 kts

Complement: 20

SHIPS

781, 783, 785, 787, 789, 791

WEAPONS SYSTEMS

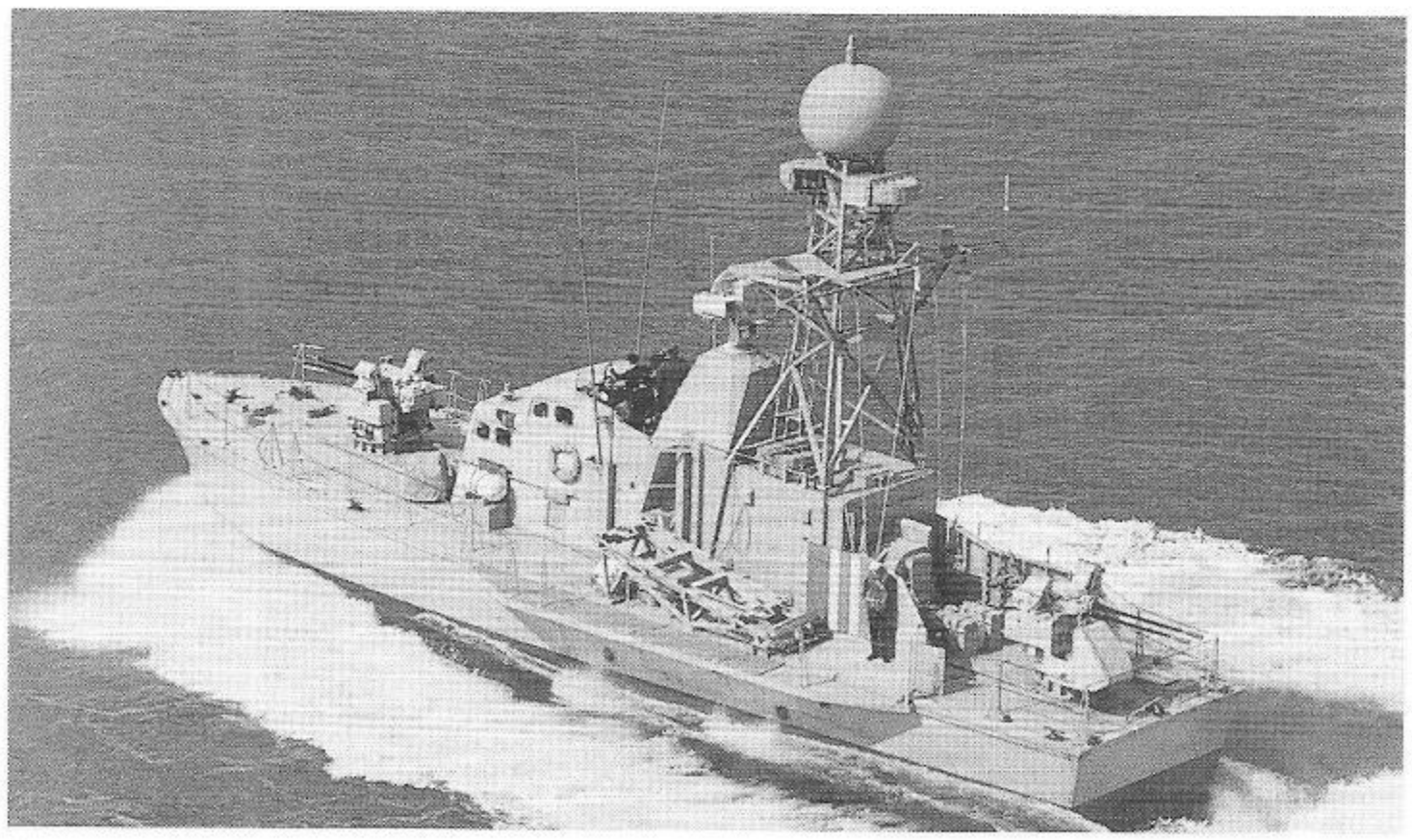
SURFACE-TO-SURFACE MISSILES (SSM)

Otomat Mk 1

There are two launchers, one either side of the superstructure, for Alenia/Matra Otomat Mk 1 anti-ship missiles.

Specifications
Length: 4.66 m (15.28 ft)
Diameter: 46 cm
Wing span: 1.36 m (4.46 ft)
Weight: 770 kg (2,526 lb) (with boosters)
Speed: Mach 0.9
Range: 35 n miles (65 km) (Longer ranges require helicopter support)
Warhead: 210 kg (465 lb)
Guidance: Inertial with active radar homing

Manufacturer/Contractor
Alenia Missile Systems/Matra BAe Dynamics.



A converted '6 October'. Note the racks for Otomat missiles, twin BMARC/Oerlikon 20 mm mounts and new lattice mast, topped by the GEC-Marconi S 810 radar. Note also the new platform to provide a walk-way around the missile launcher (Vosper Thornycroft)

GUNS

Royal Ordnance GCM-AO1

The '6 October' class has two Royal Ordnance GCM-AO1 (formerly A.32) twin 30 mm gun mountings, one on the foredeck, the other on the stern.

Specifications
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,547 ft/s)
Rate of fire: 650 rds/m (per gun)
Range: 1.5 n miles (3 km) and 3,500 m (11,500 ft)

Mounting
Weight: 2.26 t
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
Royal Ordnance, London, UK.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-Thorn Cutlass

Cutlass uses the same antenna as RDL and provides bearings, CW bearing and frequency measurement over the E/J-band with instantaneous frequency measurement. The system can incorporate a responsive noise jammer as well as providing spot or barrage noise. It may also be integrated with decoy launchers.

DECOYS

These ships have the Racal-Thorn Protean decoy launcher system. Each launcher has four magazines with 36 × 40 mm chaff or infra-red payload grenades. The former fire at intervals of 0.1 s per magazine and within 1 s create a 1,000 m² decoy cloud while the infra-red ones cover both the 3-5 µm and 8-14 µm bands.

Manufacturer/Contractor
Racal-Thorn, UK.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

BAe Sapphire

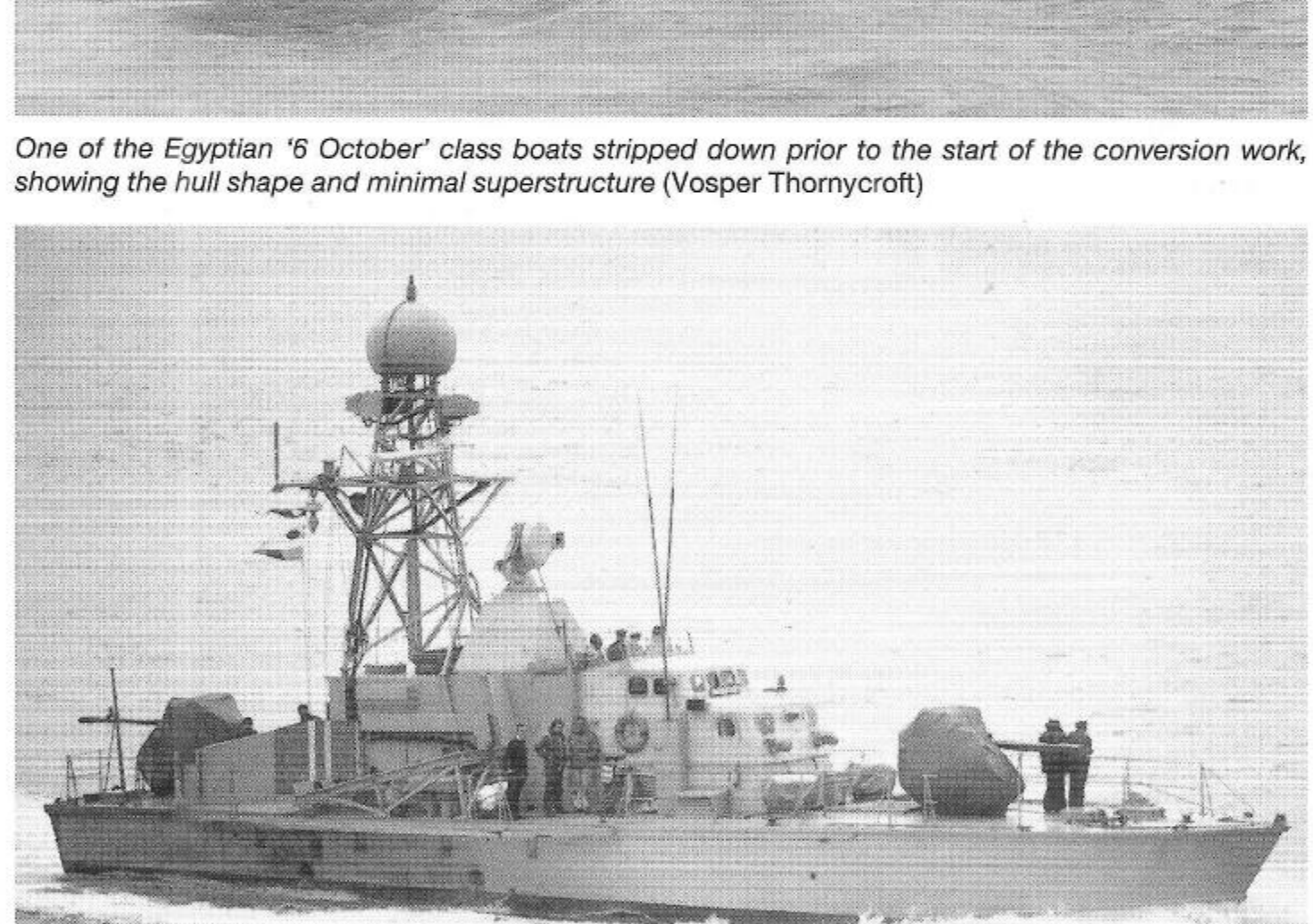
These ships have the British Aerospace Systems and Equipment Sapphire weapon control system. Sapphire is a radar and electro-optical weapon control system for guns based upon the Sea Archer 1 predictor. The system is operated from a single console.

Manufacturer/Contractor
BAe, UK.

RADARS

	S810	ST802
Maker	GEC-Marconi	GEC-Marconi
Role	Search	Weapon control
Frequency	I-band	I-band
Beam	2.2, 25°	2.4°
Peak power	180 kW	150 kW
Gain	29.5 dB	36.5 dB
Pulsewidth	0.33, 0.67 µs	0.33, 0.67 µs
PRF	1,500 pps	3,000 pps
Scan rate	24 rpm	20 rpm
Typical range	13.5 n miles (25 km)	21.5 n miles (40 km)

Note:
There is also an (unidentified) nayigation radar.



One of the Egyptian '6 October' class boats stripped down prior to the start of the conversion work, showing the hull shape and minimal superstructure (Vosper Thornycroft)

A converted '6 October' class FAC-M of the Egyptian Navy (H & L van Ginderen Collection)

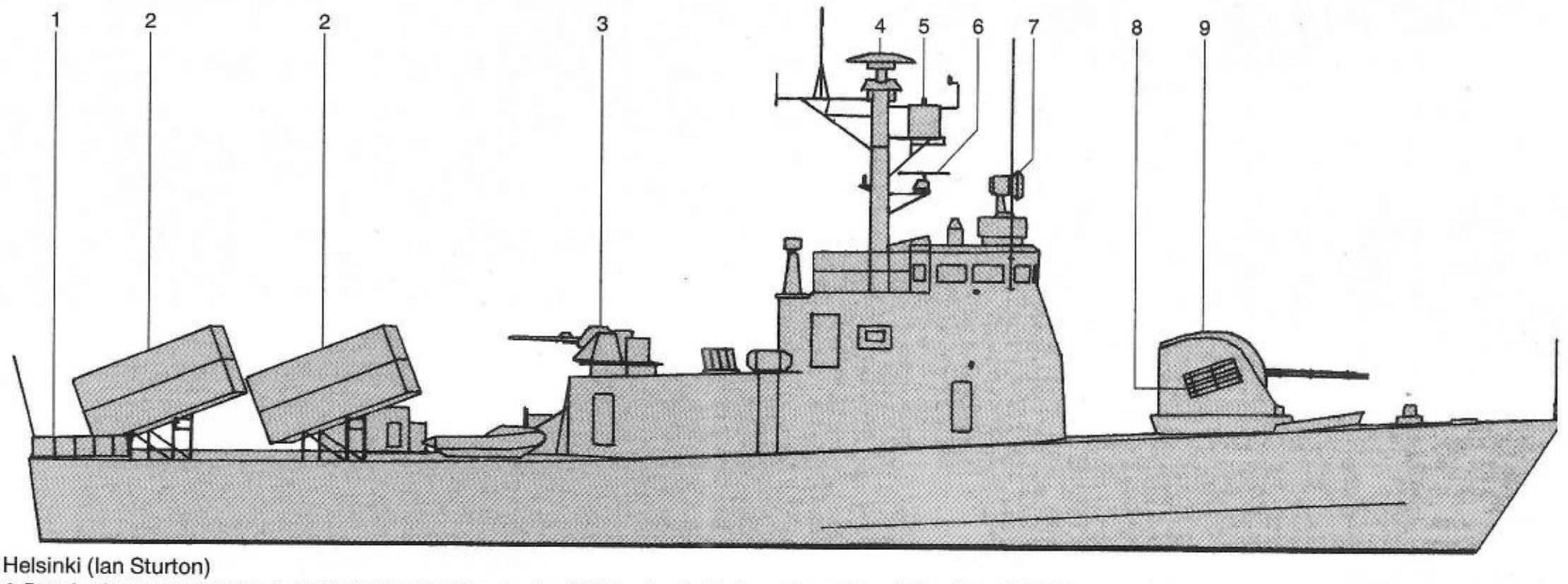
PROPULSION

Specifications
System: Diesel
Main machinery: 4 CRM 12 D/SS; 3.67 MW (5,000 hp)
Shafts: 4

FURTHER INFORMATION

These wooden-hulled vessels were built in Alexandria between 1975 and 1976 using the hull design of the 'Komar' class. They were refitted by Vosper Thornycroft in 1979/1981 and given new weapons and electronics, plus a GRP operations room which can be removed to give access to the engine hatches.

HELSINKI



Helsinki (Ian Sturton)
1 *Depth charge rack* **2** *Saab RBS 15M anti-ship missiles* **3** *Seko barbette for either Matra/BAe Mistral SAMs or twin 23 mm cannon* **4** *CelsiusTech 9GA 208 surface search radar* **5** *ArgoSystem AR 700A ESM* **6** *Raytheon SPS-69 navigation radar* **7** *CelsiusTech 9GR60 weapon-control radar* **8** *130 mm flare launchers* **9** *Bofors SAK 57 Mk 2 57/70 automatic gun*

GENERAL SPECIFICATIONS

Operator: Finland
Type: FAC, Missile

Class: HELSINKI

Built: 4
Active: 4

Displacement:
standard: 280 t
full load: 300 t

Dimensions
Length: 45 m (147.6 ft)
Beam: 8.9 m (29.2 ft)
Draught: 3 m (9.9 ft)

Speed: 30 kts

Complement: 30

SHIPS

HELSINKI (60)
Builder Wärtsilä, Helsinki, Finland
Commissioned 1 Sep 1981

KOTKA (61)
Builder Wärtsilä, Helsinki, Finland
Commissioned 3 Jun 1985

OULU (62)
Builder Wärtsilä, Helsinki, Finland
Commissioned 1 Oct 1985

TURKU (63)
Builder Wärtsilä, Helsinki, Finland
Commissioned 16 Jun 1986

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

RBS 15M

The 'Helsinki' class has up to four twin launchers on the after deck for the RBS 15M anti-ship missile. The launchers are trained forward with two pairs on the starboard side and the other two pairs on the port side.

Specification
Length: 4.35 m (14.26 ft)
Diameter: 50 cm (19.68 in)
Wing span: 1.4 m (4.6 ft)
Weight: 780 kg (1,720 lb) (with boosters)
Speed: Mach 0.8
Range: 38 n miles (70 km)
Warhead: 200 kg (440 lb)
Guidance: Inertial navigation with active radar homing

Manufacturer/Contractor
Saab Missiles AB, Linkoping, Sweden.

Kotka *(63) alongside a 'Turunmaa' class corvette at the completion of BALTOPS '96. Note the 57 mm gun with 103 mm flare launchers on the sides and the RBS 15M missile launchers aft* (H M Steele)

SURFACE-TO-AIR MISSILES (SAM)

Mistral

A Sako-made barbette with either twin 23 mm guns or six Matra BAe Dynamics Mistral surface-to-air missiles is installed at the rear of the superstructure.

Specifications
Length: 1.81 m (5.9 ft)
Diameter: 9.2 cm (3.6 in)
Wing span: 11.1 cm (4.4 in)
Weight: 18.4 kg (40.5 lb)

Speed: Mach 2.6
Range: 2.7 n miles (5 km)
Warhead: 2.95 kg (6.5 lb)
Guidance: Infra-red passive homing

Manufacturer/Contractor
Matra BAe Dynamics.

GUNS

SAK 57 Mk 2
There is one Bofors SAK 57 Mk 2 57 mm/70 on the foredeck.

Specifications
Gun
Calibre: 57 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,020 m/s (3,347 ft/s)
Rate of fire: 220 rds/min
Range: 9 n miles (17 km)

Mounting
Weight: 6.7 t
Traverse: 360°
Elevation: −10 to +77°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Sako twin 23 mm mounting
The alternative weapon fit for the Sako barbette is a pair of Sako-made Russian 23 mm/87 cannon.

Specifications
Gun
Calibre: 23 mm
Length of barrel: 87 calibres
Muzzle velocity: 970 m/s (3,182 ft/s)
Rate of fire: 200 rds/min
Range: 1.1 n miles (2 km)

Mounting
Weight: 1.7 t
Traverse: 360°
Elevation: −15 to +80°

Manufacturer/Contractor
Sako, Riihimaki, Finland.

Kotka (63). Sensors above the bridge are: 9GR 60 weapon control (bridge roof); SPS-69 navigation radar (lower platform on mast); AR-700 ESM (upper platform) and 9GA 208 surface search radar (masthead). Immediately behind the 9GA 208 is the log periodic carried by most Finnish warships (Pär-Henrik Sjöström)

MINES

Two minerails can be fitted in place of the stern missile launchers.

DEPTH CHARGES

There are two depth charge racks.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

ArgoSystems AR-700A
These ships have an ARGO AR-700A receiver system which covers the C/J-bands. The wide open, monopulse, direction-finding and parallel instantaneous frequency receiver approach ensures there is no channelisation or band-stepping to degrade performance.

ELECTRONIC COUNTERMEASURES (ECM)

CelsiusTech Philax decoy launcher
The CelsiusTech Philax decoy launcher system consists of trainable 875/720/950 mm launchers, weighing 180 kg (397 lb). Each has four magazines with 36, 40 mm chaff or infra-red payload grenades. The former fire at intervals of 0.1 s per magazine and within 1 s create a 1,000 m² decoy cloud while the infra-red ones cover both the 3-5 µm and 8-14 µm bands.

Manufacturer/Contractor
CelsiusTech, Sweden.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

9LV 200 Mk 2 fire-control system
The basic 9LV 200 system (LV — *Luftvarn* (anti-aircraft)) fire-control system controls the guns, anti-ship missiles and wire-guided torpedoes. The system can direct one or more guns against one or more targets simultaneously and includes a CelsiusTech 9GR600 radar. The 9LV 200 family has a mainframe architecture, using Philips P800 minicomputers with a memory of 128 k which may be expanded to 512 k, the Mk 2 being a digital version. There is a tactical display and missile control console together with one gun control console for surface engagements one for air engagements and a torpedo control console. The tactical display and missile control unit is a three-man console (tactical picture compiler, principal warfare officer and the commanding officer) with 40 cm (16 in) tactical displays and two alphanumeric displays for surveillance, target acquisition and target designation. There is automatic track-while-scan of up to 16 air and surface targets with weapon systems exchanging target data. Also available is an external VHF/UHF voice channel and short burst transmission for exchanging target data with other ships. The principal warfare officer designates surface targets to either guns or missiles but also launches missiles either from integrated controls or a nearby missile firing panel. Surface targets to be engaged by gunfire are transferred to the appropriate gun console depending upon whether or not the target is to be tracked by the director or by track-while-scan, if the search radar is used.

Manufacturer/Contractor
CelsiusTech, Sweden.

RADARS

	9GA 208	9GR600	SPS-69 ARPA
Maker	CelsiusTech	CelsiusTech	Raytheon
Role	Search	Weapon control	Navigation
Band	I	I	I
Beam	1, 3°	1.1, 7°	4, 25°
Peak power	200 kW	200 kW	4 kW
Gain	38 dB	35.5 dB	n/k
Pulsewidth	0.25, 1.0 µs	0.25, 1.0 µs	0.08, 0.5, 0.25 µs
PRF	1,000, 3,000 pps	1,000, 3,000 pps	750, 1,500, 2,250 pps
Scan rate	60 rpm	60 rpm	24 rpm
Typical range	n/k	n/k	32 n miles (59 km)

SONARS

Simrad Marine SS 304
There are two sonars: the hull-mounted Simrad Marine SS 304 and a Finnyards Sonac PTA (Passive Towed Array). The SS 304 is a searchlight-type sonar operating at 34 kHz with 17 preformed receiving beams covering an 85° sector. The transducer may be turned and tilted −105 to +15°.

Finnyards SONAC passive towed array
The passive towed array has a 78 m (256 ft) array at the end of a 600 m (1,969 ft) cable which operates down to a depth of 100 m (328 ft) at a maximum speed of 12 knots.

ELECTRO-OPTIC SENSORS

Saab EOS-400

EOS-400 uses a Saab television tracker for automatic tracking in conjunction with a laser rangefinder, both units being mounted on a common training and elevating stabilised platform. This unit is the only above-deck item of equipment, (apart from the weapon being controlled) and below deck the control/display unit is located in the operations room. The control/display unit contains a TV monitor and a joystick for sensor platform operation, a mode selector and target data displays. The system tracks one target among several in close formation, tracking when radar tracking is not possible, and is equally effective against both surface and air targets. Inputs from other systems include the ship's surveillance radar and reference data from ship's compass. The system calculates ballistics for several guns and gives gun-laying data.

Specifications

Tracking parameters
Training: 360°
Elevation: −30 to +85°

Platform
Angular speeds, azimuth and elevation: 150°/s
Angular accelerations:
azimuth: 2 rad/s²
elevation: 3 rad/s²
Tracking: Digital correlation

Contrast selection: Automatic black/white
Lock on area: Whole field

Daylight camera
Scanning standard: 625 lines
Camera tube: Si-vidicon
Night camera: IR camera optional

Laser rangefinder
Wavelength: 1.06 µm
Repetition rate: 10 Hz
Beamwidth: 1.5 mrad

Manufacturer/Contractor

CelsiusTech, Sweden.

PROPULSION

Specifications

System: Diesel
Main machinery: 3 MTU 16V 538 TB92; 7.52 MW (10,230 hp)
Shafts: 3

FURTHER INFORMATION

PROGRAMME

First of class, *Helsinki* (60) was ordered in October 1978 and launched in 1980. The second, third and fourth ships were not ordered until 1983 and were commissioned in 1985-86.

More would have been ordered, but it was then decided to switch to the 'Rauma' class (sometimes known as the 'Helsinki II' class.

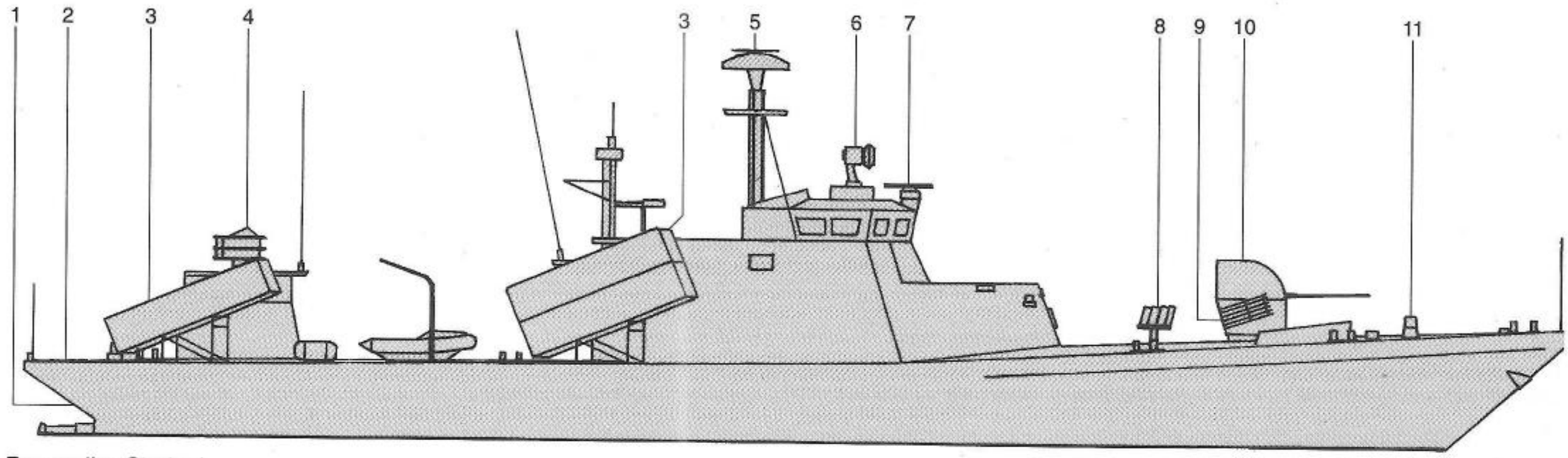
DESIGN

These ships have an aluminium alloy hull and superstructure. The second and subsequent ships were built with a revised armament and bridge and *Helsinki* was later brought up to the same standard.

The Seko barbette enables either Mistral SAMs or twin 23 mm cannon to be carried. Also, the after missile launchers can be replaced by two minerails.

Turku (61) *with a full load of eight RBS-15 anti-ship missiles* (Pär-Henrik Sjöström)

RAUMA



Rauma (Ian Sturton)
1 *Undercut stern* **2** *Minerails (if missile launchers removed)* **3** *Saab RBS-15M anti-ship missiles (maximum of eight)* **4** *Sako barbette for either six Matra/BAe Mistral SAM or twin 23 mm ZV-23 cannon* **5** *CelsiusTech 9GA 208 search radar* **6** *CelsiusTech 9GR 600 weapon-control radar* **7** *Raytheon SPS-69 ARPA navigation radar* **8** *CelsiusTech Philax chaff launcher* **9** *103 mm flare launchers* **10** *Bofors 40 mm/70 automatic gun* **11** *Saab Elma ASW mortar*

GENERAL SPECIFICATIONS

Operator: Finland
Type: FAC, Missile

Class: RAUMA

Built: 4
Active: 4

Displacement:
standard: 215 t
full load: 248 t

Dimensions
Length: 48 m (157.5 ft)
Beam: 8 m (26.2 ft)
Draught: 1.5 m (4.5 ft)

Speed: 30 kts

Complement: 19 (5 officers)

SHIPS

RAUMA (70)
Builder Hollming, Rauma, Finland
Commissioned 18 Oct 1990

RAAHE (71)
Builder Hollming, Rauma, Finland
Commissioned 20 Aug 1991

PORVOO (72)
Builder Finnyards, Rauma, Finland
Commissioned 27 Apr 1992

NAANTALI (73)
Builder Finnyards, Rauma, Finland
Commissioned 23 Jun 1992

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Saab RBS 15M
Six or eight Saab Dynamics RBS 15M missiles may be embarked. Single or double missile launchers are embarked outboard of the after end of the superstructure and on the port and starboard quarters.

Specifications
Length: 4.35 m (14.26 ft)
Diameter: 50 cm (19.68 in)
Wing span: 1.4 m (4.6 ft)
Weight: 780 kg (1,720 lb) (with boosters)
Speed: Mach 0.8
Range: 38 n miles (70 km)
Warhead: 200 kg (440 lb)
Guidance: Inertial navigation with active radar homing

Manufacturer/Contractor
Saab Missiles AB, Sweden.

SURFACE-TO-AIR MISSILES (SAM)

Mistral
A Sako barbette with six Matra BAe Dynamic Mistral missiles may be embarked.

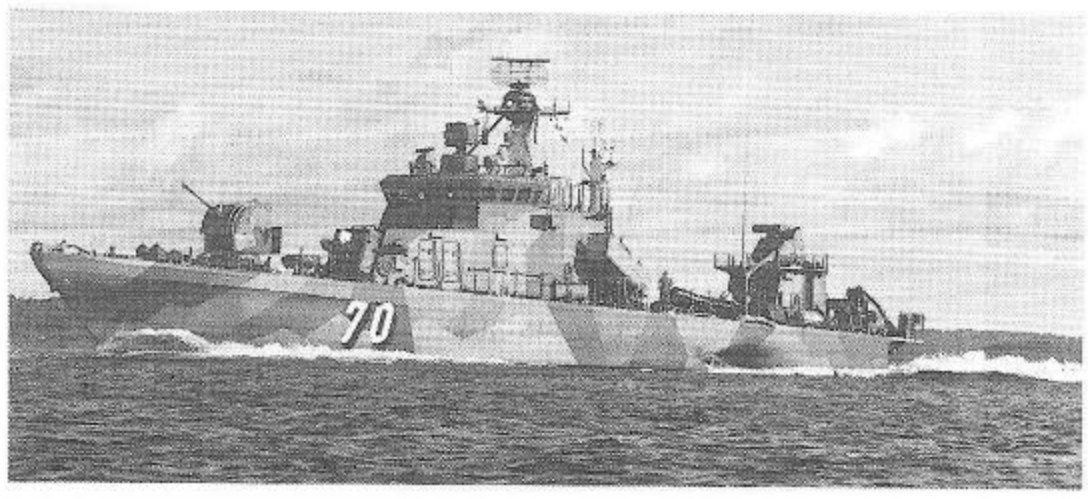
Specifications
Length: 1.81 m (5.9 ft)
Diameter: 9.2 cm (3.6 in)
Wing span: 11.1 cm (4.4 in)
Weight: 18.4 kg (40.5 lb)
Speed: Mach 2.6
Range: 2.7 n miles (5 km)
Warhead: 2.95 kg (6.5 lb)
Guidance: Infra-red passive homing

Manufacturer/Contractor
Matra BAe Dynamics.

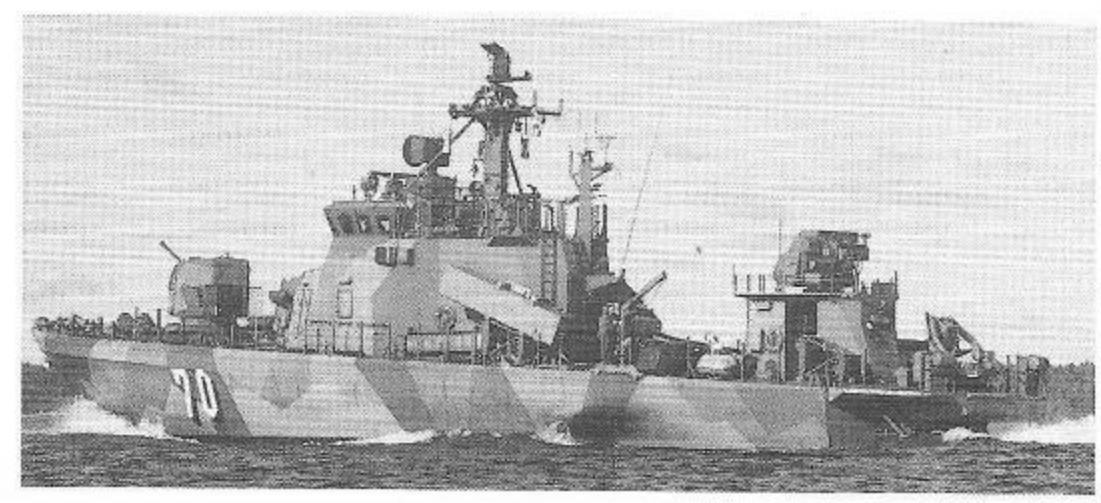
GUNS

Sako twin 23 mm mounting
If missiles are not carried, the Sako barbette has two 23 mm guns.

Specifications
Gun (Russian)
Calibre: 23 mm



Rauma *(70). Forward of the Bofors 40 mm/70 are four Saab Elma ASW mortars. Sensors above bridge are Raytheon navigation radar, CelsiusTech 9LV 225 fire-control director and (at the masthead) 9GA 208 surface search radar.*



Rauma *(70) from astern. The FAC is carrying only two missile launchers. Note the Sako barbette on top of the aft deckhouse, the platform sticking out over the stern and the two depth charges on the stern rails* (Pär-Henrik Sjöström)

Length of barrel: 87 calibres
Muzzle velocity: 970 m/s (3,182 ft/s)
Rate of fire: 200 rds/min
Range: 1.1 n miles (2 km)

Mounting
Weight: 1.7 t
Traverse: 360°
Elevation: −15 to +80°

Manufacturer/Contractor
Sako, Riihimaki, Finland.

12.7 mm machine guns
There are two 12.7 mm machine guns.

Saab Elma ASW mortars
Four nine-tubed launchers for the Elma ASW grenade. This weapon launches a grenade with a 4.2 kg (9.26 lb) warhead over a range of 350 m (1,148 yd), and was developed to counter submarine incursions in Swedish waters. It is intended to be capable of forcing a submarine to the surface rather than destroying it in the manner of a torpedo; hence the designation 'incident weapon.' Thus, the concept is to dissuade a submarine from entering Swedish waters without the political consequences of destroying it.

The LLS-920 non-magnetic, nine-tube Elma launchers are loaded from the muzzle, with firing initiated from the Combat Information Centre (CIC). A variety of programmable patterns result in carpets of 9, 18, 27 and 36 grenades. The Elma grenade is equipped with a shaped charge warhead the blast jet of which is capable of penetrating a submarine's pressure hull after passing through the water-filled superstructure.

Specifications
Launcher weight: 103 kg (227 lb)
Tube calibre: 100 mm (4 in)
Grenade weight: 4.35 kg (9.6 lb)
System range: 250-350 m (870-1,148 ft)

Manufacturer/Contractor
Saab, Sweden.

MINES

Minerails
Two minerails can be mounted in place of the missile launchers on the stern.

DEPTH CHARGES

One depth-charge rail is mounted.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-Thorn Matilda
These vessels have the Racal-Thorn Matilda which is a lightweight system whose antenna provides a broad vertical beam to detect sea-skimmers and high-angle dive attack missiles. It covers the H/J-band with bearing resolution of 45° and features a visual and audio warning system.

Log Periodic Antennas
These vessels have the same type of log periodic antennas as the 'Turunmaa' corvettes. These are mounted on a pole mast amidships, with one horizontally and one vertically polarised. These could serve either an ESM or a communications function.

DECOYS AND ILLUMINANTS

CelsiusTech Philax
The CelsiusTech Philax decoy launcher system consists of trainable 875/720/950 mm launchers weighing 180 kg (397 lb). Each has four magazines with 36 40 mm chaff or infra-red payload grenades. The former fire at intervals of 0.1 s per magazine and within 1 s create a 1,000 m² decoy cloud, while the infra-red grenades cover both the 3-5 µm and 8-14 µm bands.

103 mm Flare Launchers
There are six launcher rails for 103 mm illuminating rockets.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

CelsiusTech 9LV Mk 3
These vessels have the CelsiusTech 9LV Mk 3 weapon control system. This is a radar-based, distributed architecture system based upon Motorola 68020 and 68040 processors with an Ethernet-standard local area network linking two workstations.

SONARS

Simrad Subsea ST 570 Toadfish
The 'Rauma' class has Simrad Subsea ST 570 Toadfish variable depth and Finnyards Sonac PTA towed array sonars. The Toadfish is a lightweight active sonar operating at 57 kHz and creating 64 digitally formed beams with a range of 6.5 n miles (12 km).

Finnyards Sonar PTA
The PTA (Passive Towed Array) sonar has a 78 m array at the end of a 600 m (1,969 ft) cable which operates down to a depth of 100 m (328 ft) at a maximum speed of 12 knots.

RADARS

	9GA 208	9GR600	SPS-69 ARPA
Maker	CelsiusTech	CelsiusTech	Raytheon
Role	Search	Weapon control	
Band	I	I	I
Beam	1, 3°	1.1, 7°	4, 25°
Peak power	200 kW	200 kW	4 kW
Gain	38 dB	35.5 dB	n/k
Pulsewidth	0.25, 1.0 µs	0.25, 1.0 µs	0.08, 0.5, 0.25 µs
PRF	1,000, 3,000 pps	1,000, 3,000 pps	750, 1,500, 2,250 pps
Scan rate	60 rpm	60 rpm	24 rpm
Typical range	n/k	n/k	32 n miles (59 km)

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 16V 538 TB93; 5.52 MW (7,510 hp)
Shafts: None.
Waterjets: These FACs are propelled by two Riva Calzoni waterjets

FURTHER INFORMATION

PROGRAMME

The 'Rauma' class was developed from the 'Helsinki' class and also has aluminium alloy hull and superstructure. *Rauma* and *Raahe* were built by Hollming at Rauma and commissioned in 1990 and 1991, while *Naantali* and *Porvoo* were built by Finnyards and commissioned in 1992. These vessels were ordered in 1987 and a fifth was ordered in 1996; a further seven are planned.

The ships are primarily anti-ship platforms but also possess an ASW capability.

DESIGN

The design is based on that of the 'Helsinki' class, but is 3 m (9.9 ft) longer and with 50 per cent less draught (1.5 m (4.5 ft) versus 3 m (9.9 ft)). This is one of the smallest ships to carry a towed array, Finnyards Sonac PTA, which can be towed at speeds up to 12 knots. One unusual feature is the stern deck extension which carries the towed array cable and gives an 'undercut' appearance.

GENERAL NAZAIRE BOULINGUI

GENERAL SPECIFICATIONS

Country of origin: France
Operator: Gabon
Type: FAC, Missile

Class: GENERAL NAZAIRE BOULINGUI

Built: 1
Active: 1

Displacement:
full load: 160 t

Dimensions
Length: 42 m (138 ft)
Beam: 7.7 m (25.3 ft)
Draught: 1.9 m (6.5 ft)

Speed: 32 kts
Range: 1,500 n miles (2,780 km) at 15 kts

Complement: 20 (3 officers)

SHIPS

GENERAL NAZAIRE BOULINGUI (P 10)
Builder Chantiers Navale de l'Esterel, Cannes, France
Commissioned 7 Aug 1978

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

SS 12M

There is a launcher with four Aerospatiale SS 12M anti-ship missiles forward of the bridge.

Specifications
Length: 1.86 m (6.1 ft)
Diameter: 21 cm (8.26 in)
Wing span: 65 cm (25.6 in)
Weight: 76 kg (167.5 lb)
Speed: Mach 0.6
Range: 0.5-3 n miles (1-5.5 km)
Warhead: 28.38 kg (62.5 lb)
Guidance: Wire command to line of sight

Manufacturer/Contractor
Aerospatiale Missiles, France.

GUNS

There is one DCN Type C Bofors 40 mm L/60 near the stern and one GIAT F2 Type A 20 mm gun mounting forward of the missile launcher.

Bofors 40 mm L/60

Specifications
Gun
Calibre: 40 mm
Length of barrel: 56 calibres
Muzzle velocity: 881 m/s (2,891 ft/s)
Rate of fire: 60 rds/min
Range: 5.5 n miles (10 km)

Mounting
Traverse: 360°
Elevation: -15 to +85°

Manufacturer/Contractor
DCN International, France.

Giat F2 Type A

Specifications
Gun
Calibre: 20 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,101 ft/s)
Rate of fire: 750 rds/min
Range: 5.5 n miles (10 km)

Mounting
Weight: 470 kg
Traverse: 360°
Elevation: -15 to +80°

Manufacturer/Contractor
Giat Industries, France.

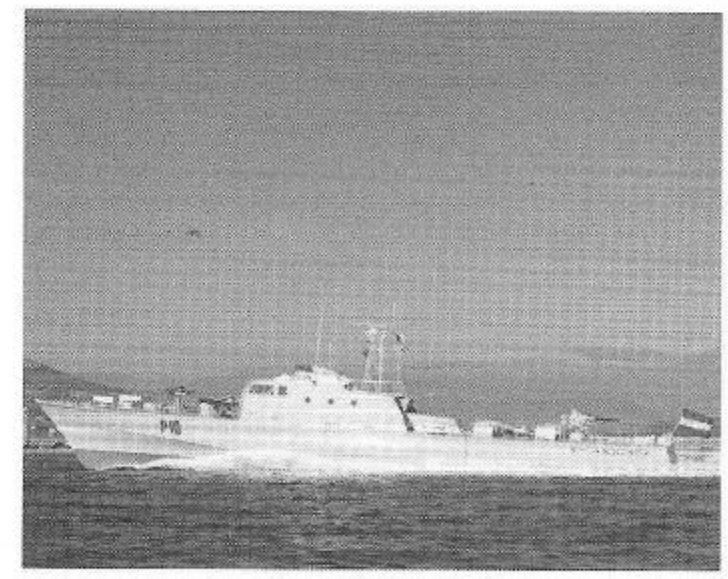
COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca RM 1226

Specifications
Role: Surface search
Band: I
Beam: 1.2°
Peak power: 25 kW
Pulsewidth: 0.05, 0.25, 1.0 µs
PRF: 1,300 pps
Scan rate: 25 rpm
Typical range: 20 n miles (37 km)

Manufacturer/Contractor
Racal-Decca, UK.



General Nazaire Boulingui *(P 10) of the Gabonese Navy* (Chantiers Navals d'Esterel)

PROPULSION

Specifications
System: Diesel
Main machinery: 3 SACM 195 V12 CSHR; 3.97 MW (5,400 hp)
Shafts: 3

FURTHER INFORMATION

This vessel was built with a hull of triple-skinned mahogany by Chantiers Navals de l'Estérel, being launched and commissioned in 1978. In 1985 the original two MTU 16V 538 TB91 diesels were replaced, although they gave a speed of 40 knots and, with the new engines, speed was reduced to 32 knots.

DIOPOS ANTINIOU

GENERAL SPECIFICATIONS

Country of origin: France
Operator: Greece
Type: FAC, Missile

Class: DIOPOS ANTINIOU

Built: 2
Active: 2

Displacement:
full load: 115 t

Dimensions
Length: 32 m (105 ft)
Beam: 5.8 m (19 ft)
Draught: 1.6 m (5.3 ft)

Speed: 30 kts
Range: 1,500 n miles (2,780 km) at 15 kts

Complement: 17

SHIPS

DIOPOS ANTINIOU (P 286)
Builder Chantiers Navals de l'Esterel, Cannes, France
Commissioned 4 Dec 1975

KELEFSTIS STAMOU (P 287)
Builder Chantiers Navals de l'Esterel, Cannes, France
Commissioned 28 Jul 1975

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

SS 12M
These vessels carry a launcher with four Aerospatiale SS 12M anti-ship missiles.

Specifications
Length: 1.86 m (6.1 ft)
Diameter: 21 cm (8.26 in)
Wing span: 65 cm (25.6 in)
Weight: 76 kg (167.5 lb)
Speed: Mach 0.6
Range: 0.5-3 n miles (1-5.5 km)
Warhead: 28.38 kg (62.5 lb)
Guidance: Wire command to line of sight

Manufacturer/Contractor
Aerospatiale Missiles, Paris.

GUNS

S.20
One Rheinmetall Rh-202 20 mm gun is installed aft of the superstructure.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,101 ft/s)
Rate of fire: 800-1,000 rds/min
Range: 1 n mile (1.8 km)

Mounting
Weight: 418 kg (922 lb)
Traverse: 360°
Elevation: −10 to +55°

Manufacturer/Contractor
Rheinmetall Wehrtechnik, Germany.

12.7 mm machine gun
One M2HB 12.7 mm machine gun is carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca Type 1226

Specifications
Role: Surface search
Band: I
Beam: 1.2°
Peak power: 25 kW
Pulsewidth: 0.05, 0.25, 1.0 µs
PRF: 1,300 pps
Scan rate: 25 rpm
Typical range: 20 n miles (37 km)

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

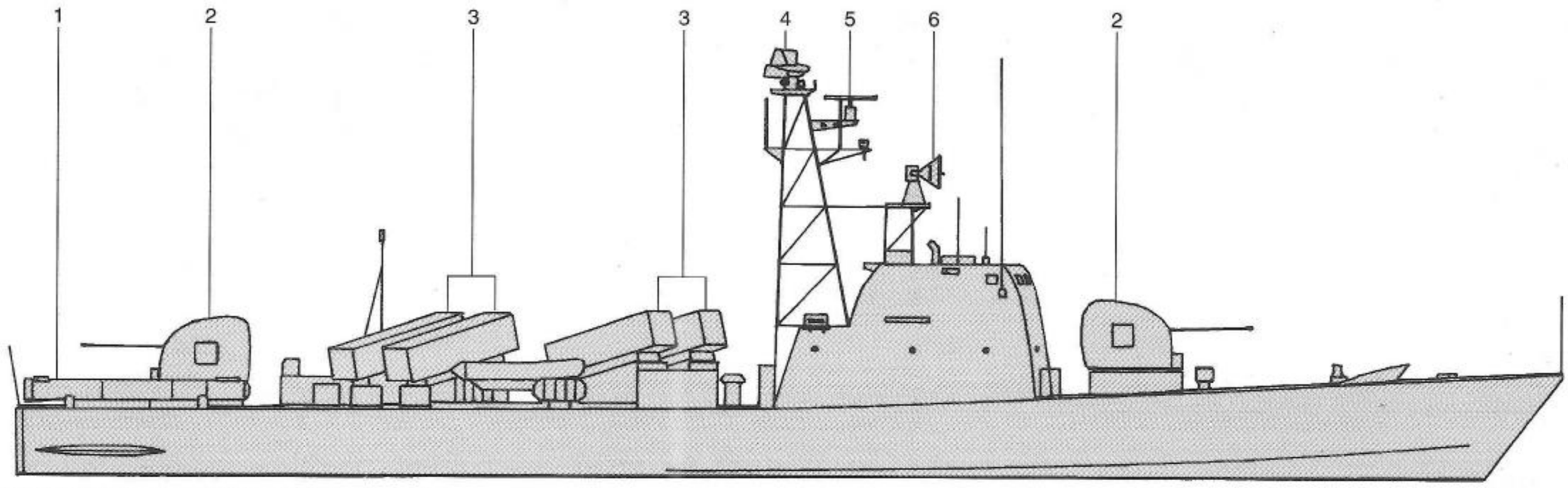
Specifications
System: Diesel
Main machinery: 2 MTU 12V 331 TC 81; 1.92 MW (2,610 hp)
Shafts: 2

FURTHER INFORMATION

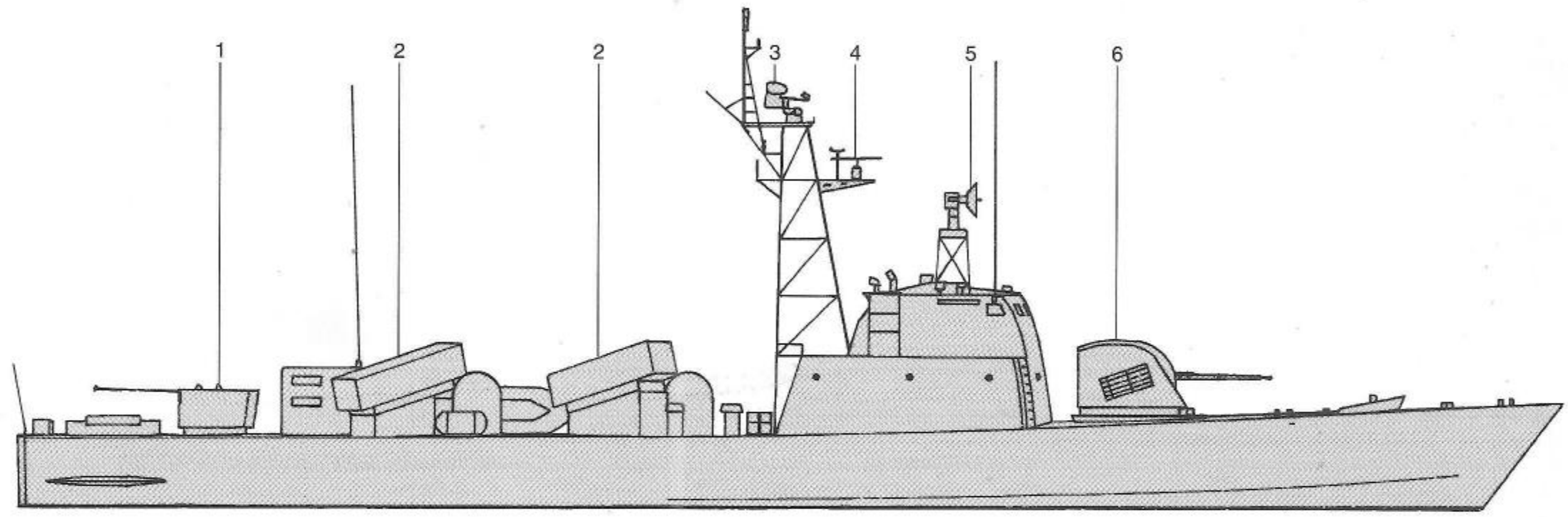
These wooden-hulled vessels were ordered by the Cyprus Government from Chantiers Navals de l'Esterel and built in 1974/1975. Due to the Turkish invasion they were not delivered and were acquired instead by Greece. They were commissioned in 1975.

Diopos Antoniou *(P 286)* (Hellenic Navy)

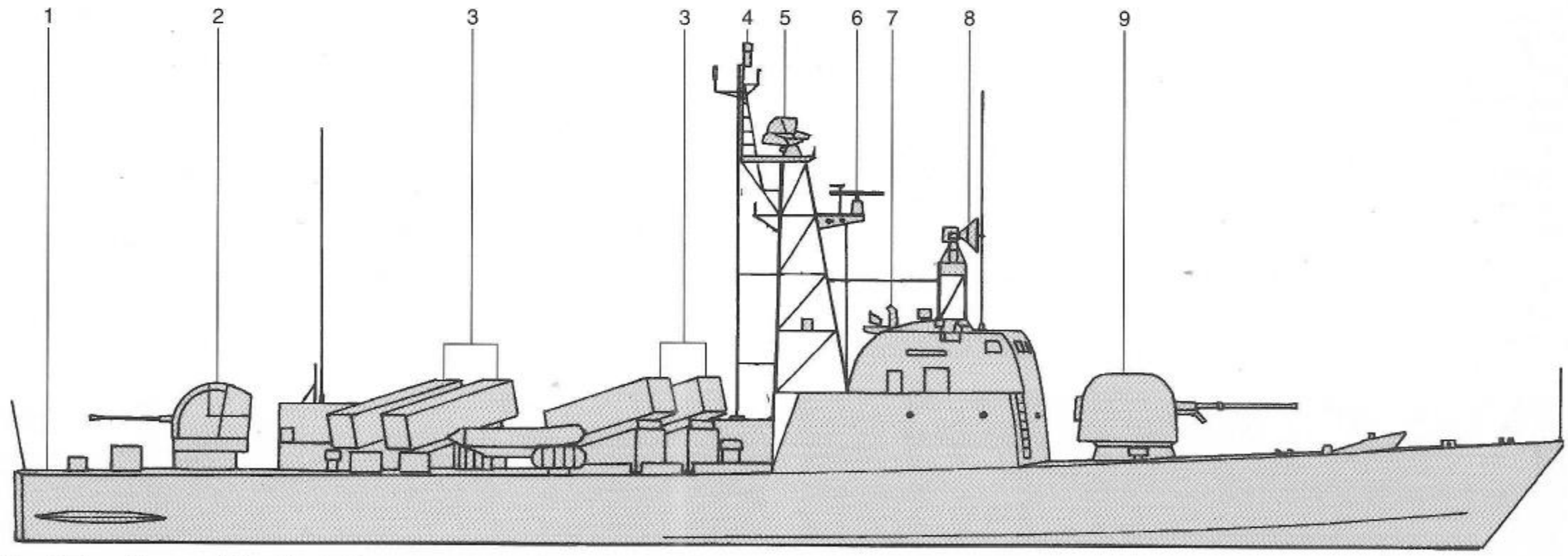
LA COMBATTANTE II/TIGER (TYPE 148)



Antipliarhos Anninos *(Greece)* (Ian Sturton)
1 *533 mm (21 in) torpedo tube (two) (aft-facing)* **2** *Oerlikon twin 35 mm/90 automatic cannon* **3** *Aerospatiale MM 38 Exocet anti-ship missiles (four)* **4** *Thomson-CSF Triton air/surface search radar* **5** *Racal-Decca 1226C navigation radar* **6** *Thomson-CSF fire-control radar*



Perdana *(Malaysia)* (Ian Sturton)
1 *Bofors 40 mm/70 (open mount)* **2** *Aerospatiale MM 38 Exocet anti-ship missiles (two)* **3** *Thomson-CSF Triton air/surface search radar* **4** *Racal-Decca 616 navigation radar* **5** *Thomson-CSF Pollux fire-control radar* **6** *Bofors 57 mm/70 automatic gun (enclosed mount)*



'Tiger' *class (Germany)* (Ian Sturton)
1 *Minerails* **2** *Bofors 40 mm/70* **3** *Aerospatiale MM 38 anti-ship missile (four)* **4** *Racal-Decca Octopus ESM/ECM suite* **5** *Thomson-CSF Triton air/search radar* **6** *SMA 3 RM 20 navigation radar* **7** *CSEE Defénse Panda optical director* **8** *Thomson-CSF Castor fire director* **9** *OTOBREDA 76 mm (3 in)/62 Compact*

GENERAL SPECIFICATIONS

Country of origin: France
Operators: Greece, Iran, Libya, Malaysia ('Perdana') Germany, Greece ('Tiger')
Type: FAC, Missile

Class: LA COMBATTANTE II/TIGER (TYPE 148)

Built: 30 ('La Combattante II); 20 ('Tiger')
Active: 27 ('La Combattante II); 20 ('Tiger')

TABLE I: PARTICULARS

	Germany	Greece		Iran	Libya	Malaysia
	Tiger	**Anninos**	**Votsis**	**Kaman**	**Sharaba**	**Perdana**
Displacement						
standard	234 t	234 t	234 t	249 t	—	234 t
full load	265 t	255 t	265 t	275 t	311 t	265 t
Length	47.0 m (154.2 ft)	47.0 m (154.2 ft)	47.0 m (154.2 ft)	47.0 m (154.2 ft)	49.0 m (160.7 ft)	47.0 m (154.2 ft)
Beam	7.0 m (23.0 ft)	7.1 m (23.3 ft)	7.0 m (23 ft)	7.1 m (23.3 ft)	7.1 m (23.3 ft)	7.0 m (23 ft)
Draught	2.7 m (8.9 ft)	2.5 m (8.2 ft)	2.7 m (8.9 ft)	1.9 m (6.2 ft)	2.0 m (6.6 ft)	3.9 m (12.8 ft)
Speed	36 kts	36.5 kts	36 kts	37.5 kts	39 kts	36.5 kts
Range	570 n miles at 30 kts; 1,600 n miles at 15 kts	850 n miles at 25 kts	570 n miles at 30 kts; 1,600 n miles at 15 kts	2,000 n miles at 15 kts; 700 n miles at 33.7 kts	1,600 n miles at 15 kts	800 n miles at 25 kts; 1,800 n miles at 15 kts
Complement	30 (4 officers)	40 (4 officers)	30 (4 officers)	31	27	30 (4 officers)

SHIPS

Germany ('Tiger' class)
TIGER (P 6141)
Commissioned 30 Oct 1972
Builder CMN, Cherbourg, France

LUCHS (P 6143)
Commissioned 9 Apr 1973
Builder CMN, Cherbourg, France

LEOPARD (P 6145)
Commissioned 21 Aug 1973
Builder CMN, Cherbourg, France

FUCHS (P 6146)
Commissioned 17 Oct 1973
Builder CMN, Cherbourg, France

JAGUAR (P 6147)
Commissioned 13 Nov 1973
Builder CMN, Cherbourg, France

LÖWE (P 6148)
Commissioned 9 Jan 1974
Builder CMN, Cherbourg, France

WOLF (P 6149)
Commissioned 26 Feb 1974
Builder CMN, Cherbourg, France

PANTHER (P 6150)
Commissioned 27 Mar 1974
Builder CMN, Cherbourg, France

PELIKAN (P 6153)
Commissioned 24 Sep 1974
Builder CMN, Cherbourg, France

ELSTER (P 6154)
Commissioned 14 Nov 1974
Builder CMN, Cherbourg, France

ALK (P 6155)
Commissioned 7 Jan 1975
Builder CMN, Cherbourg, France

DOMMEL (P 6156)
Commissioned 12 Feb 1975
Builder CMN, Cherbourg, France

WEIHE (P 6157)
Commissioned 3 Apr 1975
Builder CMN, Cherbourg, France

PINGUIN (P 6158)
Commissioned 22 May 1975
Builder CMN, Cherbourg, France

REIHER (P 6159)
Commissioned 24 Jun 1975
Builder CMN, Cherbourg, France

KRANICH (P 6160)
Commissioned 6 Aug 1975
Builder CMN, Cherbourg, France

Greece ('Anninos' class)
ANTIPLIARHOS ANNINOS (P 14)
Commissioned Jun 1972
Builder CMN, Cherbourg, France

IPOPLIARHOS ARLIOTIS (P 15)
Commissioned Apr 1972
Builder CMN, Cherbourg, France

IPOPLIARHOS KONIDIS (P 16)
Commissioned Jul 1972
Builder CMN, Cherbourg, France

IPOPLIARHOS BATSIS (P 17)
Commissioned Dec 1971
Builder CMN, Cherbourg, France

Greece ('Votsis' (ex-Tiger) class)
IPOPLIARHOS VOTSIS* (P 72)
Commissioned (FGN) 8 Jan 1973
Builder CMN, Cherbourg, France
Transferred to Greece Sep 1993

ANTIPLIARHOS PEZOPOULOS* (P 73)
Commissioned (FGN) 17 Jul 1974
Builder CMN, Cherbourg, France
Transferred to Greece Sep 1993

PLOTARHIS VLAHAVAS* (P 74)
Commissioned (FGN) 14 Jun 1973
Builder CMN, Cherbourg, France
Transferred to Greece 16 Mar 1995

PLOTARHIS MARIDAKIS* (P 75)
Commissioned (FGN) 12 Jun 1974
Builder CMN, Cherbourg, France
Transferred to Greece 16 Mar 1995

Kaman, *one of 12 La Combattante IIs bought by Iran, two of which have been sunk in action. They were the only vessels of the type to be armed with Harpoon missiles (as seen here) but are in the process of being rearmed with Chinese-supplied YJ-1 or YJ-2 missiles*

Close-up of the bridge of German 'Tiger' class vessel, Elster *(P 6154). Note the Exocet launchers (bottom left), Thomson-CSF Castor fire director (on bridge roof), CSEE Panda optical director (far side of bridge) and SMA 3RM 20 navigation radar (slotted waveguide). The commanding officer wears a white-topped cap, a German Navy tradition* (H & L van Ginderen Collection)

Iran ('Kaman' class)
KAMAN (P 221)
Commissioned 12 Aug 1977

ZOUBIN (P 222)
Commissioned 12 Sep 1977

KHADANG (P 223)
Commissioned 15 Mar 1978

FALAKHON (P 226)
Commissioned 31 Mar 1978

SHAMSHIR (P 227)
Commissioned 31 Mar 1978

GORZ (P 228)
Commissioned 22 Aug 1978

GARDOUNEH (P 229)
Commissioned 11 Sep 1978

KHANJAR (P 230)
Commissioned 1 Aug 1981

NEYZEH (P 231)
Commissioned 1 Aug 1981

TABARZIN (P 232)
Commissioned 1 Aug 1981

Libya ('Sharaba' class)
SHARABA (518)
Commissioned Feb 1982

SHEHAB (522)
Commissioned 3 Apr 1982

WAHAG (524)
Commissioned 29 May 1982

SHOUAIAI (528)
Commissioned 5 Sep 1982

SHOULA (532)
Commissioned 29 Oct 1982

SHAFAK (534)
Commissioned 17 Dec 1982

BARK (536)
Commissioned 11 Mar 1983

RAD (538)
Commissioned 10 May 1983

LAHEEB (542)
Commissioned 29 Jul 1983

Malaysia ('Perdana' class)
PERDANA (3501)
Commissioned 21 Dec 1972

SERANG (3502)
Commissioned 31 Jan 1973

GANAS (3503)
Commissioned 28 Feb 1973

GANYANG (3504)
Commissioned 20 Mar 1973

WEAPONS SYSTEMS

TABLE II: WEAPON SUMMARY

	Germany	Greece		Iran	Libya	Malaysia
Class	Tiger (Type 148)	Anninos	Votsis	Kaman	Sharaba	Perdana
Missiles, anti-ship	4 × Exocet MM 38	4 × Exocet MM 38	4 × Exocet MM 38	4 × Harpoon or 4 × Chinese YJ-1	4 × Otomat Mk 2	2 × Exocet MM 38
Guns						
main	1 × OTOBREDA 76 mm/62 (1 × 1)	4 × Oerlikon 35 mm/90 (2 × 2)	1 × OTOBREDA 76 mm/62 (1 × 1)	1 × OTOBREDA 76 mm/62 (1 × 1)	1 × OTOBREDA 76 mm/62 (1 × 1)	1 × Bofors 57 mm/70 (1 × 1)
secondary	1 × Bofors 40 mm/70 (1 × 1)	4 × Oerlikon 35 mm/90 (2 × 2)	1 × Bofors 40 mm/70 (1 × 1)	1 × Breda 40 mm/70 (1 × 2)	2 × Breda 40 mm/70 (1 × 1)	1 × Bofors 40 mm/70 (1 × 1)
Torpedoes	–	2 × 533 mm	–	–	–	–
Mines	Yes	–	Yes	–	–	–

SURFACE-TO-SURFACE MISSILES (SSM)

All vessels have two twin missile launchers aft of the superstructure, the forward pair trained to starboard and the after pair trained to port, except for the Malaysian vessels which have only two launchers. The missiles are usually Aerospatiale Exocet MM 38 (Greece, Germany) although Iranian vessels were designed to carry four Harpoon 1A missiles but now normally carry Chinese missiles (either C-801 (YJ-1) or C-802 (YJ-2)) while Libyan vessels carry Matra-Alenia Otomat Mk 2.

Aerospatiale Exocet MM 38

Specifications
Length: 5.21 m (17.08 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 22.5 n miles (42 km)
Warhead: 165 kg (365 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, France.

Chinese C-801 (CSS-N-4 'Sardine' or YJ-1)

Specifications
Length: 5.81 m (19.5 ft)
Diameter: 36 cm (14.17 in)
Wing span: 1.18 m (3.87 ft)
Weight: 815 kg (1,797 lb)
Speed: Mach 0.9
Range: 23 n miles (42 km)
Warhead: 165 kg (364 lb)
Guidance: Inertial and active radar

Manufacturer/Contractor
China Precision Machinery Import and Export Corporation, Beijing, China.

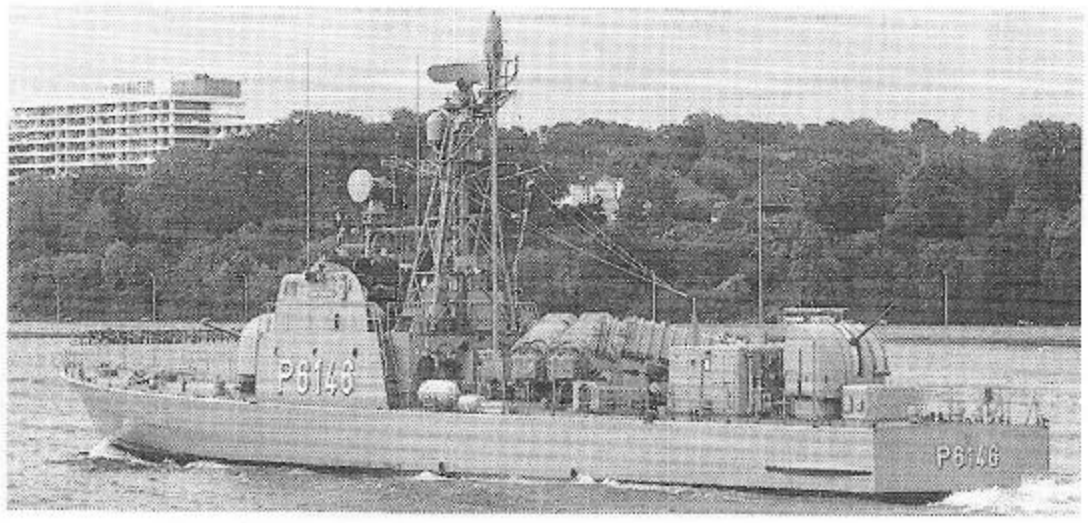
Chinese C-802 (CSS-N-8 'Saccade' or YJ-2)

Specification
Length: 6.39 m (12.10 ft)
Diameter: 36 cm (14.17 in)
Wing span: 1.18 m (3.87 ft)
Weight: 715 kg (1576.5 lb)
Speed: Mach 0.9
Range: 65 n miles (120 km)
Warhead: 165 kg (364 lb)
Guidance: Inertial and active radar

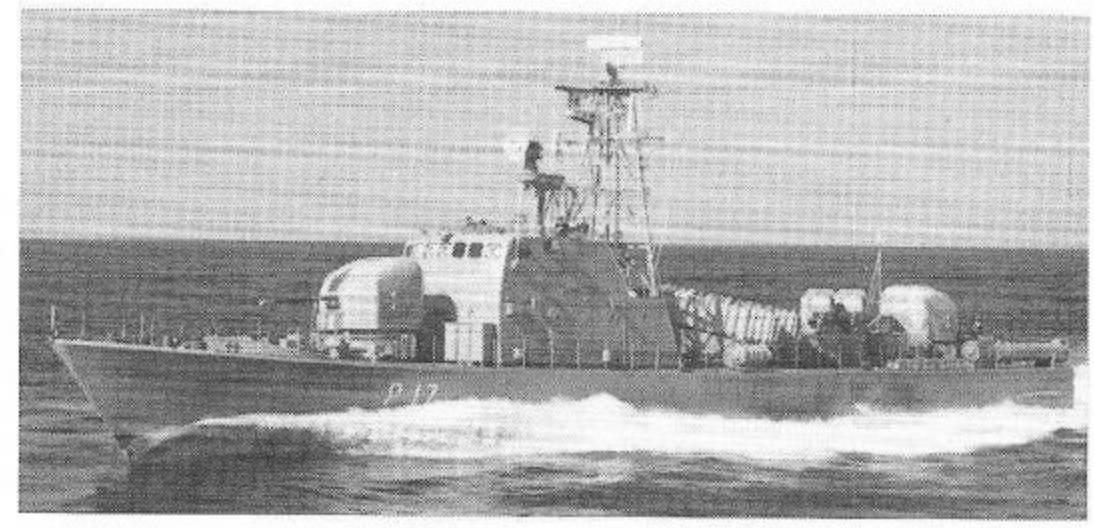
Manufacturer/Contractor
China Precision Machinery Import and Export Corporation, Beijing, China.

Matra/Alenia Otomat Mk 2

Specifications
Length: 4.46 m (14.62 ft)
Diameter: 46 cm (18.1 in)



The classic FAC of the 1970s was the La Combattante II, epitomised here by Reiher *(P 6159) of the Federal German Navy. The design was fast (36 knots) and packed a great deal of weaponry into a small hull* (H & L van Ginderen Collection)



Ipoploiarhos Batsis, *one of four La Combattante IIs purchased by the Greek Navy in 1971/72. These have twin Oerlikon 35 mm/90 s fore and aft, four MM 38 Exocet, and are the only La Combattante IIs to carry torpedo tubes* (Hellenic Navy)

Wing span: 1.36 m (4.46 ft)
Weight: 770 kg (1,698 lb) (with boosters)
Speed: Mach 0.9
Range: 35 n miles (65 km) (Longer ranges require helicopter support)
Warhead: 210 kg (465 lb)
Guidance: Inertial with active radar homing

Manufacturer/Contractor
Alenia Missile Systems/Matra BAe Dynamics.

TUBES

The Greek 'La Combattante II' class have two 533 mm (21 in) torpedo tubes with STN Atlas SST-4 torpedoes on each side of the aft gun mounting.

TORPEDOES

SST-4

Specifications
Length: 6.55 m (21.5 ft) (with guidance wire dispenser)
Diameter: 533 mm (21 in)
Weight: 1,420 kg (3,131 lb) (without dispenser)
Propulsion: Electric
Speed: 35 kts
Range: 15 n miles (28 km)
Warhead: 260 kg (573 lb)
Guidance: Wire and active/passive sonar

GUNS

'Kaman' and 'Sharaba' class vessels have an OTOBREDA 76/62 Compact mounting forward and an OTOBREDA twin 40 mm Compact aft. The 'Tiger' and 'Votsis' classes are similar but with a Bofors 40 mm SAK 40 L/70-350 aft. 'Perdana' class vessels have a single 57 mm Bofors SAK 57 Mk 1 forward and a Bofors 40 mm L/70 aft while the 'Anninos' class has two Oerlikon-Contraves GDM-A twin 35 mm gun mountings fore and aft.

OTOBREDA 76/62 Compact

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Weight: 8.5 t (loaded)
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Bofors SAK 57 Mk 1

Specifications
Gun
Calibre: 57 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,020 m/s (3,347 ft/s)
Rate of fire: 200 rds/min
Range: 9 n miles (17 km)

Mounting
Traverse: 360°
Elevation: −10 to +75°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Bofors SAK 40 L/70-350

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 300 rds/min
Range: 6.75 n miles (12.5 km)

Mounting
Traverse: 360°
Elevation: −9 to +85°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

OTOBREDA 40 mm/70

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 600 rds/min
Range: 3.25 n miles (12.5 km)

Mounting
Weight: 5.5 t (unloaded)
Traverse: 360°
Elevation: −13 to +85°

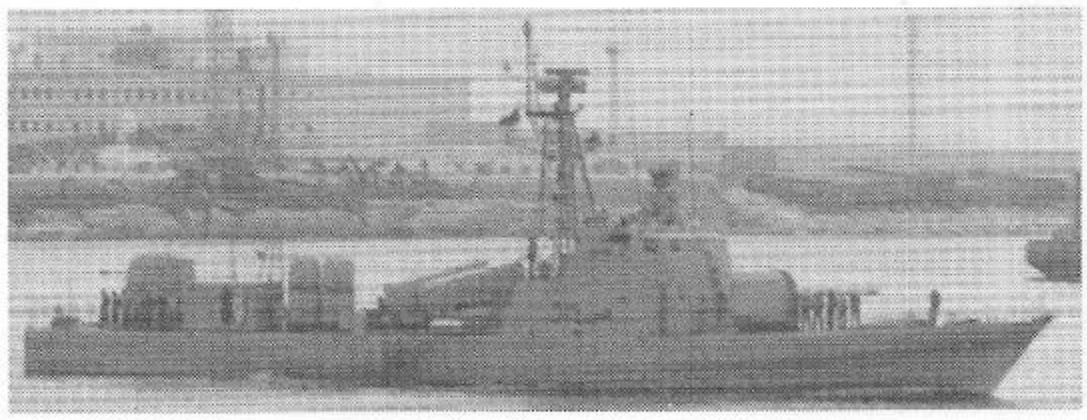
Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Oerlikon GDM-A 35 mm/90

Specifications
Gun
Calibre: 35 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,175 m/s (3,855 ft/s)
Rate of fire: 550 rds/min/barrel
Range: 2.7 n miles (5 km)

Mounting
Weight: 6.52 t
Traverse: 360°
Elevation: −15 to +85

Manufacturer/Contractor
Oerlikon-Contraves, Switzerland.



Shafak. *The Libyan vessels are armed with Matra/Alenia Otomat anti-ship missiles. They also have one 76 mm/62 gun and a twin 40 mm/70 mount*

Weihe *(P 6157), following recent modification. The navigation radar antenna is now on the bridge roof and a new radome is mounted on the mast above the Thomson-CSF Castor fire director. At the mast head is an ESM antenna and below it the Thomson-CSF Tritor air/surface search radar*
(H & L van Ginderen Collection)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

'Anninos', 'Kaman', 'Perdana', 'Sharaba' classes. These classes have a Thomson-CSF DR 2000S ESM system. This is an F-band analysis receiver designed to detect pulse and CW signals using six direction-finding antennas in a radome. Greek 'Combattante' ('Anninos' class) also have the Siemens-Plessey Mk 10 IFF system.

'Kaman' class. The Iranian ships have the Thomson-CSF Dalia (TMV 433) radar analyser which operates over the E to J-bands and uses instantaneous frequency measurement. They also have the UPZ-27N/AP-72 IFF system.

'Tiger', 'Votsis' classes. The 'Tiger' and 'Votsis' (ex-'Tiger') classes are equipped with a Racal-Thorn Octopus electronic warfare suite based upon the Racal-Thorn Cutlass B1 ESM and Scorpion ECM systems with DASA threat library. The Cutlass B1 uses the Anaren DESM antenna and provides bearings, CW bearing and frequency measurement over the E/J-band with instantaneous frequency measurement. There is also the DASA Telegon 6 modular, high-frequency direction-finding system.

ELECTRONIC COUNTERMEASURES (ECM)

'Kaman' class. Iranian vessels have the Thomson-CSF Alligator dual-mode (noise deception) I-band jammer with instantaneous frequency measurement to measure the radar threat.

'Perdana' class. Malaysian vessels have four 103 mm decoy rocket launchers attached to the SAK 57 mounting.

'Tiger', 'Votsis' classes. The 'Tiger' and 'Votsis' classes have a Racal-Thorn Scorpion wide-band jammer covering the E/J-band. The dual-beam antenna can call upon 50 kW of radiated power and the system can deal with between five and eight targets. It is supported in the 'Tiger' class by a Wolke chaff launcher.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

'Anninos', 'Sharaba' classes. Greek and Libyan vessels have a Thomson-CSF Vega radar-based weapon control system. This has a mainframe architecture, with CDE mini-computer, as well as radar display, gun and surface-to-surface missile weapon control consoles.

'Kaman' class. Iranian vessels have a Signaal WM28 radar-based weapon control system with mainframe architecture, based upon the SMR mini-computer, and a two-man display and control console. It can operate against two targets simultaneously using two guns or surface-to-surface missiles.

'Tiger', 'Votsis' classes. The 'Tiger' and 'Votsis' classes have a Thomson-CSF Vega I radar-based weapon control system of mainframe architecture, with BCH mini-computer, as well as radar display, gun and surface-to-surface missile weapon control consoles. This is supplemented by a PALIS active/passive tactical data system using Link 11 which automatically transfers data between vessels of the same squadron.

'KAMAN' CLASS

	1226C	WM28
Maker	Racal-Decca	Signaal
Role	Search	Weapon control
Band	I	I
Beam	1.2°	1.5, 7°, 2.4°
Peak power	25 kW	200 kW
Gain	n/k	33.5 dB
Pulsewidth	0.05, 0.25, 1.0 µs	0.22, 0.45 µs
PRF	1,300 pps	1,800, 3,600 pps
Scan rate	25 rpm	60 rpm
Typical range	20 n miles (37 km)	16 n miles (30 km)

'SHARABA' CLASS

	Triton	Castor IIB
Maker	Thomson-CSF	Thomson-CSF
Role	Search	Weapon control
Band	H	I
Beam	2, 22°	2.45, 2.3°
Peak power	250 kW	30 kW
Gain	38 dB	30 dB
Pulsewidth	0,2, 0.5. 0.7 µs	0.4 µs
PRF	n/k	3,600, 7,200 pps
Scan rate	12, 24 rpm	n/k
Typical range	24 n miles (45 km)	13 n miles (25 km)

RADARS

'TIGER', 'VOTSIS' CLASSES

	Triton	Castor II	3RM20
Maker	Thomson-CSF	Thomson-CSF	SMA
Role	Search	Weapon control	Navigation
Band	H	I	I
Beam	2 × 22°	2.45 × 2.3°	0.8/2.0 × 26°
Peak power	250 kW	30 kW	7 kW
Gain	38 dB	36 dB	27 dB
Pulsewidth	0,2, 0.5, 0.7 µs	0.5 µs	0.05, 0.15, 0.5, 1.0 us
PRF	n/k	4,000, 8,000 pps	750, 1,500, 3,000, 6,000 pps
Scan rate	12, 24 rpm	n/k	25 rpm
Typical range	24 n miles (45 km)	13 n miles (25 km)	n/k

'ANNINOS' CLASS

	Triton	Pollux	1226C
Maker	Thomson-CSF	Thomson-CSF	Racal-Decca
Role	Search	Weapon control	Navigation
Band	H	I	I
Beam	2, 22°	n/k	1.2°
Peak power	250 kW	200 kW	25 kW
Gain	38 dB	30 dB	n/k
Pulsewidth	0,2, 0.5, 0.7 µs	0.3 µs	0.05, 0.25, 1.0 µs
PRF	n/k	1,500 pps	1,300 pps
Scan rate	12, 24 rpm	n/k	25 rpm
Typical range	24 n miles (45 km)	16 n miles (30 km)	20 n miles (37 km)

'PERDANA' CLASS

	Triton	Pollux	616
Maker	Thomson-CSF	Thomson-CSF	Racal-Decca
Role	Search	Weapon control	Navigation
Band	H	I	I
Beam	2, 22°	n/k	1.2°
Peak power	250 kW	200 kW	25 kW
Gain	38 dB	30 dB	n/k
Pulsewidth	0,2, 0.5, 0.7 µs	0.3 µs	0.05, 0.25, 1.0 µs
PRF	n/k	1,500 pps	1,300 pps
Scan rate	12, 24 rpm	n/k	25 rpm
Typical range	24 n miles (45 km)	16 n miles (30 km)	20 n miles (37 km)

ELECTRO-OPTIC SENSORS

CS Défense Panda director

Specifications
Weight: 480 kg (1,058 lb)
Elevation: −25 to +65°
Sensors: Optical

PROPULSION

Specifications
System: Diesel
Main machinery:
Germany, Greece: 4 MTU MD 16V 538 TB90; 8.82 MW (12,000 hp)
Iran: 4 MTU 16V 538 TB91; 9.03 MW (12,280 hp)
Libya: 4 MTU 20V 538 TB91; 11.29 MW (15,360 hp)
Malaysia: 4 MTU MB 870; 10.3 MW (14,000 hp)
Shafts: 4

FURTHER INFORMATION

PROGRAMME

The 'La Combattante II' class (the La Combattante I was an experimental design) was derived from the Lürssen TNC 42 design, but for political reasons they were built by CMN in France.

The Greek vessels ('Anninos' class) were ordered in 1969 from CMN and were commissioned between 1971 and 1972. They were the platforms for the first Exocet order.

The Iranian vessels ('Kaman' class) were ordered in 1974 and the first nine were commissioned between 1977 and 1978. Delivery of the remainder was delayed by the outbreak of the Iranian Revolution but they were eventually delivered in 1981 and commissioned the same year. In addition to the vessels mentioned above, Iran received the *Joshan* and *Peykan* which were sunk in action with Iraqi and US forces.

The Libyan 'La Combattante IIG' vessels ('Sharaba' class) were ordered in 1977 and completed between 1982 and 1983. They have steel hulls and alloy superstructures. Another ship, *Waheed*, was sunk by US forces in 1986.

The Malaysian vessels ('Perdana' class) were ordered in 1970 and delivered in 1973. In addition to the armament they have six 103 mm rails for rocket illuminants on the SAK 57 turret.

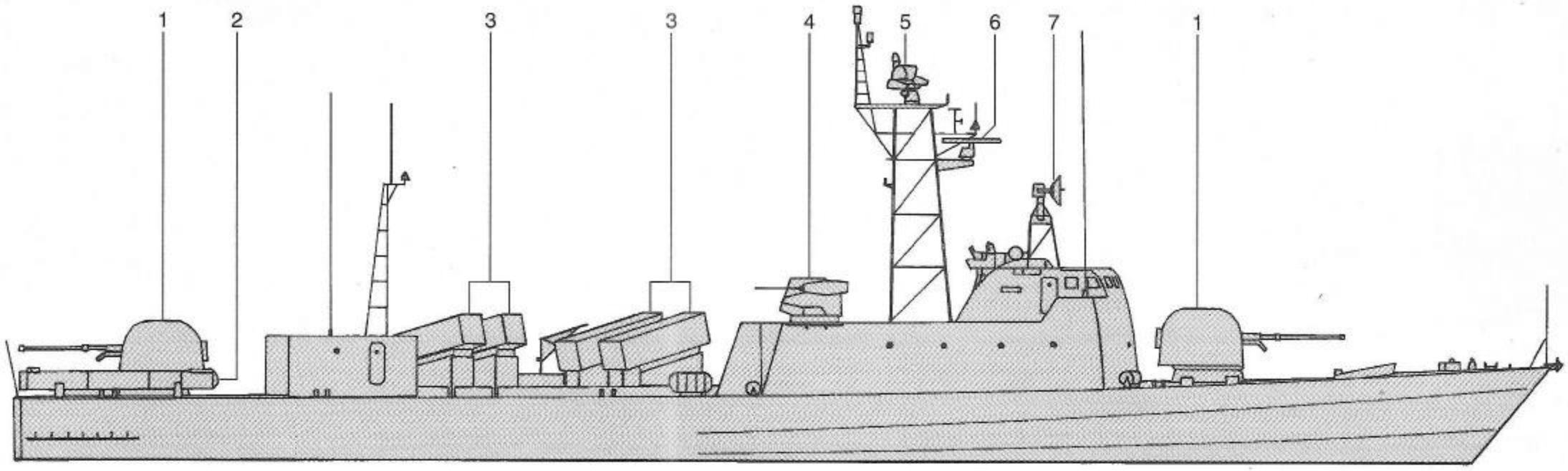
The 'Tiger' class (actually 'La Combattante IIA but designated Type 148 by the German Navy) was ordered in 1970 and built by CMN, although many were outfitted by Lürssen, and they were commissioned between 1972 and 1975. Four were transferred to Greece in 1993 and 1994.

DESIGN

They have steel hulls and aluminium superstructures. They generally have about 115 m² of living space and have a fuel capacity of up to 42.5 tonnes although the Greek, Malaysian and 'Tiger' class carry 39 tonnes while Iranian vessels carry 41 tonnes.

German 'Tiger' class, armed with OTOBREDA 76 mm/62 gun, Bofors 40 mm/70 aft and four MM 38 Exocet (H & L van Ginderen Collection)

LA COMBATTANTE III



Antipliarhos Laskos *(P 20) (Greece)* (Ian Sturton)
1 *OTOBREDA 76 mm/62 Compact automatic gun* **2** *533 mm (21 in) torpedo tubes (two)* **3** *Aerospatiale MM 38 Exocet anti-ship missiles (four)* **4** *Esco (formerly Emerlec) twin 30 mm cannon (two twin mounts)* **5** *Thomson-CSF Tritor surface search radar* **6** *Racal Decca 1226C naviation radar* **7** *Thomson-CSF Castor II fire control*

GENERAL SPECIFICATIONS

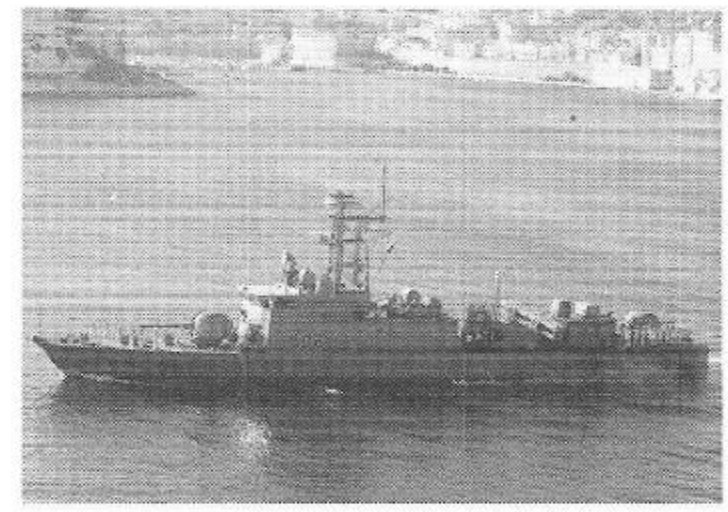
Operators: Greece, Nigeria, Qatar, Tunisia
Type: FAC, Missile

Class: LA COMBATTANTE III

Built: 19
Active: 18

TABLE I: PARTICULARS

Country	Greece		Qatar	Tunisia	Nigeria
Class	**P20-P23**	**P24-P29**	**'Damsah'**	**'La Galité'**	**'Ayam'**
Displacement					
standard	329 t	359 t	345 t	345 t	385 t
full load	429 t	425 t	395 t	425 t	430 t
Length	56.2 m (184 ft)	56.2 m (184 ft)	56.0 m (183.7 ft)	56.0 m (183.7 ft)	56.2 m (184 ft)
Beam	8 m (26.2 ft)	8 m (26.2 ft)	8.2 m (26.9 ft)	8.2 m (26.9 ft)	7.6 m (24.9 ft)
Draught	2.1 m (7 ft)	2.1 m (7 ft)	2.2 m (7.2 ft)	2.2 m (7.2 ft)	2.1 m (7 ft)
Speed	36 kts	32.5 kts	38.5 kts	38.5 kts	38 kts
Range	700 n miles (1,300 km) at 32 kts; 2,700 n miles (5,000 km) at 15 kts	700 n miles (1,300 km) at 32 kts; 2,700 n miles (5,000 km) at 15 kts	2,000 n miles (3,700 km) at 15 kts;	700 n miles (1,300 km) at 33 kts; 2,800 n miles (5,185 km) at 10 kts	2,000 n miles (3,700 km) at 15 kts;
Complement	42 (5 officers)	42 (5 officers)	41 (6 officers)	35	32 (5 officers)



Tunis *(502), a standard La Combattante III M FAC* (H & L van Ginderen Collection)

SHIPS

Greece ('P 20' class)

ANTIPLIARHOS LASKOS (P 20)
Builder CMN, Cherbourg, France.
Commissioned 20 Apr 1977

PLOTARHIS BLESSAS (P 21)
Builder CMN, Cherbourg, France.
Commissioned 7 Jul 1977

IPOPLIARHOS MIKONIOS (P 22)
Builder CMN, Cherbourg, France.
Commissioned 10 Feb 1978

IPOPLIARHOS TROUPAKIS (P 23)
Builder CMN, Cherbourg, France.
Commissioned 8 Nov 1977

Greece ('P 24' class)

SIMEOFOROS KAVALOUDIS (P 24)
Builder Hellenic Shipyard, Skaramanga, Greece.
Commissioned 14 Jul 1980

ANTIPLIARHOS KOSTAKOS (P 25)
Builder Hellenic Shipyard, Skaramanga, Greece.
Commissioned 9 Sep 1980

IPOPLIARHOS DEGIANNIS (P 26)
Builder Hellenic Shipyard, Skaramanga, Greece.
Commissioned Dec 1980

SIMEOFOROS XENOS (P 27)
Builder Hellenic Shipyard, Skaramanga, Greece.
Commissioned 31 Mar 1981

SIMEOFOROS SIMITZOPOULIS (P 28)
Builder Hellenic Shipyard, Skaramanga, Greece.
Commissioned Jun 1981

SIMEOFOROS STARAKIS (P 29)
Builder Hellenic Shipyard, Skaramanga, Greece.
Commissioned 12 Oct 1981

Nigeria

AYAM (P 182)
Builder CMN, Cherbourg, France.
Commissioned 11 Jun 1981

EKUN (P 183)
Builder CMN, Cherbourg, France.
Commissioned 18 Sep 1981

Qatar
DAMSAH (P Q 01)
Builder CMN, Cherbourg, France.
Commissioned 10 Nov 1982

AL GHARIYAH (P Q 02)
Builder CMN, Cherbourg, France.
Commissioned 10 Feb 1983

RBIGAH (P Q 03)
Builder CMN, Cherbourg, France.
Commissioned 11 May 1983

Tunisia
LA GALITE (501)
Builder CMN, Cherbourg, France.
Commissioned 27 Feb 1985

TUNIS (502)
Builder CMN, Cherbourg, France.
Commissioned 27 Mar 1985

CARTHAGE (503)
Builder CMN, Cherbourg, France.
Commissioned 28 Apr 1985

WEAPONS SYSTEMS

TABLE II: WEAPON FITS

	Greece		Nigeria	Qatar	Tunisia
	P 20-P 23	**P 24-P 29**	**'Ayam'**	**'Damsah'**	**'La Galité'**
Missiles, anti-ship	4 × MM 38 Exocet	6 × NFT Penguin Mk 2	4 × MM 38 Exocet	8 × MM 40 Block I Exocet	8 × MM 40 Block II Exocet
Guns					
main	OTOBREDA 76 mm/62 (2 × 1)	OTOBREDA 76 mm/62 (2 × 1)	OTOBREDA 76 mm/62 (1 × 1)	OTOBREDA 76 mm/62 (1 × 1)	OTOBREDA 76 mm/62 (1 × 1)
secondary	Esco 30 mm twin (2 × 2)	Esco 30 mm twin (2 × 2)	OTOBREDA 40 mm/70 twin (1 × 2) Esco 30 mm twin (2 × 2)	OTOBREDA 40 mm/70 twin (1 × 2) RO/Oerlikon GCM-A01 30 mm/75 (twin) (2 × 2)	OTOBREDA 40 mm/70 twin (1 × 2) RO/Oerlikon GCM-A03-2 30 mm/75 twin (2 × 2)
Torpedoes	2 × 533 mm (21 in) tubes (2 × 1)	2 × 533 mm (21 in) tubes (2 × 1)	–	–	–

SURFACE-TO-SURFACE MISSILES (SSM)

Twin or quad launchers for surface-to-surface missile launchers are between the forward and aft superstructures, with the forward launchers pointing to port and the after ones pointing to starboard. The Greek *Antipliarhos Laskos, Ipopliarhos Mikonios, Ipopliarhos Troupakis* and *Plotarhis Blessas,* as well as Nigerian vessels have two twin launchers for Exocet MM 38 while Qatari and Tunisian vessels have two quad launchers for Exocet MM 40 (the Tunisian vessels having MM 40 Block 2). The remaining Greek vessels have six launchers for the Penguin Mk 2 anti-ship missile with three launchers, pointing to port and three to starboard.

Exocet MM 38

Specifications
Length: 5.21 m (17.08 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 22.5 n miles (42 km)
Warhead: 165 kg (365 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles.

Exocet MM 40 Block 1

Specifications
Length: 5.78 m (18.95 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.13 m (3.7 ft)
Weight: 855 kg (1,885 lb)
Speed: Mach 0.9
Range: 38 n miles (70 km)
Warhead: 155 kg (340 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles.

Exocet MM 40 Block 2

Specifications
Length: 5.80 m (19.02 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.13 m (3.7 ft)
Weight: 870 kg (1,918 lb)
Speed: Mach 0.9
Range: 40.5 n miles (75 km)
Warhead: 155 kg (340 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles.

Penguin Mk 2

Specifications
Length: 3.0 m (9.84 ft)
Diameter: 28 cm (11.02 in)
Wing span: 1.4 m (4.65 ft)
Weight: 340 kg (750 lb)
Speed: Mach 0.8
Range: 14 n miles (27 km)
Warhead: 120 kg (264.6 lb)
Guidance: Inertial navigation with infra-red homing

Manufacturer/Contractor
NFT, Norway.

TUBES

The Greek ships have two 533 mm (21 in) torpedo tubes with STN Atlas SST-4 torpedoes trained aft on either side of the aft gun mounting.

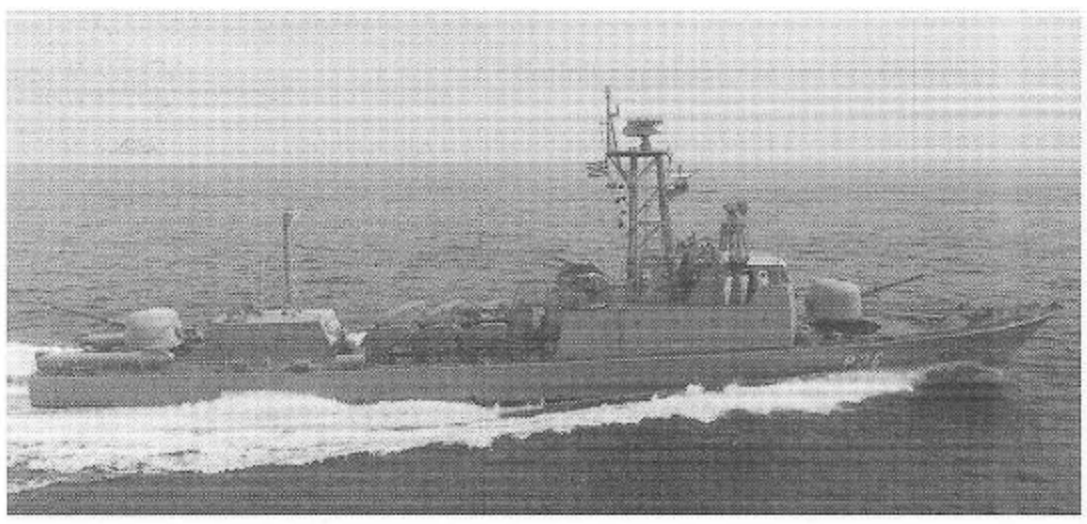
TORPEDOES

SST-4

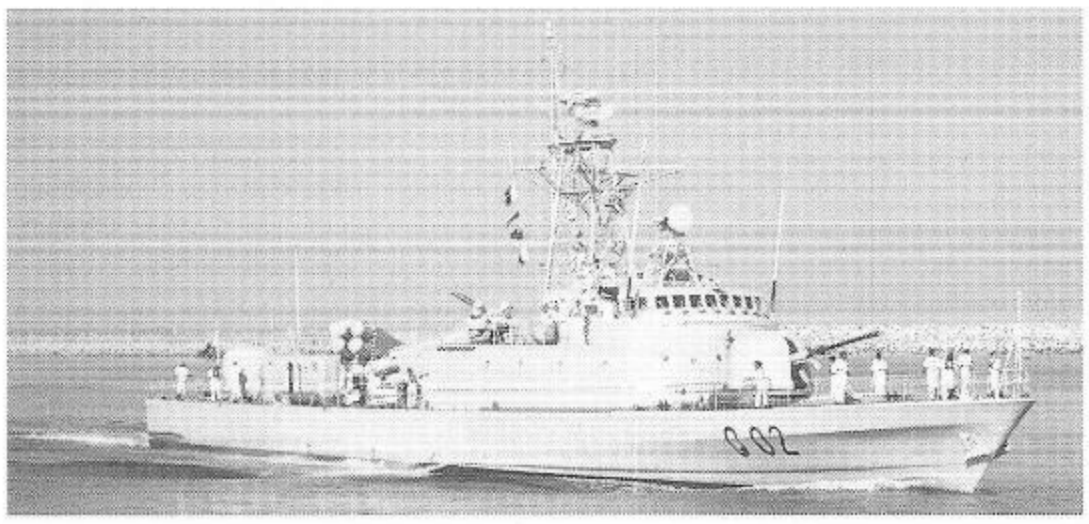
Specifications
Length: 6.55 m (21.5 ft) (with guidance wire dispenser)
Diameter: 533 mm (21 in)
Weight: 1,420 kg (3,131 lb) (without dispenser)
Propulsion: Electric
Speed: 35 kts
Range: 15 n miles (28 km)
Warhead: 260 kg (573 lb)
Guidance: Wire and active/passive sonar

GUNS

The Greek ships have two OTOBREDA 76/62 Compact mountings and two twin Esco (formerly Emerlec) 30 mountings at the rear of the superstructure. Nigerian ships have a single 76/62 Compact forward of the bridge, two Esco 30 mountings at the rear of the superstructure and an OTOBREDA twin 40 mm Compact at the stern. Qatari and Tunisian vessels have a single 76/62 forward of the bridge, an OTOBREDA twin 40 mm Compact at the stern and two Royal Ordnance twin 30 mm GCM-AO1 (Qatar) or GCM-AO3-2 (Tunisia) in the superstructure.



Ipoploiarhos Degiannis *(P 26), one of the Greek ships armed with six Norwegian-designed Penguin Mk 2 anti-ship missiles. The Greek ships also have two 76 mm guns and two 533 mm torpedo tubes* (Hellenic Navy)



Al Ghariyah *(Q 02), one of three La Combattante III M FACs operated by Qatar. Armament includes eight MM 40 Exocet missiles, one 76 mm gun, one twin 40 mm, and two twin 30 mm* (H M Steele)

OTOBREDA 76/62 Compact

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Weight: 8.5 t (loaded)
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA.

OTOBREDA twin 40 mm L/70 Compact

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 600 rds/min
Range: 3.25 n miles (12.5 km)

Mounting
Weight: 5.5 t (unloaded)
Traverse: 360°
Elevation: −13 to +85°

Manufacturer/Contractor
OTOBREDA.

Emerlec 30

Specifications
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 600 rds/min/barrel
Range: 3.25 n miles (6 km)

Mounting
Weight: 3.88 t
Traverse: 360°
Elevation: −15 to +80°

Manufacturer/Contractor
Systems and Electronics Inc.

GCM-AO1

Specifications
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 650 rds/min/gun
Range: 1.5 n miles (3 km) and 3,500 m (11,500 ft)

Mounting
Weight: 2.26 t
Traverse: 360°
Elevation: −15 to +85°

Manufacturers/Contractors
Royal Ordnance, UK.
Oerlikon, Switzerland.

GCM-AO3-2

Specifications
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 650 rds/min/gun
Range: 1.5 n miles (3 km) and 3,500 m (11,500 ft)

Mounting
Weight: 2.56 t
Traverse: 360°
Elevation: −13 to +75°

Manufacturers/Contractors
Royal Ordnance, UK.
Oerlikon, Switzerland.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Greece
Not known.

Tunisia
These vessels have an unidentified French ESM system.

Nigeria
The Racal-Thorn RDL-2 system covers the 1-18.5 GHz range and in addition to the automatic pulse analyser it includes a frequency measurement capability.

Qatar
The Racal-Thorn Cutlass uses the same antenna as RDL and provides bearings, CW bearing and frequency measurement over the E/J-band with instantaneous frequency measurement. The associated Cygnus is a narrowband tracking jammer covering the D/J-bands and designed to operate with Cutlass for spot or barrage jamming. With one transmitter and two antennas it can jam two targets simultaneously, the 300 kW jammer being tuned by instantaneous frequency measurement.

ELECTRONIC COUNTERMEASURES (ECM)

Greece
The Greek ships have the Buck-Wegmann Hot Dog (infra-red) and Silver Dog (chaff) decoy launchers. These systems consist of 12 or 24—76 mm grenade launchers which weigh 115 or 220 kg (253 or 485 lb). Each group of three launcher tubes is 196 mm wide, 710 mm long and 420 mm high. The Hot Dog grenade weighs 0.74 kg (1.63 lb) while that for the Silver Dog weighs 0.95 kg (2.1 lb), the chaff of the latter being deployed within 2 s of launching.

Tunisia, Qatar
The CS Défense DAGAIE Mk 2 is a trainable mounting with 10 replaceable containers loaded with a mixture of 3/5 and 8/14 µm IR or I/J-band chaff projectiles produced by Etienne Lacroix Défense.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Thomson-CSF Vega II
Apart from the Greek ships equipped with Penguin, all these vessels have a Thomson-CSF Vega II radar-based weapon control system. This has a mainframe architecture, with CDE mini-computer, as well as radar display, gun and surface-to-surface missile weapon control consoles.

NFT PFCS 2
The Greek Penguin-equipped ships have the Kongsberg PFCS 2 (Penguin Fire-Control System) which is a mainframe architecture system based upon the KS500 mini-computer with a console which has tactical situation, radar and weapon control displays.

Thomson-CSF Tavitac
Tunisian vessels augment their Vega systems with the Thomson-CSF Tavitac tactical data system. This has a federated architecture based upon the CIMSA Sintra 15M125 mini-computer with one display console capable of tracking 16 targets simultaneously.

RADARS

GREECE ('P 20', 'P 24' classes)

	Triton	Castor II	Pollux	1226
Maker	Thomson-CSF	Thomson-CSF	Thomson-CSF	Racal-Decca
Role	Search	Weapon control	Weapon control	Navigation
Band	H	I	I	I
Beam	2, 22°	2.45, 2.3°	n/k	1.2°
Peak power	250 kW	30 kW	200 kW	25 kW
Gain	38 dB	36 dB	30 dB	n/k
Pulsewidth	0.2, 0.5, 0.7 µs	0.5 µs	0.3 µs	0.05, 0.25, 1.0 µs
PRF	—	4,000, 8,000 pps	1,500 pps	1,300 pps
Scan rate	12, 24 rpm	—	—	25 rpm
Typical range	24 n miles (45 km)	13 n miles (25 km)	16 n miles (30 km)	20 n miles (37 km)

NIGERIA, QATAR, TUNISIA

	Triton	Castor II	1226
Maker	Thomson-CSF	Thomson-CSF	Racal-Decca
Role	Search	Weapon control	Navigation
Band	H	I	I
Beam	2, 22°	2.45, 2.3°	1.2°
Peak power	250 kW	30 kW	25 kW
Gain	38 dB	36 dB	n/k
Pulsewidth	0,2, 0.5, 0.7 µs	0.5 µs	0.05, 0.25, 1.0 µs
PRF	—	4,000, 8,000 pps	1,300 pps
Scan rate	12, 24 rpm	—	25 rpm
Typical range	24 n miles (45 km)	13 n miles (25 km)	20 n miles (37 km)

ELECTRO-OPTIC SENSORS

CS Défense Panda director (Greece, Nigeria)

Specification
Weight: 480 kg (1,058 lb)
Elevation: −25 to +65°
Sensors: Optical

CS Défense Lynx director (Qatar)
Weight: 195 kg (430 lb)
Elevation: −15 to +75°
Sensors: Optical

CS Défense Naja (Tunisia)
Weight: 480 kg (1,058 lb)
Elevation: −25 to +65°
Sensors: TV camera, laser rangefinder

PROPULSION

Greece (P 20 — P 23)

Specifications
System: Diesel
Main machinery: 4 MTU MD 20V 538 TB92; 12.54 MW (17,060 hp)
Shafts: 4

Greece (P 24 — P 29)
System: Diesel
Main machinery: 4 MTU MD 20V 538 TB91; 11.29 MW (15,360 hp)
Shafts: 4

Nigeria
System: Diesel
Main machinery: 4 MTU 16V 956 TB92; 13 MW (17,700 hp)
Shafts: 4

Qatar and Tunisia
System: Diesel
Main machinery: 4 MTU 20V 538 TB93; 13.8 MW (18,740 hp)
Shafts: 4

FURTHER INFORMATION

PROGRAMME

La Combattante III is a version of the 'La Combattante II' which was designed in response to customer requests for a larger derivative with better sea-keeping qualities, together with more comprehensive weapon and electronics fits, and which might also be employed as a leader for smaller missile boats.

The Greek Exocet-equipped vessels were ordered from CMN in 1974 and were commissioned in 1977 and 1978. The Penguin-equipped vessels were ordered from Hellenic Shipyards, Skaramanga in 1978 and commissioned in 1980 and 1981. All have three Jeomont Schneider 150 kW generator sets (440 V, 60 Hz, three phase) while the 76 mm gun has 360 rounds and the Emerlec has 3,600 rounds.

The Nigerian 'La Combattante IIB' vessels were ordered in 1977 but financial problems meant they were not delivered until 1982. A third vessel, *Siri,* has been cannibalised.

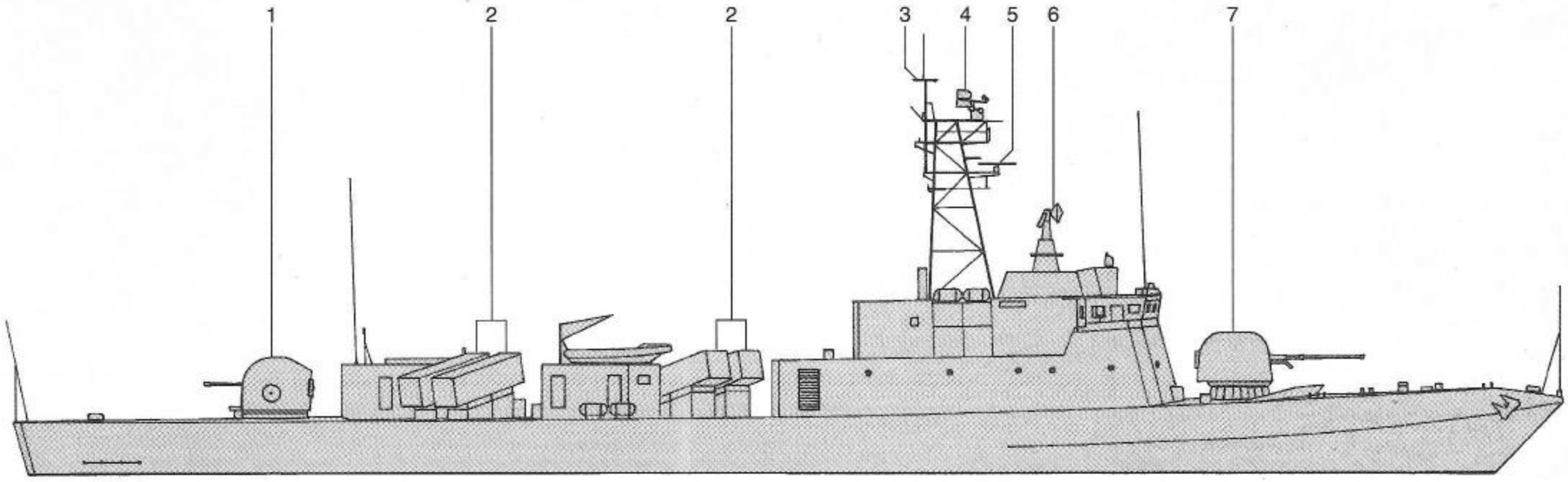
Qatari 'La Combattante IIIM' vessels were ordered in 1980 and commissioned between 1982 and 1983.

The Tunisian vessels were ordered in 1981 and were commissioned in 1985. They have a 405 kVA electricity generation system and a CS Défense Sylosat navigation system.

DESIGN

These vessels have round-bilge hull forms with some 125 m² of living space and carry between 50 and 70 tons of fuel.

VELARDE (PR-72)



Velarde (Ian Sturton)
1 *OTOBREDA twin 40 mm/70 automatic cannon* **2** *Aerospatiale MM 38 Exocet (four)* **3** *Thomson-CSF DR 2000 ESM* **4** *Thomson-CSF Triton surface search radar* **5** *Racal-Decca 1226 navigation radar* **6** *Thomson-CSF Castor fire control* **7** *OTOBREDA 76 mm/62 Compact automatic gun*

GENERAL SPECIFICATIONS

Country of origin: France
Operator: Peru ('Velarde' class)
Type: FAC, Missile

Class: VELARDE (PR-72)

Built: 6
Active: 6

Displacement:
standard: 470 t
full load: 560 t

Dimensions
Length: 64 m (210 ft)
Beam: 8.4 m (27.4 ft)
Draught: 2.6 m (5.2 ft)

Speed: 37 kts
Range: 2,500 n miles at 16 kts

Complement: 36

SHIPS

VELARDE (CM 21)
Builder SFCN, Villeneuve-de-Garonne, France.
Launched 16 Sep 1978
Commissioned 25 Jul 1980

SANTILLANA (CM 22)
Builder SFCN, Villeneuve-de-Garonne, France.
Launched 11 Sep 1978
Commissioned 25 Jul 1980

DE LOS HEROS (CM 23)
Builder SFCN, Villeneuve-de-Garonne, France.
Launched 20 May 1979
Commissioned 17 Nov 1980

HERRERA (CM 24)
Builder SFCN, Villeneuve-de-Garonne, France.
Launched 16 Feb 1979
Commissioned 10 Feb 1981

LARREA (CM 25)
Builder SFCN, Villeneuve-de-Garonne, France.
Launched 12 May 1979
Commissioned 16 Jun 1981

SANCHEZ CARRILLON (CM 26)
Builder SFCN, Villeneuve-de-Garonne, France.
Launched 28 Jun 1979
Commissioned 14 Sep 1981

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Aerospatiale Exocet MM 38

These vessels carry two twin launchers for Exocet MM 38 missiles aft of the superstructure, with the forward pair angled to starboard and the after pair angled to port.

Specifications
Length: 5.21 m (17.08 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 22.5 n miles (42 km)
Warhead: 165 kg (365 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, France.

GUNS

One OTOBREDA 76/62 Compact is on the foredeck, with an OTOBREDA twin 40 mm Compact aft.

OTOBREDA 76/62 Compact

Specifications
Gun
Calibre: 76 mm

Herrera *(CM 24) on builders trials in 1979. These large FACs were built in the late 1970s, part of a worldwide move towards small, fast, missile-armed attack craft* (Thomson-CSF)

Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10/85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA twin 40 mm L/70 Compact

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 600 rds/min
Range: 3.25 n miles (12.5 km)

Mounting
Traverse: 360°
Elevation: −13 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Thomson-CSF DR 2000
There is a Thomson-CSF DR2000 ESM system, an F-band analysis receiver designed to detect pulse and CW signals using six direction-finding antennas in a radome.

DASA Telegon 4
They also have a DASA Telegon 4 high-frequency direction-finding system with egg-shaped ferrite antenna which limits it to intercepting ground waves.

COMMAND AND CONTROL SYSTEM

WEAPONS CONTROL

Thomson-CSF Vega II
These ships have a Thomson-CSF Vega II radar-based weapon control system. This has a mainframe architecture, with CDE mini-computer, as well as radar display, gun and surface-to-surface missile weapon control consoles.

ELECTRO-OPTIC SENSORS

CS Défense Panda director

Specifications
Weight: 480 kg (1,058 lb)
Elevation: −25 to +65°
Sensors: Optical

RADARS

	Triton	Castor II	1226
Maker	Thomson-CSF	Thomson-CSF	Racal-Decca
Role	Search	Weapon control	Navigation
Band	H	I	I
Beam	2, 22°	2.45, 2.3°	1.2°
Peak power	250 kW	30 kW	25 kW
Gain	38 dB	36 dB	n/k
Pulsewidth	0.2, 0.5, 0.7 µs	0.5 µs	0.05, 0.25, 1.0 µs
PRF	n/k	4,000, 8,000 pps	1,300 pps
Scan rate	12, 24 rpm	n/k	25 rpm
Typical range	24 n miles (45 km)	13 n miles (25 km)	20 n miles (37 km)

PROPULSION

Specifications
System: Diesel
Main machinery: 4 SACM AGO 240 V16 M7; 16.32 MW (22,200 hp)
Shafts: 4

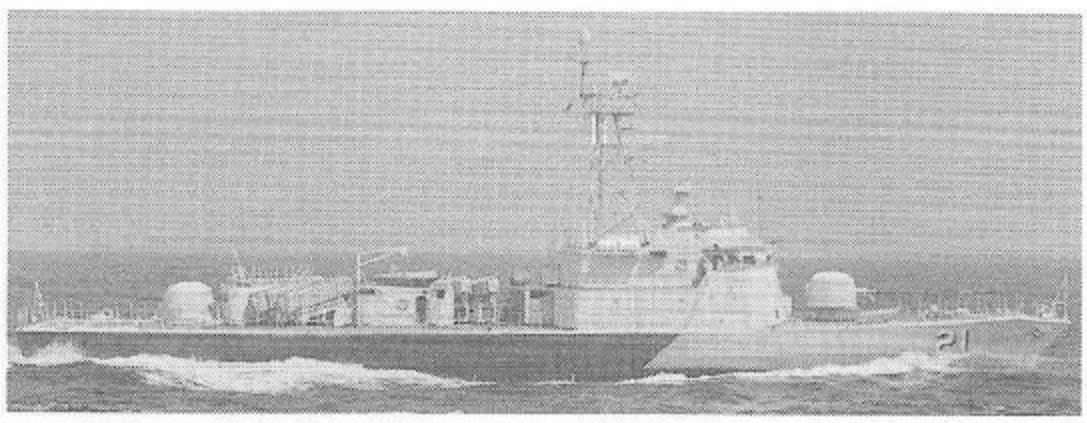
FURTHER INFORMATION

PROGRAMME
These Peruvian ships were ordered in 1976 and built by SFCN, although the hulls of *Velarde, De Los Heros,* and *Larrea* were subcontracted to the Lorient Naval Yard. They were commissioned between 1980 and 1981.

DESIGN
These vessels have round-bilge hulls of steel with aluminium superstructures and carry some 85 tonnes of fuel and have some 235 m² of living space. Their electricity generation systems provide 560 kW.

Patrol boat versions are used by Morocco and Senegal.

These vessels are classified as corvettes by the Peruvian Navy.



Velarde *(CM 21)* (Peruvian Navy)

Herrera *(CM 24) in 1995. Note the curved tip to the bows, designed to enable the gun to fire dead ahead, which is also a feature of many French destroyer and frigate designs* (Peruvian Navy)

TYPE P48

GENERAL SPECIFICATIONS

Country of Origin: France
Operators: Cameroon, Tunisia ('Bizerte')
Type: FAC, Missile

Class: TYPE P48

Built: 4
Active: 4

TABLE I: PARTICULARS

	Cameroon 'Bakassi' class	Tunisia 'Bizerte' class
Displacement full load	308 t	250 t
Dimensions		
length	52.6 m (172.5 ft)	48 m (157.5 ft)
beam	7.2 m (23.6 ft)	7.1 m (23.3 ft)
draught	2.4 m (7.9 ft)	2.3 m (7.5 ft)
Speed	25 kts	20 kts
Range	2,000 n miles at 16 kts	2,000 n miles at 16 kts
Complement	39 (6 officers)	34 (4 officers)

Cameroon vessel, Bakassi *(P 104)* (SFCN)

SHIPS

Cameroon
BAKASSI (P 104)
Builder SFCN, Villeneuve-la-Garonne
Launched 22 Oct 1982
Commissioned 9 Jun 1984

Tunisia
BIZERTE (P 301)
Builder SFCN, Villeneuve-la-Garonne, France.
Commissioned 10 Jul 1970

HORRIA (P302)
Builder SFCN, Villeneuve-la-Garonne, France.
Commissioned Oct 1970

MONASTIR (P 304)
Builder SFCN, Villeneuve-la-Garonne, France.
Commissioned 25 Mar 1976

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

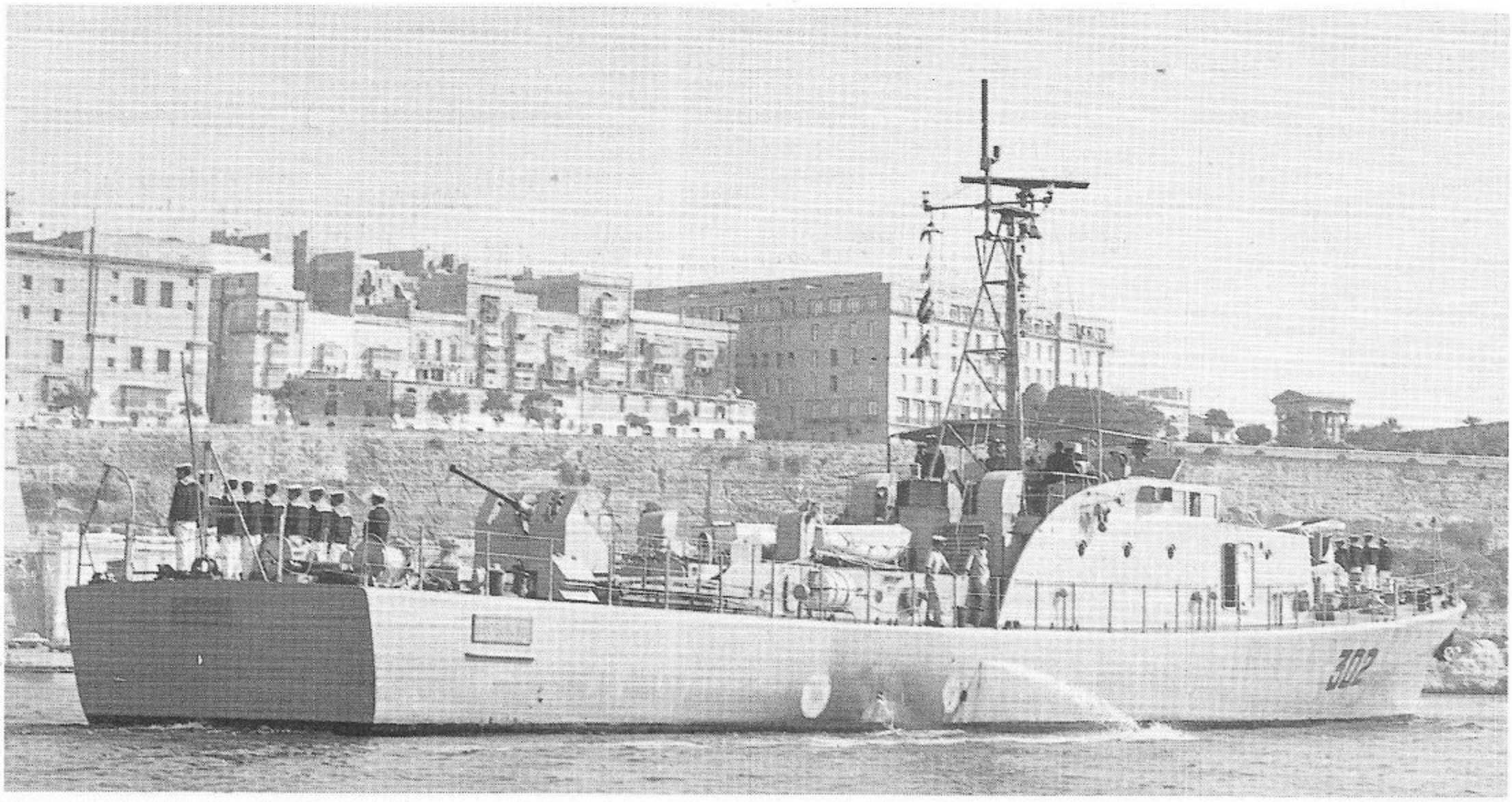
This class carries two quad launchers for anti-ship missiles. The Cameroon vessel has Aerospatiale Exocet MM 40 launchers aft of the superstructure. Tunisian ships carry SS 12M.

Aerospatiale Exocet MM 40 Block 1

Specifications
Length: 5.78 m (18.95 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.13 m (3.7 ft)
Weight: 855 kg (1,885 lb)

Speed: Mach 0.9
Range: 38 n miles (70 km)
Warhead: 155 kg (340 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, Paris, France.



Horria *(P 302) of the Tunisian Navy in 1982, armed with single Bofors 40 mm/70 guns* (H & L van Ginderen Collection)

Aerospatiale SS 12M

Specifications
Length: 1.86 m (6.1 ft)
Diameter: 21 cm (8.26 in)
Wing span: 65 cm (25.6 in)
Weight: 76 kg (167.5 lb)
Speed: Mach 0.6
Range: 3 n miles (5.5 km)
Warhead: 28.38 kg (62.5 lb)
Guidance: Wire command to line of sight

Manufacturer/Contractor
Aerospatiale Missiles, Paris, France.

GUNS

The Cameroon ship has two single Bofors 40 mm L/70, while the Tunisian ships have two twin 37 mm mountings, fore and aft of the superstructure.

Bofors 40 mm L/70

Specifications
40 mm L/70
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 300 rds/min
Range: 6.75 n miles (12.5 km)

Mounting
Traverse: 360°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Twin 37 mm/63

The Tunisian ships have exhanged their Bofors 40 mm for twin 37 mm mounts, which are almost certainly of Chinese origin as these are used in several other Tunisian naval vessels.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

There is a Thomson-CSF DR 2000S ESM system. This is an F-band analysis receiver designed to detect pulse and CW signals using six direction-finding antennas in a radome.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

This class has a CS Défense RADOP 30 weapon control system. This includes a Racal Defence Systems CANE, a mainframe tactical data handling system which uses a navigation radar display and automatic plotting table. This is integrated with the Naja electro-optical director.

RADARS

Racal-Decca Type 1226 (2)

Specifications
Maker: Racal-Decca
Role: Surface search
Band: I
Beam: 1.2°
Peak power: 25 kW
Pulsewidth: 0.05, 0.25, 1.0 µs
PRF: 1,300 pps
Scan rate: 25 rpm
Typical range: 20 n miles (37 km)

Note
Cameroon ships have two Racal-Decca 1226 while Tunisian vessels have one (French Navy designation DRBN 32).

ELECTRO-OPTIC SENSORS

CS Défense Naja (Cameroon)

Specifications
Weight: 480 kg (1,058 lb)
Elevation: −25 to +65°
Sensors: TV camera, laser rangefinder

PROPULSION

Cameroon

Specifications
System: Diesel
Main machinery: 2 SACM 195 V16 CZSHR; 5.88 MW (8,000 hp)
Shafts: 2

Tunisia

Specifications
System: Diesel
Main machinery: 2 MTU 16V 652 TB81; 3.4 MW (4,600 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

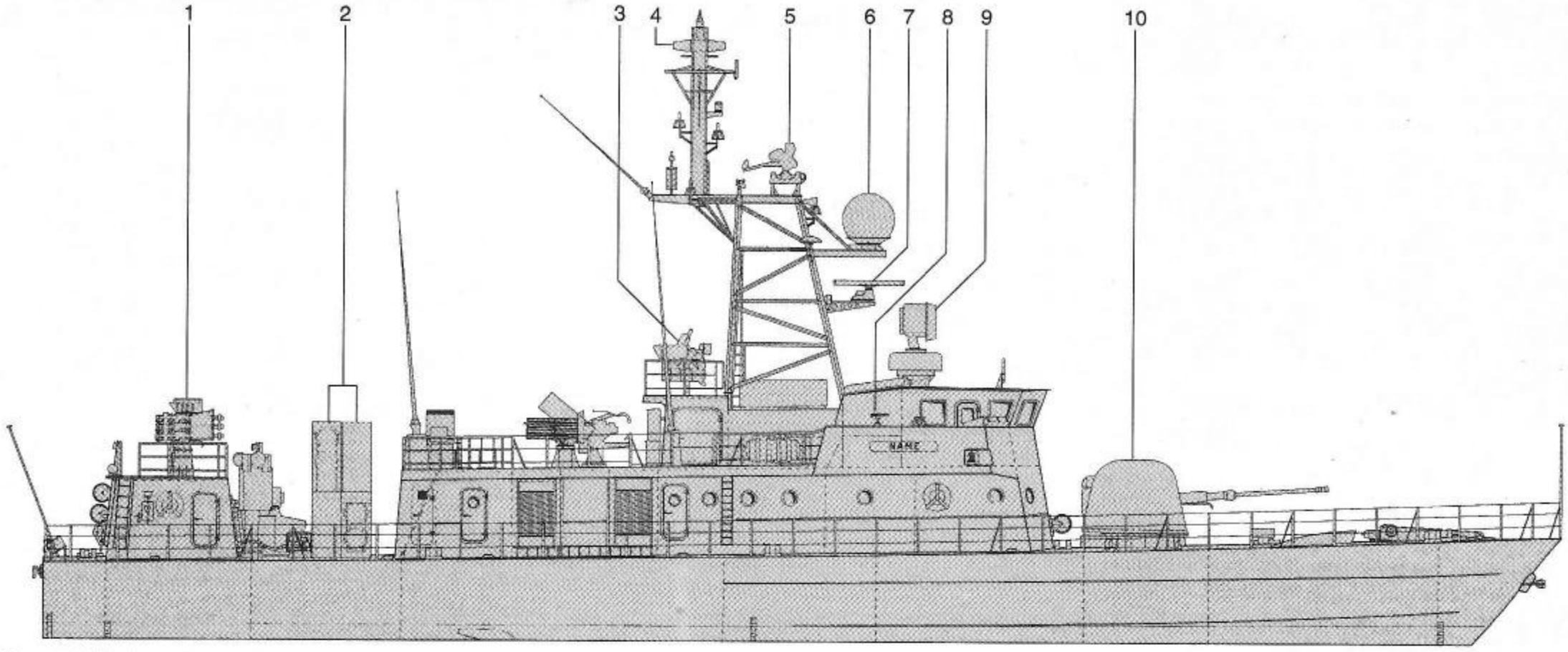
The Cameroon vessel was ordered in January 1981, launched 22 months later and commissioned in January 1984. It has a 280 kW electricity generation system. The radars have since been updated with a Decca RM1230 replaced by a second TM1229C.

The Tunisian vessels *Bizerte* and *Horria* were ordered in 1968 and commisisoned in 1970. The *Monastir* was ordered in 1973 and commissioned in 1975. In 1994 the W-11-M mountings replaced Bofors 40 mm L/70.

DESIGN

This design was produced by SFCN of Villeneuve-La-Garonne with steel hulls and an aluminium superstructure. There is some 290 m² of living space and they carry 116 tonnes of fuel.

LÜRSSEN FPB 44



Lürssen FBP 44 (Fr Lürssen)
1 *Aerospatiale MM 40 Exocet anti-ship missiles (four)* **2** *Matra Sadral launcher for Mistral SAM (six rounds)* **3** *CS Defense Najir electro-optic director (for SAM)* **4** *Racal-Thorn Cutlass E ESM* **5** *CelsiusTech Sea Giraffe 50HC search radar* **6** *Racal-Thorn Cygnus jammer* **7** *Racal-Decca 1226 navigation radar* **8** *MG3 7.62 mm light machine gun (two)* **9** *CelsiusTech 9GR 600 fire-control radar (gun)* **10** *OTOBREDA 76 mm/62-C Mod 6 automatic gun*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: UAE ('Mubarraz' class)
Type: FAC, Missile

Class: LÜRSSEN FPB 44

Built: 2
Active: 2

Displacement:
standard: 275.6 t
full load: 307.2 t

Dimensions
Length: 43.75 m (143.53 ft)
Beam: 7.20 m (23.62 ft)
Draught: 2.68 m (8.79 ft)

Speed: 32.5 kts
Range: 500 n miles (925 km) at 38 kts; 2,200 n miles (4,033 km) at 15 kts

Complement: 29 (5 officers)

SHIPS

MUBARRAZ (P 4401)
Builder Lürssen, Vegesack, Bremen, Germany
Commissioned Aug 1990

MAKASIB (P 4402)
Builder Lürssen, Vegesack, Bremen, Germany
Commissioned Aug 1990

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 40 Block 1

These FACs have four launchers in crossover configuration aft of the superstructure for Aerospatiale Exocet MM 40 anti-ship missiles. The forward pair of launchers point to port and the after pair point to starboard.

Specifications
Length: 5.78 m (18.95 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.13 m (3.7 ft)
Weight: 855 kg (1,885 lb)
Speed: Mach 0.9
Range: 38 n miles (70 km)
Warhead: 155 kg (340 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, Paris, France.

SURFACE-TO-AIR MISSILES (SAM)

Mistral

There is a six-round Sadral launcher for Matra Mistral point defence missiles mounted on the stern deckhouse. This is also the magazine and contains three complete reloads, for a total of 24 missiles.

Specifications
Length: 1.81 m (5.9 ft)
Diameter: 9.2 cm (3.6 in)
Wing span: 11.1 cm (4.4 in)
Weight: 18.4 kg (40.5 lb)
Speed: Mach 2.6
Range: 2.7 n miles (5 km)
Warhead: 2.95 kg (6.5 lb)
Guidance: Infra-red passive homing

Manufacturer/Contractor
Matra BAe Dynamics.

GUNS

OTOBREDA 76/62-C Mod 6 Super Rapid

A single OTOBREDA 76/62 Super Rapid is mounted forward of the bridge, making this one of the smallest vessels to mount a 76 mm gun.

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 120 rds/m
Range: 8.5 n miles (16 km)

Mounting
Weight: 9.5 t (loaded)
Traverse: 360°
Elevation: −15 to +85°
Ammunition: 225 rounds

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

MG3 machine guns

Two MG3 7.62 mm machine guns are mounted in the bridge wings.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-Thorn Cutlass E
Cutlass E provides bearings, CW bearing and frequency measurement over the E/J-band with instantaneous frequency measurement.

ELECTRONIC COUNTERMEASURES (ECM)

Racal-Thorn Cygnus
Cygnus is a narrowband tracking jammer covering the D/J-bands and designed to operate with Cutlass for spot or barrage jamming. With one transmitter and two antennas it can jam two targets simultaneously, the 300 kW jammer being tuned by instantaneous frequency measurement.

DECOYS

CS Défense DAGAIE Mk 2
This is a trainable mounting with 10 replaceable containers loaded with a mixture of IR or I/J-band chaff projectiles produced by Etienne Lacroix Défense.

Manufacturer/Contractor
CS Défense, Paris, France.

COMMAND AND CONTROL SYSTEMS

WEAPON CONTROL

CelsiusTech 9LV 200 Mk 2
The 9LV 200 Mk 2 is a radar-based weapon control system of mainframe architecture using the CelsiusTech P800 mini-computer for the control of the one medium and one light calibre gun mountings as well as the surface-to-surface missiles. There is a tactical display system and two gun control displays, for ASuW and AAW operations.

Manufacturer/Contractor
CelsiusTech, Sweden.

ELECTRO-OPTIC SENSORS

CS Défense Najir director

Specifications
Weight: 560 kg (1,235 lb)
Elevation: −20 to +70°
Sensors: Thermal imager, TV camera, laser rangefinder

Manufacturer/Contractor
CS Defense, Paris, France.

RADARS

	Sea Giraffe 50HC	9GR600	1226
Maker	Ericsson	CelsiusTech	Racal-Decca
Role	Search	Weapon control	Navigation
Frequency	G-band	I-band	I-band
Beam	2.1°	1.1, 7°	1.2°
Peak power	15 kW	200 kW	25 kW
Gain	30 dB	35.5 dB	n/k
Pulsewidth	0.3 µs	0.25, 1 µs	0.05, 0.25, 1.0 µs
PRF	1,000-7,000 pps	1,000, 3,000 pps	1,300 pps
Scan rate	30, 60 rpm	60 rpm	25 rpm
Typical range	54 n miles (100 km)	n/k	20 n miles (37 km)

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 20V 538 TB93; 6.9 MW (9,370 hp)
Shafts: 2
Ships services: 2 152 kVA diesel generator sets

FURTHER INFORMATION

PROGRAMME

These two ships were ordered in 1987 and delivered in 1991.

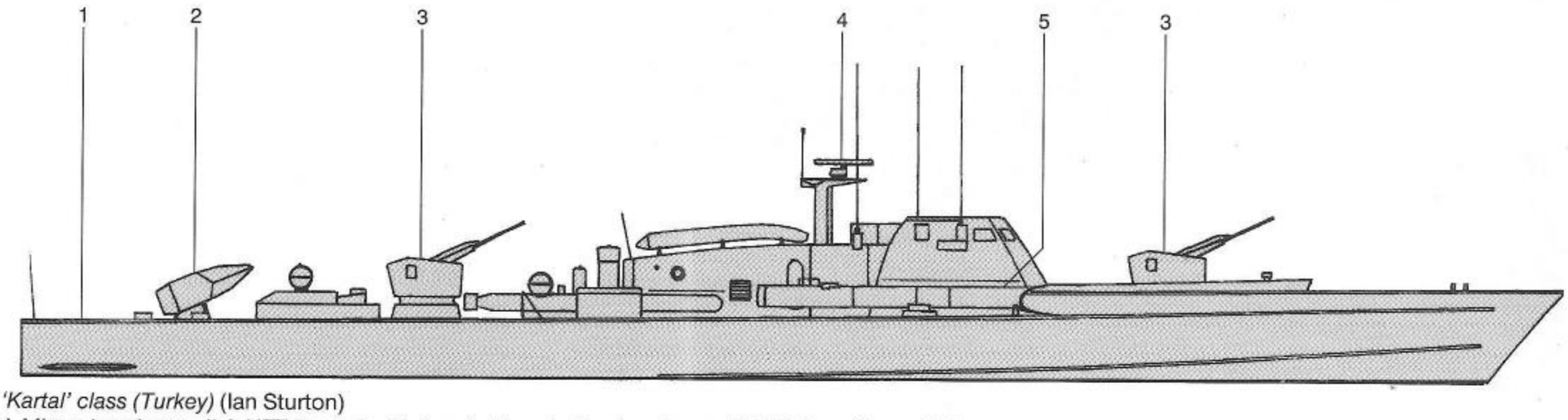
DESIGN

The FPB 44 is actually a modified FPB 38 design, with the usual steel hull and alloy superstructure. It is a larger development of the FPB 38 to allow for a more comprehensive weapon fit. The UAE vessels were the first export platforms for the Sadral/Matra SAM system. The missiles are controlled by a CS Defense Najir electro-optic director sited immediately aft of the mast.

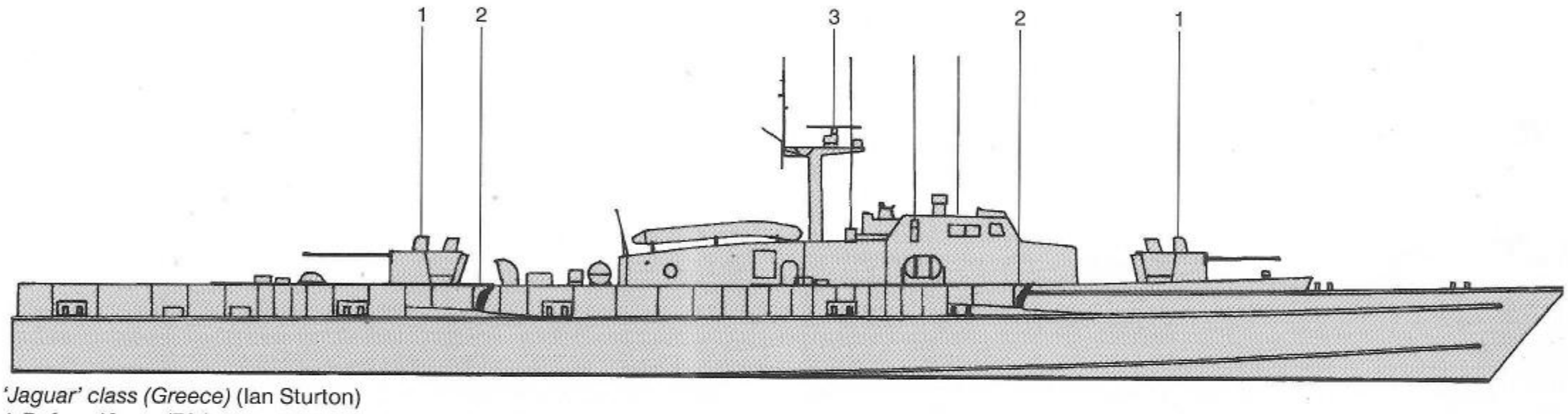
Lürssen FPB 44 is an enlarged version of the FPB 38 design, prepared to meet the operational requirements of the UAE. It is one of the smallest vessels to mount the OTOBREDA 76 mm gun. Note also the Sadral SAM launcher aft (Fr Lürssen)

Mubarraz *(P 4401). The large radome on the mast is for the Cygnus jammer* (H & L van Ginderen Collection)

LÜRSSEN TNC 42 (TYPE 140/141)



'Kartal' class (Turkey) (Ian Sturton)
1 *Mines (maximum 4)* **2** *NFT Penguin Mk 2 anti-ship missiles (maximum 4)* **3** *Bofors 40 mm/70 (gun mount)* **4** *Racal-Decca 1226 navigation radar* **5** *533 mm torpedo tube (two)*



'Jaguar' class (Greece) (Ian Sturton)
1 *Bofors 40 mm/70 in open mounts* **2** *533 mm (21 in) torpedo tube (four)* **3** *Racal-Decca 1226 navigation radar*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operators: Greece ('Jaguar'), Turkey ('Kartal')
Type: FAC, Torpedo (Greece); FAC, Missile (Turkey)

Class: LÜRSSEN TNC 42 (TYPE 140/141)

Built: 30 ('Jaguar'), 9 ('Kartal')
Active: 4 ('Jaguar'), 8 ('Kartal')

Displacement:
standard: 160 t
full load: 190 t

Dimensions
Length: 42.5 m (139.4 ft)
Beam: 7.2 m (23.6 ft)
Draught: 2.4 m (7.9 ft)

Speed: 42 kts
Range: 500 n miles (925 km) at 40 kts, 1,000 n miles (1,850 km) at 32 kts

Complement: 39

SHIPS

'Jaguar' class (Greece)

HESPEROS (P 50)
Builder Lürssen, Vegesack, Germany
Launched 1 Feb 1958
Commissioned (FGN) 29 Aug 1958 (*Seeadler* (P 6068))
Commissioned (Hellenic Navy) 24 Mar 1977

KYKLON (P 53)
Builder Lürssen, Vegesack, Germany
Launched 28 Jan 1958
Commissioned (FGN) 3 Mar 1959 (*Greif* (P 6071))
Commissioned (Hellenic Navy) 12 Dec 1976

LELAPS (P 54)
Builder Lürssen, Vegesack, Germany
Launched 17 May 1958
Commissioned (FGN) 24 Feb 1959 (*Kondor* (P 6070))
Commissioned (Hellenic Navy) 24 Mar 1977

TYFON (P 56)
Builder Lürssen, Vegesack, Germany
Launched 1 Oct 1958
Commissioned (FGN) 3 Jun 1959 (*Geier* (P 6073))
Commissioned (Hellenic Navy) 12 Dec 1976

'Kartal' class (Turkey)

DENIZKUSU (P 321)
Builder Lürssen, Vegesack, Germany
Commissioned 9 Mar 1967

ATMACA (P 322)
Builder Lürssen, Vegesack, Germany
Commissioned 9 Mar 1967

SAHIN (P 323)
Builder Lürssen, Vegesack, Germany
Commissioned 3 Nov 1966

KARTAL (P 324)
Builder Lürssen, Vegesack, Germany
Commissioned 3 Nov 1966

PELIKAN (P 326)
Builder Lürssen, Vegesack, Germany
Commissioned 11 Feb 1970

ALBATROS (P 327)
Builder Lürssen, Vegesack, Germany
Commissioned 18 Mar 1970

SIMSEK (P 328)
Builder Lürssen, Vegesack, Germany
Commissioned 6 Nov 1969

KASIRGA (P 329)
Builder Lürssen, Vegesack, Germany
Commissioned 25 Nov 1967

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Penguin Mk 2

'Kartal' class (Turkey). Turkish vessels have two or four stern launchers for Penguin Mk 2 anti-ship missiles.

Specifications

Length: 3.0 m (9.84 ft)
Diameter: 28 cm (11.02 in)
Wing span: 1.42 m (4.65 ft)
Weight: 340 kg (750 lb)
Speed: Mach 0.8
Range: 14 n miles (27 km)
Warhead: 120 kg (265 lb)
Guidance: Inertial navigation with infra-red homing

Manufacturer/Contractor

NFT, Kongsberg, Norway.

TUBES

Greek vessels carry four 533 mm (21 in) torpedo tubes with STN Atlas SST-4 torpedoes. One pair of tubes is outboard of the bridge while the second pair is either side of the after gun mounting. Turkish vessels have two such torpedo tubes but the torpedoes have not been identified.

TORPEDOES

SST-4

Specifications

Length: 6.55 m (with guidance wire dispenser)
Diameter: 533 mm (21 in)
Weight: 1,420 kg (3,131 lb) (without dispenser)
Propulsion: Electric
Speed: 35 kts
Range: 15 n miles (28 km)
Warhead: 260 kg (573 lb)
Guidance: Wire and active/passive sonar

Manufacturer/Contractor

STN Atlas, Bremen, Germany.

GUNS

There are two single Bofors 40 mm SAK 40 L/70-350 gun mountings forward of the bridge and atop the after end of the superstructure.

SAK 40 L/70-350

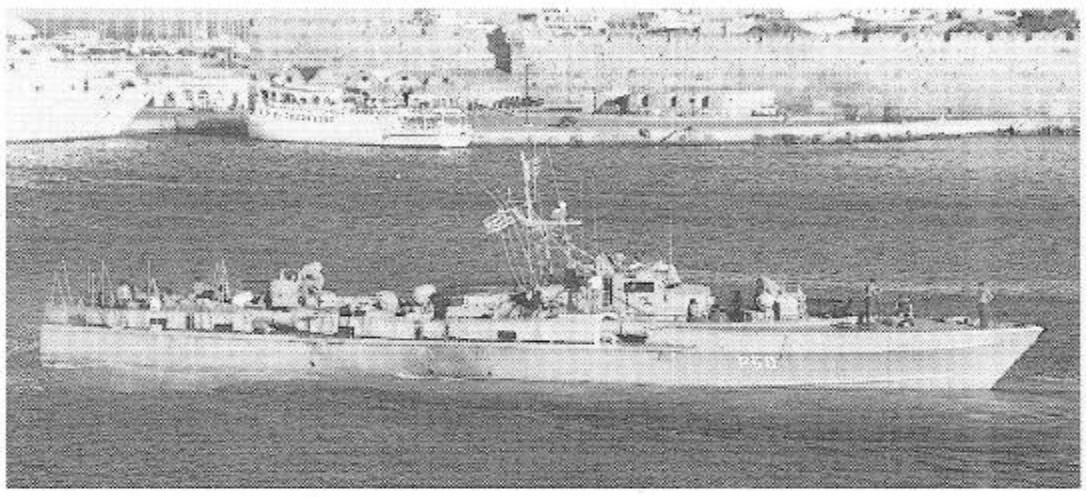
Specifications

Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 300 rds/min
Range: 6.75 n miles (12.5 km)

Mounting
Traverse: 360°
Elevation: −9 to +85°

Manufacturer/Contractor

Bofors Ordnance, Sweden.



Hesperos *(P 50) of the Hellenic Navy served in the Federal German Navy from 1958 to 1977 before being transferred. The Greek vessels are armed with two Bofors 40 mm guns and four 533 mm torpedo tubes* (H & L van Ginderen Collection)

A Turkish 'Kartal' class FAC-missile, armed with two Penguin anti-ship missiles (a maximum of four can be carried) (H M Steele)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

All vessels have a Thomson-CSF DR 2000S ESM system. This is an F-band analysis receiver designed to detect pulse and CW signals using six direction-finding antennas in a radome.

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca 1226

Specifications

Type: 1226
Role: Surface search
Frequency: I Band
Beam: 1.2°
Peak power: 25 kW
Gain: n/k
Pulsewidth: 0.05, 0.25, 1.0 µs
PRF: 1,300 pps
Scan rate: 25 rpm
Typical range: 20 n miles (37 km)

Manufacturer/Contractor

Racal-Decca, UK.

PROPULSION

Specifications

System: Diesel
Main machinery: 4 MTU MD 16V 538 TB 90; 8.82 MW (12,000 hp)
Shafts: 4

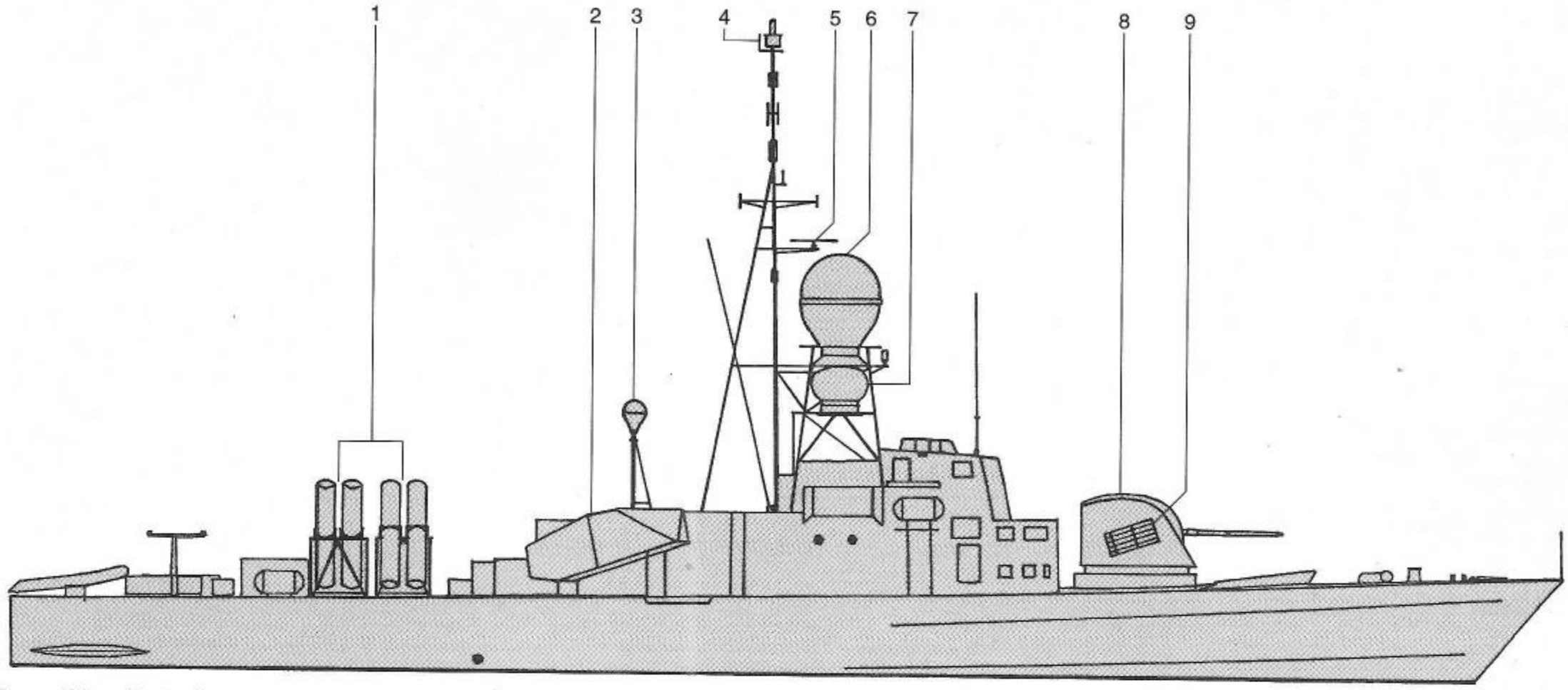
FURTHER INFORMATION

Designed as *Schnellboot* 55 by Lürssen and adopted by the (then) West German Navy as Type 140/141 FACs (later 'Jaguar' class), these vessels with steel frames, wooden hull and aluminium superstructures, were launched from 1957 to 1960. They have a raised turtle deck forecastle with a semi-well for the gun. Their generation systems produce 192 kW of electricity.

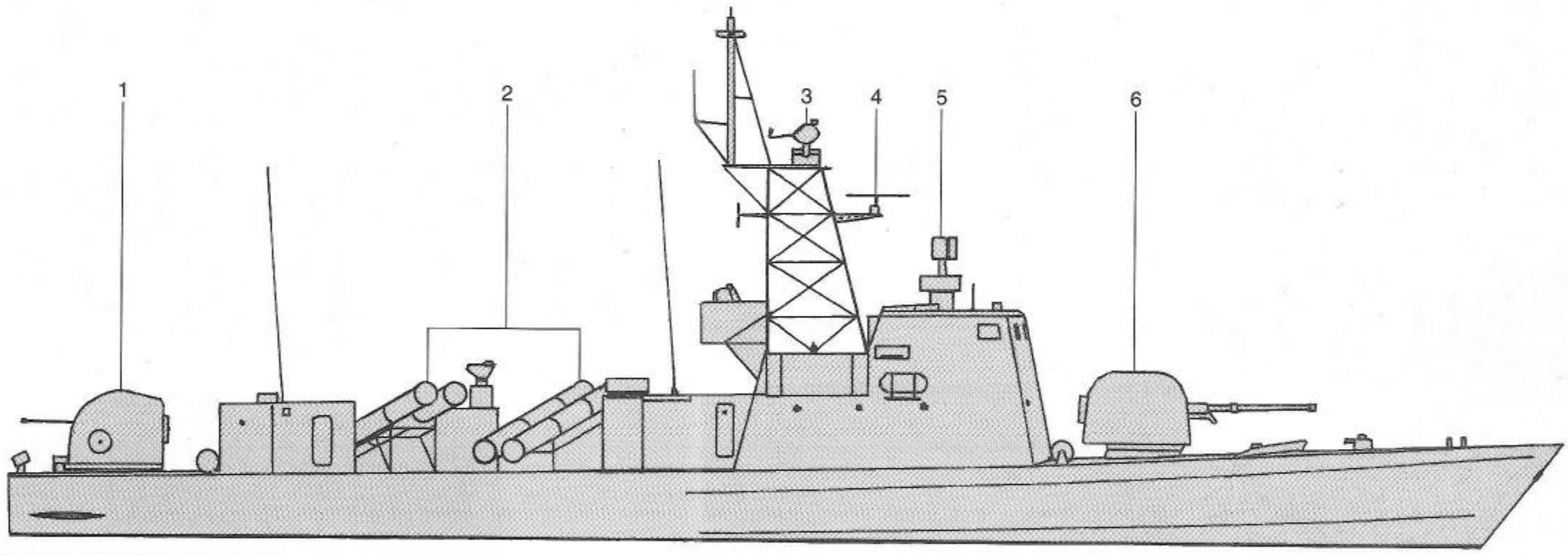
The Greek vessels, all Type 141 with Maybach diesels, were transferred in 1976/1977 and were re-engined circa 1992/1993. The torpedo tubes may be replaced by mine rails and eight (Greece) or four (Turkey) mines may be carried.

The 'Kartal' class is of similar design but was built for Turkey by Lürssen between 1967 and 1971.

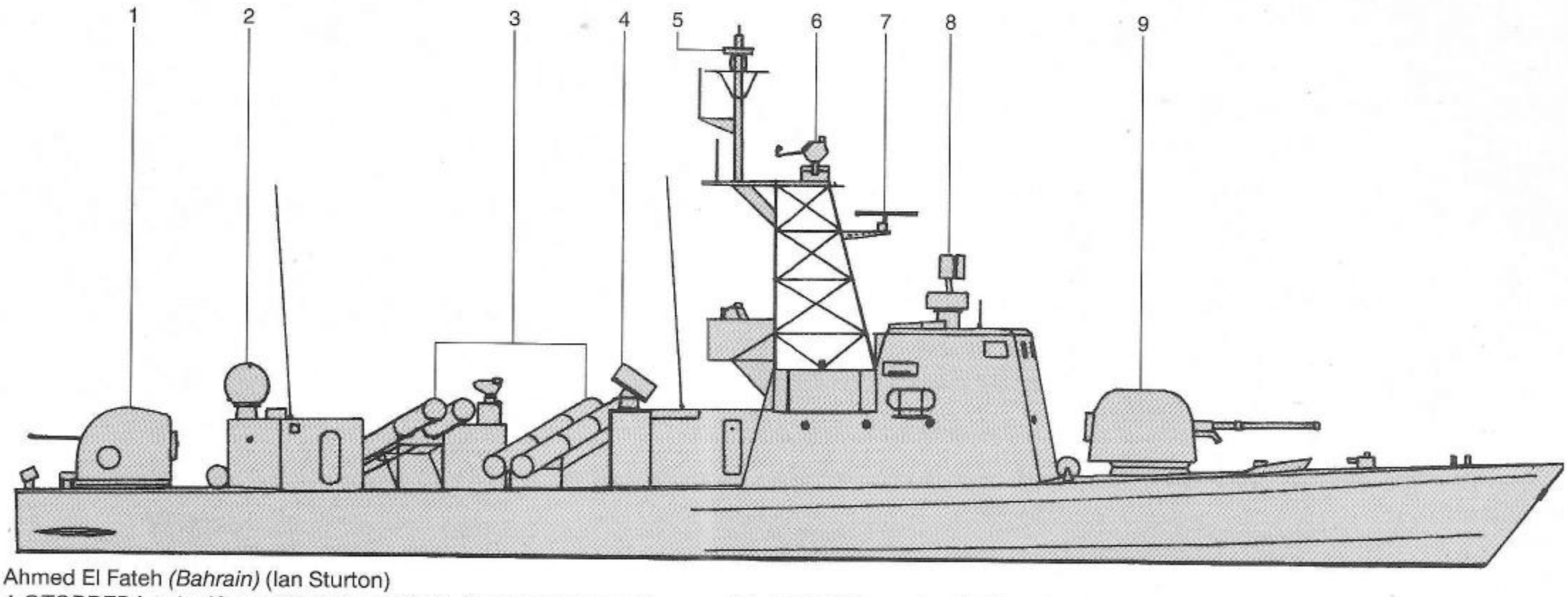
LÜRSSEN TNC 45/FPB 45



Seawolf (Ian Sturton)
1 *McDonnell Douglas Harpoon anti-ship missiles (four)* **2** *IAI Gabriel I anti-ship missiles (four)* **3** *SATNAV* **4** *Alenia RQN-3 ESM array* **5** *Racal-Decca navigation radar* **6** *Signaal WM28 fire-control radar* **7** *TQN-2 (INS-3) jammers* **8** *Bofors 57 mm/70 automatic gun* **9** *103 mm flare launchers*



Ban Yas (UAE) (Ian Sturton)
1 *OTOBREDA twin 40 mm/70* **2** *Aerospatiale MM 40 Exocet anti-ship missiles (four)* **3** *Celsius Tech Sea Giraffe 50HC search radar* **4** *Racal-Decca TM 1226 navigation radar* **5** *Celsius Tech 9LV 200 Mk 2 fire-control radar* **6** *OTOBREDA 76 mm (3 in)/62 automatic gun*



Ahmed El Fateh *(Bahrain)* (Ian Sturton)
1 *OTOBREDA twin 40 mm/70* **2** *Racal-Thorn Cygnus jammer* **3** *Aerospatiale MM 40 Exocet anti-ship missiles (four)* **4** *CS Défense Dagaie trainable chaff/IR decoy launcher* **5** *Racal-Thorn RDL-2 ESM radar warner* **6** *CelsiusTech Sea Giraffe 50HC search radar* **7** *Racal-Decca 1226 navigation radar* **8** *CelsiusTech 9LV 226/231 fire-control radar* **9** *OTOBREDA 76 mm (3 in)/62 automatic gun*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operators: Bahrain ('Ahmad el Fateh' class); Chile ('Iquique Sa'ar 3'); Ecuador ('Quito' class); Kuwait (Al Sanbouk); Singapore ('Sea Wolf'), Thailand ('Prabparapak'), UAE ('Ban Yas')
Type: FAC, Missile

Class: LÜRSSEN TNC 45/FPB 45

Built: 40
Active: 23

TABLE I: PARTICULARS

	Bahrain	Chile	Ecuador	Kuwait	Singapore	Thailand	UAE
Purchased	4	2	4	6	6	3	6
Active	4	2	4	1	6	3	6
Displacement							
standard	228 t	220 t	—	—	226 t	224 t	—
full load	259 t	250 t	255 t	255 t	254 t	268 t	260 t
Length	44.9 m (147.3 ft)	45.0 m (147.6 ft)	45.0 m (147.6 ft)	44.9 m (147.3 ft)	44.9 m (147.3 ft)	44.9 m (147.3 ft)	44.9 m (147.3 ft)
Beam	7.0 m (22.9 ft)	7.0 m (22.9 ft)	7.0 m (22.9 ft)	7.0 m (22.9 ft)	7.0 m (22.9 ft)	7.4 m (24.3 ft)	7.0 m (22.9 ft)
Draught	2.5 m (8.2 ft)	2.5 m (8.2 ft)	2.5 m (8.2 ft)	2.3 m (7.5 ft)	2.3 m (7.5 ft)	2.3 m (7.5 ft)	2.5 m (8.2 ft)
Speed	40 kts	42 kts	40 kts	41 kts	38 kts	40 kts	40 kts
Range	1,600 n miles (2,960 km) at 16 kts	2,500 n miles (4,630 km) at 15 kts 1,600 n miles (2,960 km) at 20 kts; 1,000 n miles (1,850 km) at 30 kts	700 n miles (1,300 km) at 40 kts 1,800 n miles (3,330 km) at 16 kts	1,800 n miles (3,330 km) at 16 kts	950 n miles (1,760 km) at 30 kts 1,800 n miles (3,330 km) at 15 kts	2,000 n miles (3,700 km) at 15 kts 75 n miles (140 km) at 37 kts	500 n miles (925 km) at 38 kts
Complement							
Officers	6	5	35 (total)	35 (total)	7	5	7
Ratings	30	35			33	36	33

SHIPS

'Ahmad el Fateh' class (Bahrain)

AHMAD EL FATEH (20)
Builder Lürssen Werft, Vegesack, Germany
Commissioned 5 Feb 1984

AL JIBIRI (21)
Builder Lürssen Werft, Vegesack, Germany
Commissioned 3 May 1984

ABDUL RAHMAN AL FADEL (22)
Builder Lürssen Werft, Vegesack, Germany
Commissioned 10 Sep 1986

AL TAWEELAH (23)
Builder Lürssen Werft, Vegesack, Germany
Commissioned 25 Mar 1989

'Iquique (Saa'ar 3)' class (Chile)

IQUIQUE (32)
Builder CMN, Cherbourg, France
Commissioned (Israeli Navy) 1969 (Hamit)
Transferred (Chile) Dec 1988
Recommissioned 3 May 1989

COVADONGA (33)
Builder CMN, Cherbourg, France
Commissioned (Israeli Navy) 1969 (Hefz)
Transferred (Chile) Dec 1988
Recommissioned 3 May 1989

'Quito' class (Ecuador)

QUITO (LM 21)
Builder Lürssen Werft, Vegesack, Germany
Commissioned 13 Jul 1976

GUAYAQUIL (LM 22)
Builder Lürssen Werft, Vegesack, Germany
Commissioned 22 Dec 1977

CUENCA (LM 23)
Builder Lürssen Werft, Vegesack, Germany
Commissioned 17 Jul 1977

'Al Sanbouk' class (Kuwait)

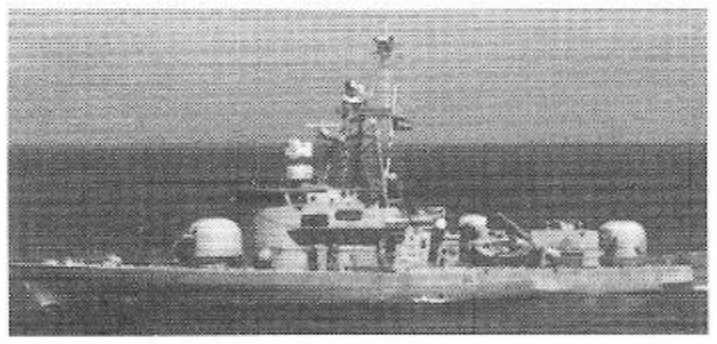
AL SANBOUK (P 4505)
Builder Lürssen Werft, Vegesack, Germany
Commissioned 26 Apr 1984

'Sea Wolf' class (Singapore)

SEA WOLF (P 76)
Builder Lürssen Werft, Vegesack, Germany
Commissioned 1972

SEA LION (P 77)
Builder Lürssen Werft, Vegesack, Germany
Commissioned 1972

SEA DRAGON (P 78)
Builder Singapore SBEC
Commissioned 1974



Al Sanbouk *(P 4505) was the only one of six TNC-45s in the Kuwaiti Navy to survive the Gulf War* (US Navy)

SEA TIGER (P 79)
Builder Singapore SBEC
Commissioned 1974

SEA HAWK (P 80)
Builder Singapore SBEC
Commissioned 1975

SEA SCORPION (P 81)
Builder Singapore SBEC
Commissioned 29 Feb 1976

'Prabparapak' class (Thailand)

PRABPARAPAK (311)
Builder Singapore SBEC
Commissioned 28 Jul 1976

HANHAK SATTRU (312)
Builder Singapore SBEC
Commissioned 6 Nov 1976

SUPHAIRIN (313)
Builder Singapore SBEC
Commissioned 1 Feb 1976

'Ban Yas' class (UAE)

BAN YAS (P 4501)
Builder Lürssen Werft, Vegesack, Germany
Commissioned Nov 1980

MARBAN (P 4502
Builder Lürssen Werft, Vegesack, Germany
Commissioned Nov 1980

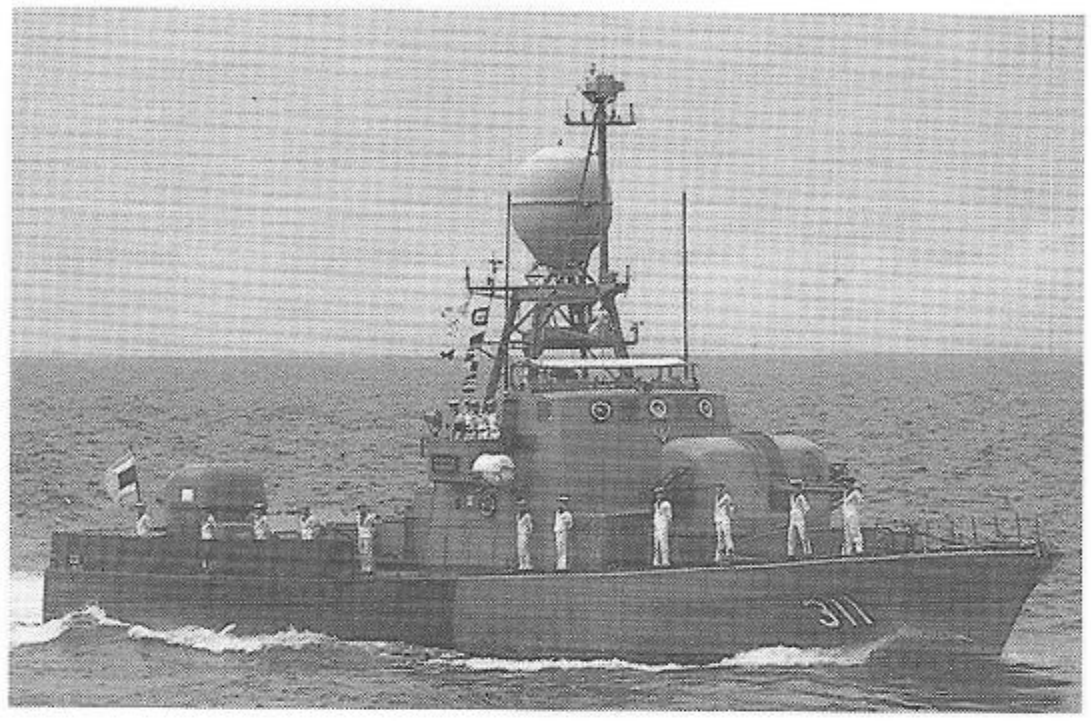
RODOM (P 4503)
Builder Lürssen Werft, Vegesack, Germany
Commissioned Jul 1981

SHAHEEN (P 4504)
Builder Lürssen Werft, Vegesack, Germany
Commissioned Jul 1981

SAGAR (P 4505)
Builder Lürssen Werft, Vegesack, Germany
Commissioned Sep 1981

TARIF (P 4506)
Builder Lürssen Werft, Vegesack, Germany
Commissioned Sep 1981

Iquique *(32) of the Chilean Navy. A Lürssen TNC-45 design, it was built in France and served in the Israeli Navy for some years before being sold to Chile* (Chilean Navy)



Prabparapak *(311) one of three Lürssen TNC-45s built in Singapore for the Royal Thai Navy* (Royal Thai Navy)

WEAPONS SYSTEMS

ANTI-SHIP MISSILES

Most ships have two twin launchers in forward-facing, crossover configuration aft of the superstructure, the forward pair trained to port and the rear pair to starboard. They usually have Exocet MM 40 anti-ship missiles (MM 38 in Ecuador) but the Singapore Navy ships have McDonnell Douglas Harpoon 1C (trained directly starboard and port) while the Thai ships have one triple and two single launchers for the IAI Gabriel 1 (the single launchers are often not embarked). Chilean vessels carry three pairs of Gabriel II missiles on the afterdeck.

TABLE II: ANTI-SHIP MISSILES — SUMMARY

	Exocet MM 8	Exocet MM 40	Harpoon	Gabriel I	Gabriel II
Bahrain		4			
Chile					6
Ecuador	4				
Kuwait		4			
Singapore			4		
Thailand				5	
UAE		4			

Exocet MM 38

Specifications
Length: 5.21 m (17.08 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 22.5 n miles (42 km)
Warhead: 165 kg (365 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, France.

Exocet MM 40 Block 1

Specification
Length: 5.78 m (18.95 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.13 m (3.7 ft)
Weight: 855 kg (1,885 lb)
Speed: Mach 0.9
Range: 38 n miles (70 km)
Warhead: 155 kg (340 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, France.

Harpoon 1C

Specifications
Length: 4.63 m (15.18 ft) (with booster)
Diameter: 34 cm (13.38 in)
Wing span: 83 cm (32.67 in)
Weight: 681.9 kg (with booster)
Speed: Mach 0.85
Range: 67 n miles (124 km)
Warhead: 221.6 kg (500 lb)
Guidance: Inertial navigation and active radar

Manufacturer/Contractor
McDonnell Douglas Missile Systems Company, USA.

Gabriel I

Specifications
Length: 3.35 m (11 ft)
Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)
Weight: 430 kg (950 lb)
Speed: Mach 0.7
Range: 10.75 n miles (20 km)
Warhead: 150 kg (330 lb)
Guidance: Semi-active radar and manual

Manufacturer/Contractor
Israel Aircraft Industries, Tel Aviv, Israel.

Gabriel II

Specifications
Length: 3.42 m (11.2 ft)
Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)
Weight: 522 kg (1,151 lb)
Speed: Mach 0.7
Range: 19 n miles (36 km)
Warhead: 150 kg (330 lb)
Guidance: Semi-active radar and manual

Manufacturer/Contractor
Israel Aircraft Industries, Tel Aviv, Israel.

SURFACE-TO-AIR MISSILES (SAM)

Mistral

The Singapore vessels have a Simbad twin launcher for Matra Mistral point defence missiles.

Specifications
Length: 1.81 m (5.9 ft)
Diameter: 9.2 cm (3.6 in)
Wing span: 11.1 cm (4.4 in)
Weight: 18.4 kg (40.5 lb)
Speed: Mach 2.6
Range: 2.7 n miles (5 km)
Warhead: 2.95 kg (6.5 lb)
Guidance: Infra-red passive homing

Manufacturer/Contractor
Matra BAe Dynamics.

GUNS

There are two gun mountings, one on the foredeck, the other aft, and the operators use a variety of weapons:

TABLE III: GUNS — SUMMARY

	Forward mount	After mount
Bahrein	OTOBREDA 76/62 Compact	OTOBREDA twin 40 mm/L70 Compact
Chile	OTOBREDA 76/62 Compact	None
Ecuador	OTOBREDA 76/62 Compact	Oerlikon-Contraves GDM-A twin 35 mm
Kuwait	OTOBREDA 76/62 Compact	OTOBREDA twin 40 mm/L70 Compact
Singapore	Bofors single 57 mm SAK 57 Mk 1	OTOBREDA twin 40 mm/L70 Compact
Thailand	Bofors single 57 mm SAK 57 Mk 1	OTOBREDA-Bofors 40 mm L/70 at the stern
UAE	OTOBREDA 76/62 Compact	OTOBREDA twin 40 mm/L 70 Compact

OTOBREDA 76/62 Compact

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10/85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Weight: 8.5 t (loaded)
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA.

SAK 57 Mk 1

Specifications
Gun
Calibre: 57 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,020 m/s (3,347 ft/s)
Rate of fire: 200 rds/min
Range: 9 n miles (17 km)

Mounting
Weight: 6.3 t
Traverse: 360°
Elevation: −10 to +75°

Manufacturer/Contractor
Bofors Ordnance.

OTOBREDA twin 40 mm L/70 Compact

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 600 rds/min
Range: 3.25 n miles (12.5 km)

Mounting
Weight: 5.5 t (unloaded)
Traverse: 360°
Elevation: −13 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezi, Italy.

OTOBREDA 40 mm L/70

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 300 rds/min
Range: 6.75 n miles (12.5 km)

Mounting
Traverse: 360°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

GDM-A

Specifications
Gun
Calibre: 35 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,175 m/s (3,855 ft/s)
Rate of fire: 550 rds/min/barrel
Range: 2.7 n miles (5 km)

Mounting
Weight: 6.52 t
Traverse: 360°
Elevation: −15 to +85

Manufacturer/Contractor
Oerlikon-Contraves, Switzerland.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-Thorn RDL 2
'Ahmed el Fateh' (Bahrain), 'Prabparapak' (Thailand). This system covers the 1-18.5 GHz range and in addition to the automatic pulse analyser it includes a frequency measurement capability.

Racal-Thorn Cutlass
'Al Sanbouk' (Kuwait), 'Ban Yas' (UAE). Cutlass uses the same antenna as RDL and provides bearings, CW bearing and frequency measurement over the E/J-band with instantaneous frequency measurement. The system can incorporate a responsive noise jammer as well as providing spot or barrage noise. It may also be integrated with decoy launchers.

Alenia RQN-3B and TDF 205
'Sea Wolf' class (Singapore). The Alenia RQN-3B is a digital interceptor with instantaneous frequency measurement covering the D/J-bands. It is usually associated with the RIN-1 display system and provides automatic control of decoy-launching systems. It is supported by a Tadiron TDF 205 direction-finding system of which no details are available.

Elta MN-53
'Iquique' class (Chile). This is a passive intercept system which measures features including band, PRF and pulsewidth with both manual and automatic direction-finding and analysis.

Racal-Thorn Cygnus
'Ahmed el Fateh' (Bahrain). Cygnus is a narrowband tracking jammer covering the D/J-bands and designed to operate with Cutlass for spot or barrage jamming. With one transmitter and two antennas it can jam two targets simultaneously, the 300 kW jammer being tuned by instantaneous frequency measurement. It is not installed in *Ahmad el Fateh* or *Al Jibiri*.

Rafael Rattler
'Iquique' (Chile). The Rattler jammer can engage three targets covering the E/J-bands simultaneously. It uses a high-powered, broadband amplifier wth low-power exciter. The system is supported by four single-tube decoy launchers and the Elbit Automatic Countermeasures Dispensing System (ACDS) with six 24-tube launchers. These use the Rafael Short-Range Chaff Rocket (SRCR) and the Long-Range Chaff Rocket (LRCR), the launchers weighing 22 (48.5) and 12.5 kg (27.5 lb) respectively. The rockets weigh 3.2 kg (7.0 lb) (SRCR) and 9.4 kg (20.7 lb) (LRCR).

DECOYS

CS Défense DAGAIE Mk 2
'Ahmad el Fateh' (Bahrain), 'Al Sanbouk' (Kuwait), 'Bon Yan (UAE). DAGAIE is a trainable mounting with 10 replaceable containers loaded with a mixture of 3/5 and 8/14 µm IR or I/J-band chaff projectiles produced by Etienne Lacroix Défense.

Loral Hycor Mk 36 Mod 1
Sea Wolf (Singapore). The Mk 36 SRBOC Mod 1 (Super Rapid Bloom Offboard Countermeasures) decoy system has two Mk 137 launchers, each with six barrels. These are 160 × 43 × 86 cm mortar systems which fire a variety of 130 mm chaff and infra-red munitions from cartridges weighing 3.8-22.7 kg (8.4-50 lb) which create chaff clouds up to 2.5 n miles (4.5 km) from the ship. There are also two Rafael twin-tube launchers in the Singapore ships.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

CelsiusTech 9LV 200 Mk 2
'Ahmed al Fateh' (Bahrain), 'Al Sanbouk' (Kuwait), 'Ban Yas' (UAE). The 9LV 200 Mk 2 is a radar-based weapon control system of mainframe architecture using the Philiips P800 mini-computer for the control of one medium and one light calibre gun mounting as well as surface-to-surface missiles. There is a tactical display system and two gun control displays, for ASuW and AAW operations.

Manufacturer/Contractor
Celsius Tech, Sweden.

Thomson-CSF Vega
'Quito' (Ecuador). The Thomson-CSF Vega I radar-based weapon control system has a mainframe architecture, with BCH mini-computer, as well as radar display, gun and surface-to-surface missile weapon control consoles.

Manufacturer/Contractor
Thomson-CSF, Paris, France.

Signaal WM28
'Sea Wolf' (Singapore), 'Prabparapak' (Thailand). The WM28 radar-based weapon control system has a mainframe architecture based upon the SMR mini-computer with a two-man display and control console. It can operate against two targets simultaneously using two guns or surface-to-surface missiles.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

IAI system
'Iquique' (Chile). These vessels have an IAI fire-control system with a one-man display control and processing console which interfaces with Gabriel surface-to-surface missiles and the main gun.

CHILE

	Neptune	Orion
Maker	Thomson-CSF	Alenia
Role	Search	Weapon control
Band	H	I
Beam	2, 22°	n/k
Peak power	250 kW	200 kW
Gain	38 dB	n/k
Pulsewidth	0.2, 0.5, 0.7 µs	1.5 µs
PRF	n/k	450-550 pps
Scan rate	12, 24 rpm	n/k
Typical range	24 n miles (45 km)	n/k

KUWAIT

	TM 1226C	9GR600
Maker	Racal-Decca	CelsiusTech
Role	Search	Weapon control
Band	I	I
Beam	1.2°	1.1, 7°
Peak power	25 kW	200 kW
Gain	n/k	35.5 dB
Pulse rate	0.05, 0.25, 1.0 µs	0.25, 1.0 µs
PRF	1,300 pps	1,000, 3,000 pps
Scan rate	25 rpm	60 rpm
Typical range	20 n miles (37 km)	n/k

SINGAPORE

	TM 626	WM28
Maker	Racal-Decca	Signaal
Role	Search	Weapon control
Band	I	I
Beam	1.2°	1.5, 7, 2.4°
Peak power	25 kW	200 kW
Gain	n/k	33.5 dB
Pulsewidth	0.05, 0.25, 1.0 µs	0.22, 0.45 µs
PRF	1,300 pps	1,800,3,600 pps
Scan rate	25 rpm	60 rpm
Typical range	20 n miles (37 km)	16 n miles (30 km)

RADARS

BAHRAIN, UAE

	Sea Giraffe 50HC	9GR600	1226
Maker	Ericsson	CelsiusTech	Racal-Decca
Role	Search	Weapon control	Navigation
Band	G	I	I
Beam	2.1°	1.1, 7°	1.2°
Peak power	15 kW	200 kW	25 kW
Gain	30 dB	35.5 dB	n/k
Pulsewidth	0.3 µs	0.25, 1 µs	0.05, 0.25, 1.0 µs
PRF	1,000-7,000 pps	1,000, 3,000 pps	1,300 pps
Scan rate	30, 60 rpm	60 rpm	25 rpm
Typical range	54 n miles (100 km)	n/k	20 n miles (37 km)

ECUADOR

	Triton	Pollux	1226
Maker	Thomson-CSF	Thomson-CSF	Racal-Decca
Role	Search	Weapon control	Navigation
Band	H	I	I
Beam	2, 22°	n/k	1.2°
Peak power	250 kW	200 kW	25 kW
Gain	38 dB	30 dB	n/k
Pulsewidth	0.2, 0.5, 0.7 µs	0.3 µs	0.05, 0.25, 1.0 µs
PRF	n/k	1,500 pps	1,300 pps
Scan rate	12, 24 rpm	n/k	25 rpm
Typical range	24 n miles (45 km)	16 n miles (30 km)	20 n miles (37 km)

THAILAND

	Type 17	WM28
Maker	Kelvin Hughes	Signaal
Role	Search	Weapon control
Band	I	I
Beam	1.0, 18, 0.75, 18°	1.5, 7, 2.4°
Peak power	25 kW	200 kW
Gain	31, 34 dB	33.5 dB
Pulsewidth	0.8/0.25, 0.75 µs	0.22, 0.45 µs
PRF	800, 1,600 pps	1,800, 3,600 pps
Scan rate	24 rpm	60 rpm
Typical range	24 n miles (44 km)	16 n miles (30 km)

ELECTRO-OPTIC SENSORS

CS Défense Panda director (Bahrain, UAE)

Specifications
Weight: 480 kg (1,058 lb)
Elevation: −25 to +65°
Sensors: Optical

CS Défense Lynx director (Kuwait)

Weight: 195 kg (430 lb)
Elevation: −15 to +75°
Sensors: Optical

UAE vessels have an electro-optical (TV, thermal imager) package on the radar director.

PROPULSION

Bahrain, Kuwait, Singapore, UAE

Specifications
System: Diesel
Main machinery: 4 MTU 16V 538 TB 92 diesels; 10 MW (13,640 hp)
Shafts: 4

Chile

Specifications
System: Diesel
Main machinery: 4 MTU MD 16V 537 TB80 diesels; 7.35 MW (10,000 hp)
Shafts: 4

Ecuador

Specifications
System: Diesel
Main machinery: 4 MTU 16V 396 diesels; 10 MW (13,640 hp)
Shafts: 4

FURTHER INFORMATION

One of the most widely used FAC designs, these vessels were a larger version of the TNC 42 and have the usual Lürssen export philosophy with steel hulls and aluminium superstructures. In most cases the electricity system generates 405 kW and they carry 250 rounds of 76 mm and 1,800 rounds of 40 mm ammunition.

The Bahraini ships were ordered in 1979 (first pair) and 1985 (second pair) and commissioned in 1984 and 1986/1989 respectively. The vessels carry 45 tonnes of fuel and three 7.62 mm machine guns.

The Ecuador ships were launched in 1975/1976 and commissioned in 1976/1977. These vessels carry 39 tonnes of fuel oil, 250 rounds of 76 mm and 1,100 rounds of 35 mm ammunition. The electricity system generates 330 kW. They originally had MTU 16V 538 diesels but these were replaced in 1994/1995.

The Israeli Navy selected the design as the basis of its FAC force but, for political reasons, they were built by CMN shipyard in France as the 'Sa'ar' class, which differed in armament installation. The Sa'ar 1 had 40 mm guns, the Sa'ar 2 were ASW optimised variants and supplemented the 40 mm gun with sonar and lightweight torpedoes. When Gabriel missiles were fitted to Sa'ar 2, the 'Sa'ar 1' class was upgraded and given the same designation. The Sa'ar 3 added a 76 mm gun and could also carry Harpoon anti-ship missiles as well as Gabriel. Two 'Sa'ar 3' class (commissioned by the Israeli Navy in 1969) were transferred to Chile in May 1989, but with Harpoon removed.

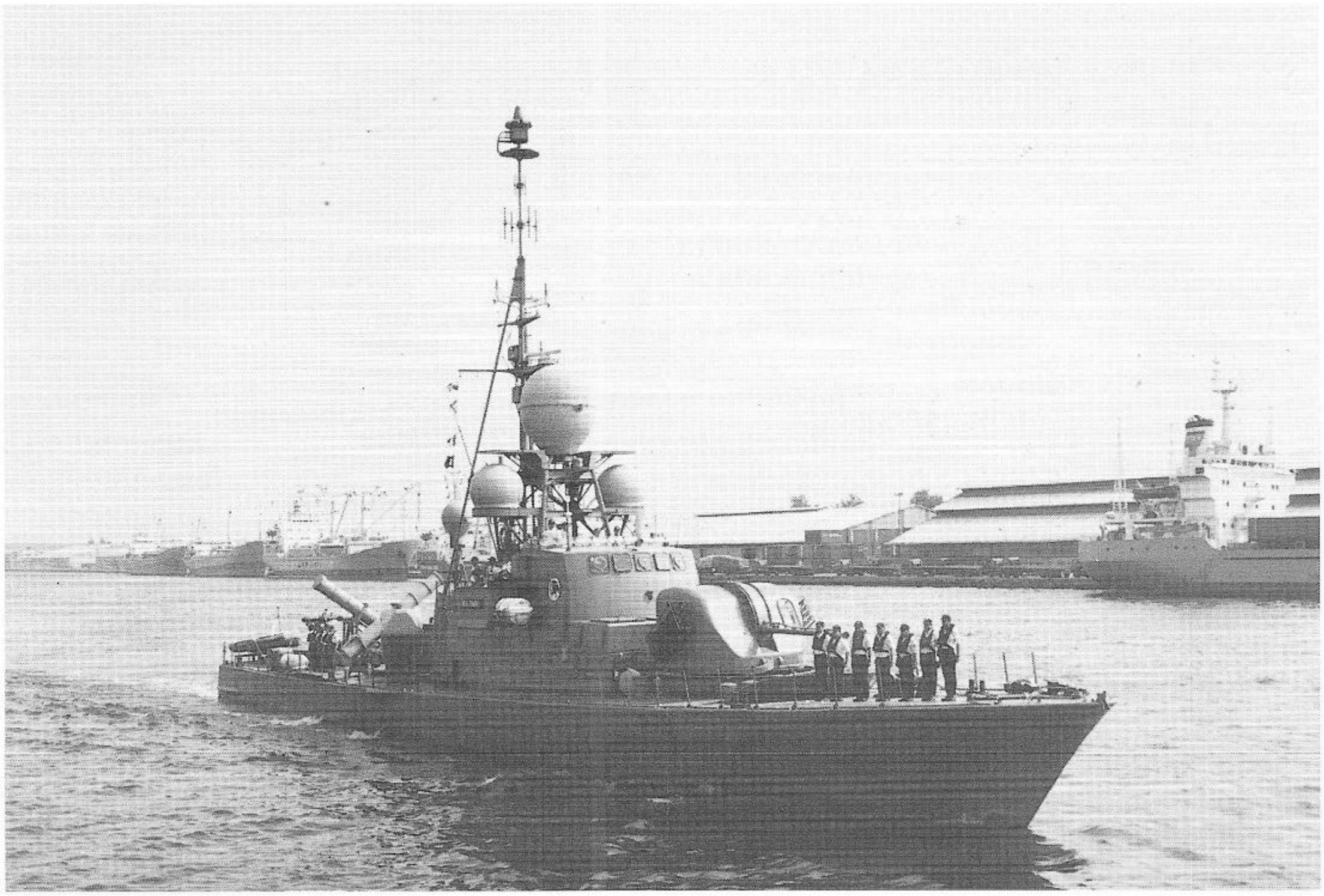
The Kuwaiti vessels were ordered from Lürssen in 1980 and delivered between 1982 and 1984. Also delivered, were *Al Abdali, Al Ahmadi, Al Boom, Al Betteel* and *Al Saadi* but these were captured and pressed into service by Iraq, and subsequently sunk by the Allies during the Gulf War.

Ordered in 1970, the first two Singapore vessels (*Sea Lion, Sea Wolf*) were built by Lürssen and commissioned in 1972 while the remainder were built by Singapore Shipbuilding and Engineering, Jurong, being commissioned between 1974 and 1976. They were the first export platforms for the Gabriel missile system. They were originally armed with the 57 mm gun (504 rounds), three launchers for Gabriel anti-ship missiles and a Bofors 40 mm L/70 gun (1,008 rounds), but from January 1988 they were refitted with Harpoon and Mistral. They also received RQN-3B electronic warfare suite, satellite navigation and GPS equipment, the work requiring some changes to the superstructure. Since 1994 they have been subject to a service life extension programme (SLEP). In addition to the weapons mentioned above, the Singapore ships have eight rails for illuminant rockets on the SAK 57 mounting.

The Thai versions of this design were built by Singapore Shipbuilding and Engineering, based upon the 'Sea Wolf' class. They were commissioned in 1976 and 1977.

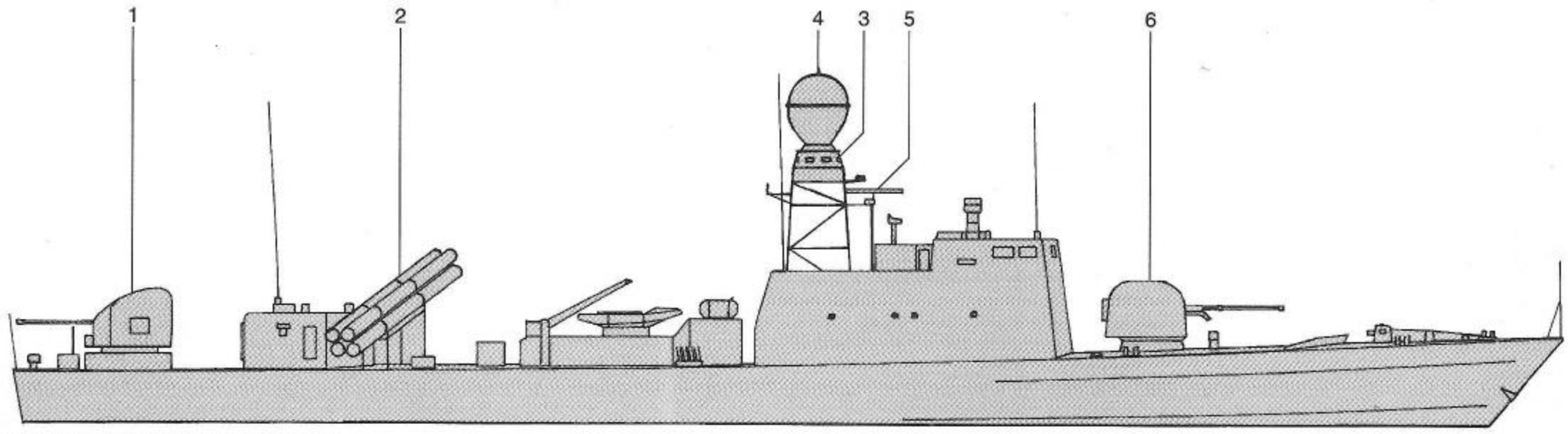
The UAE vessels were ordered from Lürssen in 1977 and commissioned between 1980 and 1981. They were the first to be equipped with Exocet MM 40 and in addition to these weapons and the gun mountings mentioned above, they carry two 7.62 mm machine guns. These ships are currently being upgraded at the Abu Dhabi Dry Dock Company in a programme which will be completed in mid-1998.

Patrol boat versions of this design are used by Argentina (2), Ghana (2), Malaysia (6), and by the Indian coastguard as the 'Jija Bai Mod 1' (11).



Sea Tiger *(P 79) of the Republic of Singapore Navy. The large radome is a Signaal 'egg' for the WM28 fire-control radar, which is flanked by two radomes for the RQN 3B ESM/ECM system. Note also the Bofors 57 mm gun and Harpoon anti-ship missiles which are unique to the Singaporean version of the TNC-45.* (H & L Van Ginderen Collection)

LÜRSSEN PB 57/FPB 57



Doğan class (Turkey) (Ian Sturton)
1 *Oerlikon-Contraves twin 35 mm/90* **2** *McDonnell-Douglas Harpoon anti-ship missiles (eight)* **3** *MEL Susie ESM* **4** *Signaal WM28/41 fire-control radar* **5** *Racal-Decca 1226 surface search/navigation radar* **6** *OTOBREDA 76 mm (3 in)/62 automatic gun*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operators: Kuwait, Morocco ('Lazaga' class), Turkey ('Doğan' class, 'Yildiz' class)
Type: FAC, Missile
Class: LÜRSSEN PB 57/FPB 57

TABLE I:

	Istiqlal class Kuwait	Morocco	Doğan class Turkey	Yildiz class Turkey
Purchased	2	4	8	2(+3)
Active	1	4	8	2
Displacement				
Standard	350 t	—	353 t	353 t
Full load	410 t	425 t	436 t	433 t
Dimensions				
Length	58.1 m (190.6 ft)	58.1 m (190.6 ft)	58.1 m (190.6 ft)	57.8 m (189.6 ft)
Beam	7.6 m (25.0 ft)	7.6 m (25.0 ft)	7.6 m (25.0 ft)	5 m (16.4 ft)
Draught	2.7 m (8.9 ft)	2.7 m (8.9 ft)	2.7 m (8.9 ft)	2.7 m (8.9 ft)
Speed	36 kts	30 kts	38 kts	38 kts
Range	1,300 n miles (2,400 km) at 30 kts	3,000 n miles (5,555 km) at 15 kts	1,050 n miles (1,945 km) at 30 kts	1,050 n miles (1,945 km) at 30 kts
Complement	40 (5 officers)	41	40 (5 officers)	45 (6 officers)

Istiqlal *(P 5702). This ship escaped to Bahrain when the Iraqis invaded Kuwait; the second ship in the class was captured and later sunk by the Allies. Note the much more extensive superstructure with Exocets on the roof and the radome aft for the Marconi S 810 surface search radar*

SHIPS

'Istiqlal' class (Kuwait)

ISTIQLAL (P 5702)
Builder Lürssen Werft, Vegesack, Germany

'Lazaga' class (Morroco)

EL KHATTABI (304)
Builder Bazan, San Fernando, Spain
Commissioned 26 Jul 1981

COMMANDANT BOUTOUBA (305)
Builder: Bazan, San Fernando, Spain
Commissioned 2 Aug 1982

COMMANDANT EL HARTY (306)
Builder Bazan, San Fernando, Spain
Commissioned 20 Nov 1981

CINNABDABT AZZOUGARH (307)
Builder Bazan, San Fernando, Spain
Commissioned 25 Feb 1982

'Dogan' class (Turkey)

DOĞAN (P 340)
Builder Lürssen Werft, Vegesack, Germany
Commissioned 23 Dec 1977

MARTE (P 341)
Builder Taşkizak Yard, Istanbul, Turkey
Commissioned: 1 Aug 1978

TAYFUN (P 342)
Builder Taşkizak Yard, Istanbul, Turkey
Commissioned 9 Aug 1979

VOLKAN (P 343)
Builder Taşkizak Yard, Istanbul, Turkey
Commissioned 25 Jul 1980

RÜZGAR (P 344)
Builder Taşkizak Yard, Istanbul, Turkey
Commissioned 24 May 1985

POYRAZ (P 345)
Builder Taşkizak Yard, Istanbul, Turkey
Commissioned 28 Aug 1986

GURBET (P 346)
Builder Taşkizak Yard, Istanbul, Turkey
Commissioned 24 Jul 1988

FIRTINA (P 347)
Builder Taşkizak Yard, Istanbul, Turkey
Commissioned 14 Oct 1988

'Yildiz' class (Turkey)

YILDIZ (P 348)
Builder Taşkizak Yard, Istanbul, Turkey
Commissioned 3 Jun 1994

KARAYEL (P 349)
Builder Taşkizak Yard, Istanbul, Turkey
Commissioned 1996

— (P 350)
Builder Lürssen Werft, Vegesack, Germany
Commissioned 1997

— (P 351)
Builder Taşkizak Yard, Istanbul, Turkey
Commissioned 1998

— (P 352)
Builder Taşkizak Yard, Istanbul, Turkey
Commissioned 1998

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

The Kuwaiti and Moroccan ships have four launchers aft of the superstructure with Exocet MM 40 (Kuwait) and Exocet MM 38 (Morocco). The Turkish ships have two quad launchers for McDonnell Douglas Harpoon 1C in V formation on the outer deck, trained inboard and forward.

Exocet MM 38

Specifications
Length: 5.21 m (17.08 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 22.5 n miles (42 km)
Warhead: 165 kg (365 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, France.

Exocet MM 40 Block 1

Specifications
Length: 5.78 m (18.95 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.13 m (3.7 ft)
Weight: 855 kg (1,885 lb)
Speed: Mach 0.9
Range: 38 n miles (70 km)
Warhead: 155 kg (340 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, France.

Harpoon 1C

Specifications
Length: 4.63 m (15.18 ft) (with booster)
Diameter: 34 cm (13.38 in)
Wing span: 83 cm (32.67 in)
Weight: 681.9 kg (1,502 lb) (with booster)
Speed: Mach 0.85
Range: 67 n miles (124 km)
Warhead: 221.6 kg (500 lb)
Guidance: Inertial navigation and active radar

Manufacturer/Contractor
McDonnell Douglas Missile Systems Company, USA.

Doğan *(P340) a Lürssen FPB-57 of the Turkish Navy. Armament comprises and OTOBREDA 76 mm gun, eight Harpoon anti-ship missiles and an Oerlikon twin 35 mm at the stern. The Signaal 'egg' covers a WM28/41 fire-control radar and beneath it is a circular receiver array for the Susie ESM radar warner* (Lürssen)

GUNS

All the ships have an OTOBREDA 76/62 Compact mounting forward but the aft gun mounting is an OTOBREDA 40 mm twin Compact in the Kuwaiti and Moroccan vessels and an Oerlikon-Contraves GDM twin 35 mm mounting in the Turkish ones. The Moroccan vessels also have two Royal Ordnance GAM-BO1 20 mm guns in the superstructure.

OTOBREDA 76/62 Compact

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Weight: 8.5 t (loaded)
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA twin 40 mm L/70 Compact

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 600 rds/min
Range: 3.25 n miles (12.5 km)

Mounting
Weight: 5.5 t (unloaded)
Traverse: 360°
Elevation: −13 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Oerlikon — Contraves GDM-A

Specifications
Gun
Calibre: 35 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,175 m/s (3,855 ft/s)
Rate of fire: 550 rds/min/barrel
Range: 2.7 n miles (5 km)

Mounting
Weight: 6.52 t
Traverse: 360°
Elevation: −15 to +85

Manufacturer/Contractor
Oerlikon-Contraves, Switzerland.

Royal Ordnance GAM-BO1

Specifications
Gun
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,150 m/s (3,445-3,773 ft/s)
Rate of fire: 900 rds/min
Range: 0.9 n miles (1.7 km)

Mounting
Weight: 500 kg
Traverse: 360°
Elevation: −15 to +60°

Manufacturer/Contractor
Royal Ordnance, UK.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-Thorn Cutlass

'Istiqlal' (Kuwait), 'Yildiz' (Turkey). Cutlass and provides bearings, CW bearing and frequency measurement over the E/J-band with instantaneous frequency measurement. The system can incorporate a responsive noise jammer as well as providing spot or barrage noise. It may also be integrated with decoy launchers. There is also the DASA Telegon 6 modular, high-frequency direction-finding system.

Manufacturer/Contractor
Racal-Thorn, UK.

Racal-Thorn Susie-1

'Doğan' (Turkey), Susie is a solid-state system operating in the E/J-band range which automatically correlates band, pulsewidth and bearing then displays the data with an accuracy of 3.5° in fine mode. The system can automatically track up to seven signals. There is also the DASA Telegon 8 digital high-frequency direction-finding system with a bearing accuracy of 1°.

Manufacturer/Contractor
Racal-Thorn, UK.

DASA Telegon

'Lazaga' class (Morocco). Moroccan ships are known to have a DASA Telegon high-frequency direction-finding system but no details are available.

Manufacturer/Contractor
DASA, Ulm, Germany.

CS Défense DAGAIE Mk 2

Istiglal (Kuwait). Dagaie is a trainable mounting with 10 replaceable containers loaded with a mixture of 3/5 and 8/14 µm IR or I/J-band chaff projectiles produced by Etienne Lacroix Défense.

Loral Hycor Mk 36 Mod 1

'Doyan' 'Yildiz' (Turkey). The Mk 36 SRBOC Mod 1 (Super Rapid Bloom Offboard Countermeasures) decoy system has two Mk 137 launchers, each with six barrels. These are 160 × 43 × 86 cm mortar systems which fire a variety of 130 mm chaff and infra-red munitions from cartridges weighing 3.8-22.7 kg (8.4-50 lb) which create chaff clouds up to 2.5 n miles (4.5 km) from the ship.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

CelsiusTech 9LV 200 Mk 2

'Istiqlal' (Kuwait). The 9LV 200 Mk 2 is a radar-based weapon control system of mainframe architecture using the Philiips P800 mini-computer for the control of one medium and one light calibre gun mounting as well as surface-to-surface missiles. There is a tactical display system and two gun control displays, for ASuW and AAW operations.

Manufacturer/Contractor

Celsius Tech, Sweden.

Signaal WM25

'Lazaga' (Morocco). This has a mainframe architecture based upon the SMR mini-computer with a two-man display and control console. It can operate against two targets simultaneously using two guns or a surface-to-surface missile.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Signaal WM28 ('Doğan')

'Doğan' (Turkey). The WM28 radar-based weapon control system has a mainframe architecture based upon the SMR mini-computer with a two-man display and control console. It can operate against two targets simultaneously using two guns or surface-to-surface missiles.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Signaal Tacticos

'Yildiz' (Turkey). These vessels have a Signaal Tacticos command and weapon control system. This is a distributed architecture system based upon SUN-1S processors with five MOC (Multifunction Operator Consoles) workstations linked by a dual databus system.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

ELECTRO-OPTIC SENSORS

CS Défense Lynx director (Kuwait)

Specifications

Weight: 195 kg (430 lb)
Elevation: −15 to +75°
Sensors: Optical

CS Défense Panda director (Morocco)

Specifications

Weight: 480 kg (1,058 lb)
Elevation: −25 to +65°
Sensors: Optical

LIOD Mk 2 ('Yildiz' class)

Specifications

Weight: 200 kg (441 lb)
Elevation: n/k
Sensors: TV camera

RADARS

ISTIQLAL (KUWAIT)

	S810	TM 1226C	9GR600
Maker	GEC-Marconi	Racal-Decca	CelsiusTech
Role	Search	Navigation	Weapon control
Frequency	I	I	I
Beam	2.2, 25°	1.2°	1.1, 7°
Peak power	180 kW	25 kW	200 kW
Gain	29.5 dB	n/k	35.5 dB
Pulsewidth	0.33, 0.67 µs	0.05, 0.25, 1.0 µs	0.25, 1.0 µs
PRF	750, 1,500 pps	1,300 pps	1,000, 3,000 pps
Scan rate	24 rpm	25 rpm	60 rpm
Typical range	13.5 n miles (25 km)	20 n miles (37 km)	n/k

LAZAGA (MOROCCO)

	ZW 06	WM25
Maker	Signaal	Signaal
Role	Search	Weapon control
Frequency	I	I
Beam	0.9, 19°	1.5, 7, 2.4°
Peak power	60 kW	200 kW
Gain	32 dB	33.5 dB
Pulsewidth	0.06, 0.6 µs	0.22, 0.45 µs
PRF	2,000, 4,000 pps	1,800, 3,600 pps
Scan rate	24 rpm	60 rpm
Typical range	14 n miles (26 km)	16 n miles (30 km)

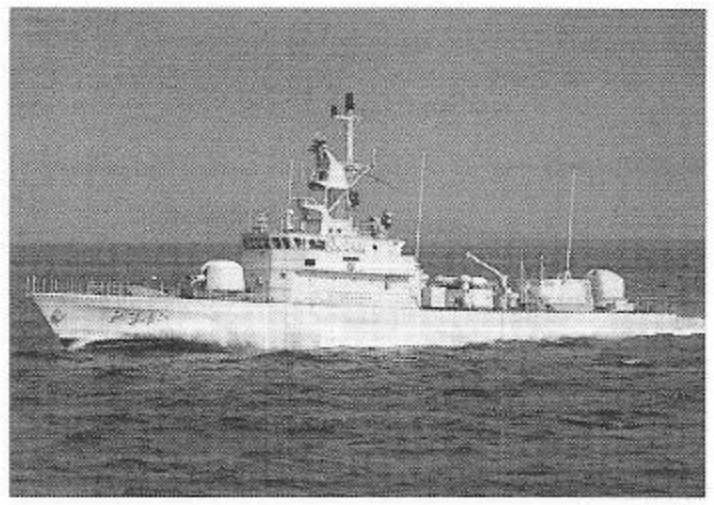
DOĞAN (TURKEY)

	1226	WM28
Maker	Racal-Decca	Signaal
Role	Search	Weapon control
Frequency	I	I
Beam	1.2°	1.5, 7, 2.4°
Peak power	25 kW	200 kW
Gain	n/k	33.5 dB
Pulsewidth	0.05, 0.25, 1.0 µs	0.22, 0.45 µs
PRF	1,300 pps	1,800, 3,600 pps
Scan rate	25 rpm	60 rpm
Typical range	20 n miles (37 km)	16 n miles (30 km)

'YILDIZ' CLASS (TURKEY)

	AWS6	MW08	TM	STING	TM 1226
Maker	Siemens Plessey	Signaal	Oerlikon Contraves	Signaal	Racal Decca
Role	Search	Search	Weapon Control	Weapon Control	Navigation
Frequency	G	G	I	I	I
Beam	1.5°	2, 12°	1.7°	0.4, 1.6°	1.2°
Peak power	49 kW	50 kW	25 kW	30 kW	25 kW
Gain	26/29 dB	23, 31.5 dB	n/k	n/k	n/k
Pulsewidth	0.1, 4.3 µs	0.6 µs	n/k	n/k	0.05, 0.25, 1.0 µs
PRF	n/k	3,800 pps	n/k	n/k	1,300 pps
Scan rate	30, 60 rpm	27 rpm	120 rpm	n/k	25 rpm
Typical range	37 n miles (70 km)	20 n miles (27 km)	37 n miles (70 km)	37 n miles (70 km)	20 n miles (27 km)

Note
Karayel and *Yildiz* have AWS6 search and TM weapon control radars while the remainder have MW08 and STING



Yildiz (P 348), lead ship of the second batch of FPB-57s for the Turkish Navy. Note the revised bridge, new mast and revised sensor fit (Turkish Navy)

PROPULSION

Specifications

Kuwait
System: Diesel
Main machinery: 4 MTU 16V 956 TB 91 diesels; 11 MW (15,000 hp)
Shafts: 4

Morocco
System: Diesel
Main machinery: 2 Bazan-made MTU 16V 956 TB91 diesels; 5.51 MW
Shafts: 2

Turkey ('Doğan' class)
System: Diesel
Main machinery: 4 MTU 16V 956 TB92 diesels; 13 MW (17,700 hp(m))
Shafts: 4

('Yildiz' class)
System: Diesel
Main machinery: 4 MTU 16V 956 TB91 diesels; 11.1 MW (15,120 hp)
Shafts: 4

FURTHER INFORMATION

The FPB 57 design, with its steel, round-bilge hull and aluminium superstructure, was designed to meet a market need among Third World navies for a small warship with a multirole capability and the space to adapt for sensor/weapon upgrades. It has some 170 m² of living space and carries about 60 tonnes of fuel. The electricity systems generate 405 kW. They have a capacity for 300 rounds of 76 mm ammunition.

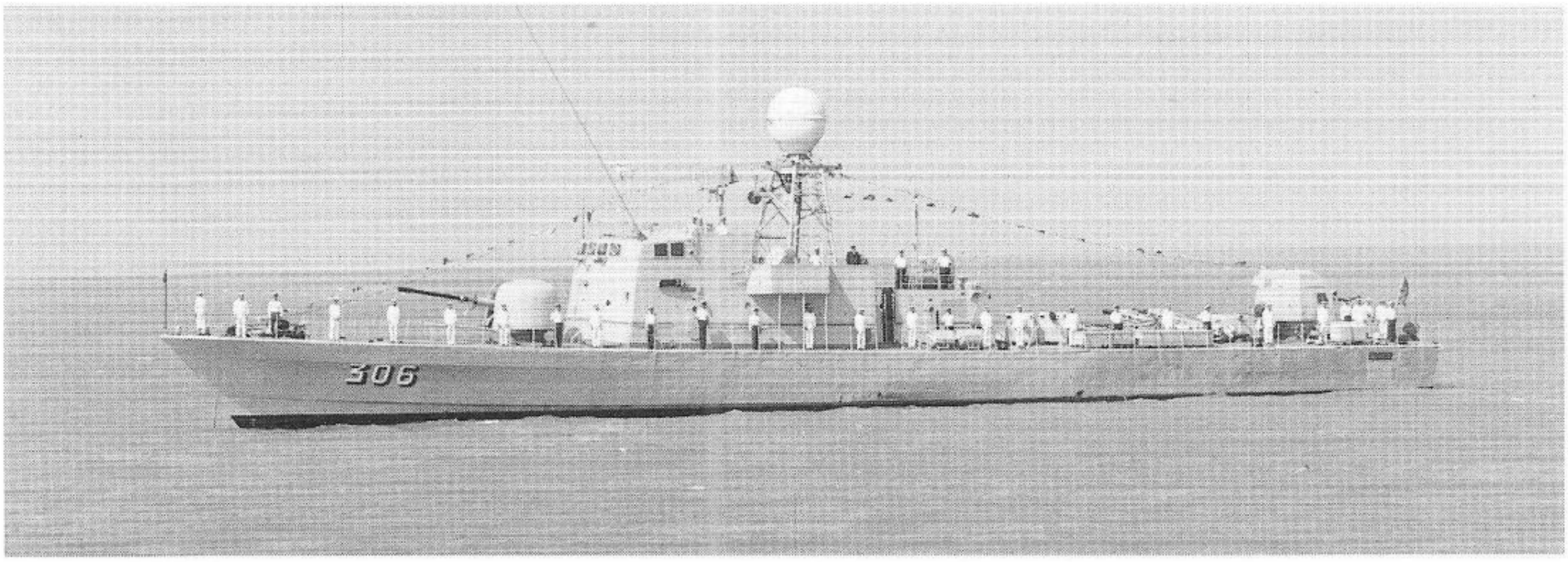
Two vessels were ordered from Lürssen by Kuwait in 1980 as leaders for the TNC 45s and were commissioned in 1982/1983. *Sabhan* was sunk in 1991 leaving *Istiqlal* which was refitted by CMN in 1995/1996.

The Moroccan vessels were ordered in 1977 and built by Bazan's San Fernando yard at Cadiz. Six more were built as the 'Lazaga' class for Spain in the mid-1970s (the first by Lürssen) but were stricken in 1993. They differed in having no missile armament.

The Turkish vessels ('Doğan' class) were ordered in 1973 with steel hulls and aluminium superstructures. The lead ship was built by Lürssen and commissioned in 1977 while the remainder were built by the Taskizak Yard, Istanbul and commissioned between 1978 and 1988.

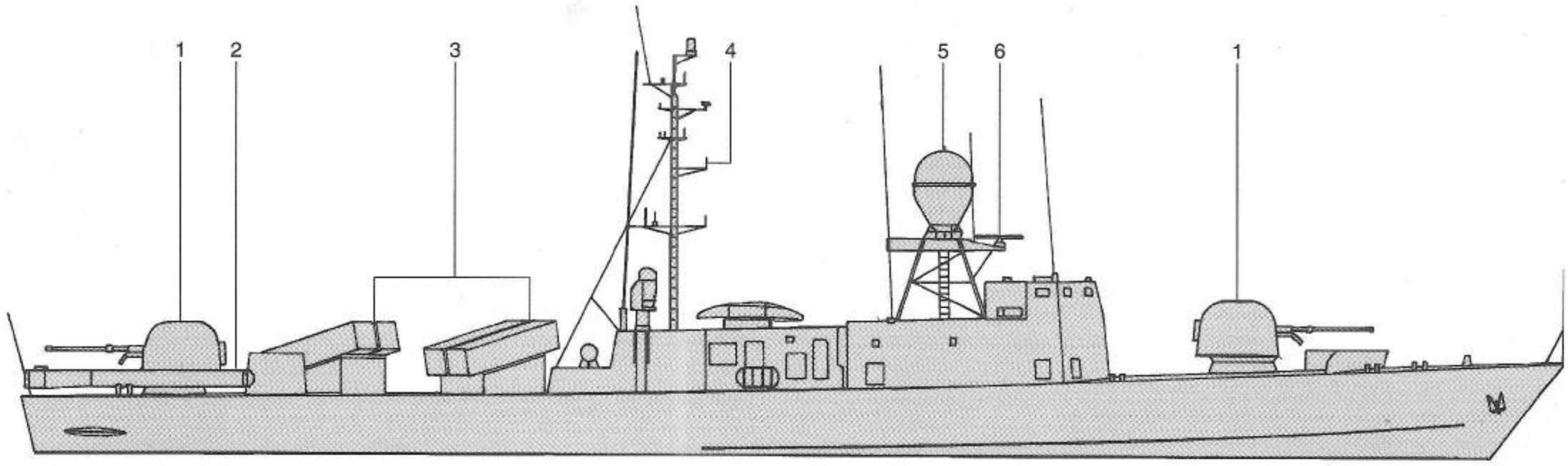
The 'Yildiz' class is essentially a 'Doğan' hull with improved sensor and weapon systems, and a revised bridge. *Yildiz and Karayel* were ordered in 1991 from the Taskizak Yard and were commissioned in 1994 and 1996 respectively. Three more were authorised in 1993 with different radars, the first being built by Lürssen and the other two by Taskizak. They will be commissioned in 1997/1998.

In addition to these FACs Ghana has a gun-armed version while the Indonesian Navy's 'Singa' and 'Kakap' classes are patrol versions of this design. The Turkish *Girne* is an unsuccessful ASW version of the PB 57 design.

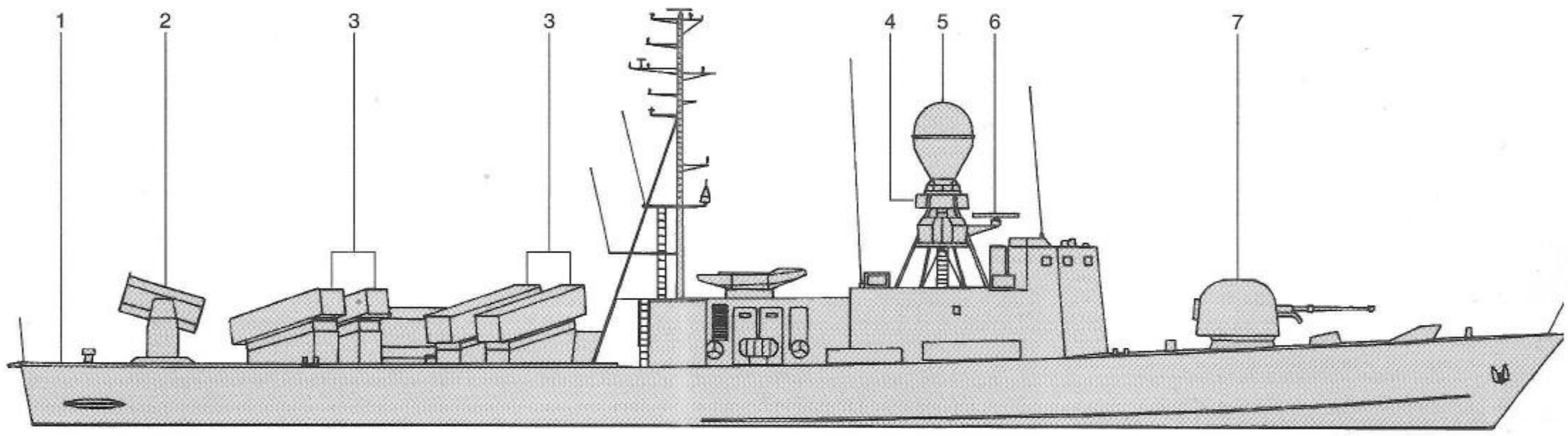


Commandant El Harty *(306) of the Moroccan Navy* (H & L van Ginderen Collection)

GEPARD (TYPE 143A)/ALBATROS (TYPE 143B)



'Albatros' class (Ian Sturton)
1 *OTOBREDA 76 mm (3 in)/62 automatic gun* **2** *533 mm (27 in) torpedo tubes (two)* **3** *Aerospatiale MM 38 anti-ship missile (four)* **4** *Racal-Thorn Scorpion jammer* **5** *Signaal WM27 surface search/fire-control radar* **6** *SMA 3RM 20 navigation radar*



'Gepard' class (Ian Sturton)
1 *Minerails (two)* **2** *RAM 21-cell SAM launcher* **3** *Aerospatiale MM 38 Exocet anti-ship missiles (four)* **4** *DASA FL1800 Mk 21 radar intercept* **5** *Signaal WM27 surface search/fire-control radar* **6** *SMA 3RM20 navigation radar* **7** *OTOBREDA 76 mm (3 in)/62 automatic gun*

GENERAL SPECIFICATIONS

Operator: Germany
Type: FAC, Missile

Class: GEPARD (TYPE 143A)/ALBATROS (TYPE 143B)

Built: 20
Active: 20

Displacement:
standard: n/k
full load: 391 t ('Gepard'); 398 t ('Albatros')

Dimensions
Length: 57.6 m (190 ft)
Beam: 7.8 m (25.6 ft)
Draught: 2.6 m (8.5 ft)

Speed: 40 kts
Range: 2,600 n miles (4,815 km) at 16 kts, 600 n miles (1,110 km) at 33 kts ('Gepard'); 1,300 n miles (2,400 km) at 30 kts

Complement: 34 (4 officers) ('Gepard'); 40 (4 officers) ('Albatros')

SHIPS

'Gepard' class (Type 143A)

GEPARD (P 6121)
Builder Lürssen, Vegesack, Bremen, Germany
Launched 25 Sep 1981
Commissioned 13 Dec 1982

PUMA (P 6122)
Builder Lürssen, Vegesack, Bremen, Germany
Launched 8 Feb 1982
Commissioned 24 Feb 1983

HERMELIN (P 6123)
Builder Kröger, Rendsburg, Germany
Launched 8 Dec 1981
Commissioned 5 May 1983

NERZ (P 6124)
Builder Lürssen, Vegesack, Bremen, Germany
Launched 18 Aug 1982
Commissioned 14 Jul 1983

ZOBEL (P 6125)
Builder Kröger, Rendsburg, Germany
Launched 30 Jun 1982
Commissioned 25 Sep 1983

FRETTCHEN (P 6126)
Builder Lürssen, Vegesack, Bremen, Germany
Launched 26 Jan 1983
Commissioned 15 Dec 1983

DACHS (P 6127)
Builder Kröger, Rendsburg, Germany
Launched 14 Dec 1982
Commissioned 22 Mar 1984

OZELOT (P 6128)
Builder Lürssen, Vegesack, Bremen, Germany
Launched 7 Jun 1983
Commissioned 3 May 1984

WIESEL (P 6129)
Builder Lürssen, Vegesack, Bremen, Germany
Launched 8 Aug 1983
Commissioned 12 Jul 1984

HYÄNE (P 6130)
Builder Lürssen, Vegesack, Bremen, Germany
Launched 5 Oct 1983
Commissioned 13 Nov 1984

'Albatros' class (Type 143B)

ALBATROS (P 6111)
Builder Lürssen, Vegesack, Bremen, Germany
Commissioned 1 Nov 1976

FALKE (P 6112)
Builder Lürssen, Vegesack, Bremen, Germany
Commissioned 13 Apr 1976

GEIER (P 6113)
Builder Lürssen, Vegesack, Bremen, Germany
Commissioned 2 Jun 1976

BUSSARD (P 6114)
Builder Lürssen, Vegesack, Bremen, Germany
Commissioned 14 Aug 1976

SPERBER (P 6115)
Builder Kröger, Rendsburg, Germany
Commissioned 27 Sep 1976

Commissioned 17 Dec 1976

GREIF (P 6116)
Builder Lürssen, Vegesack, Bremen, Germany
Commissioned 25 Nov 1976

SEEADLER (P 6118)
Builder Lürssen, Vegesack, Bremen, Germany
Commissioned 28 Mar 1977

Commissioned 23 Dec 1977

KONDOR (P 6117)
Builder Kröger, Rendsburg, Germany

HABICHT (P 6119)
Builder Kröger, Rendsburg, Germany

KORMORAN (P 6120)
Builder Lürssen, Vegesack, Bremen, Germany
Commissioned 29 Jul 1977

WEAPONS SYSTEMS

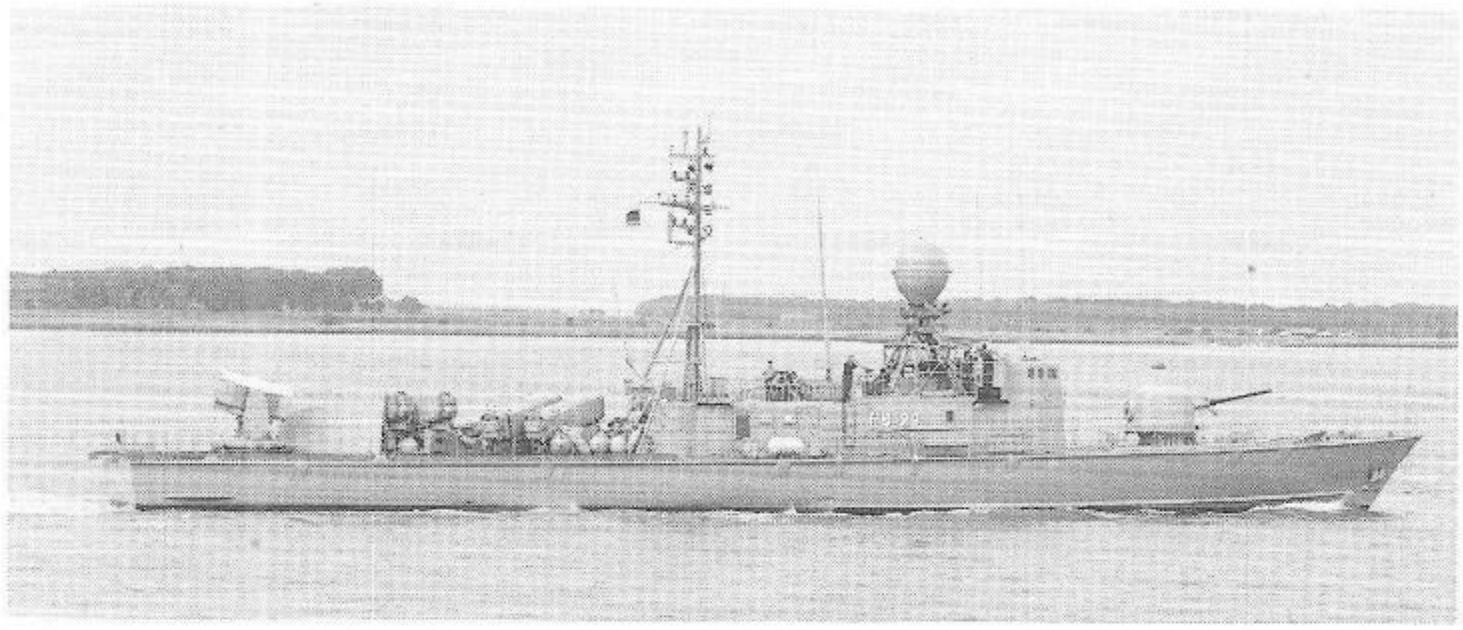
SURFACE-TO-SURFACE MISSILES (SSM)

Aerospatiale Exocet MM 38

Both classes have four forward-trained launchers for MM 38 anti-ship missiles aft of the superstructure, the forward pair pointing to port and the after pair to starboard.

Specifications
Length: 5.21 m (17.08 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 22.5 n miles (42 km)
Warhead: 165 kg (365 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, France.



Wiesel *(P 6129), a Type 143A FAC of the Federal German Navy. Armament comprises a 76 mm/62 gun forward, four MM 38 Exocet launchers and the newly fitted (1994) RAM launcher. Note the protection plate fitted to deflect the RAM exhaust from the after Exocet* (H & L van Ginderen Collection)

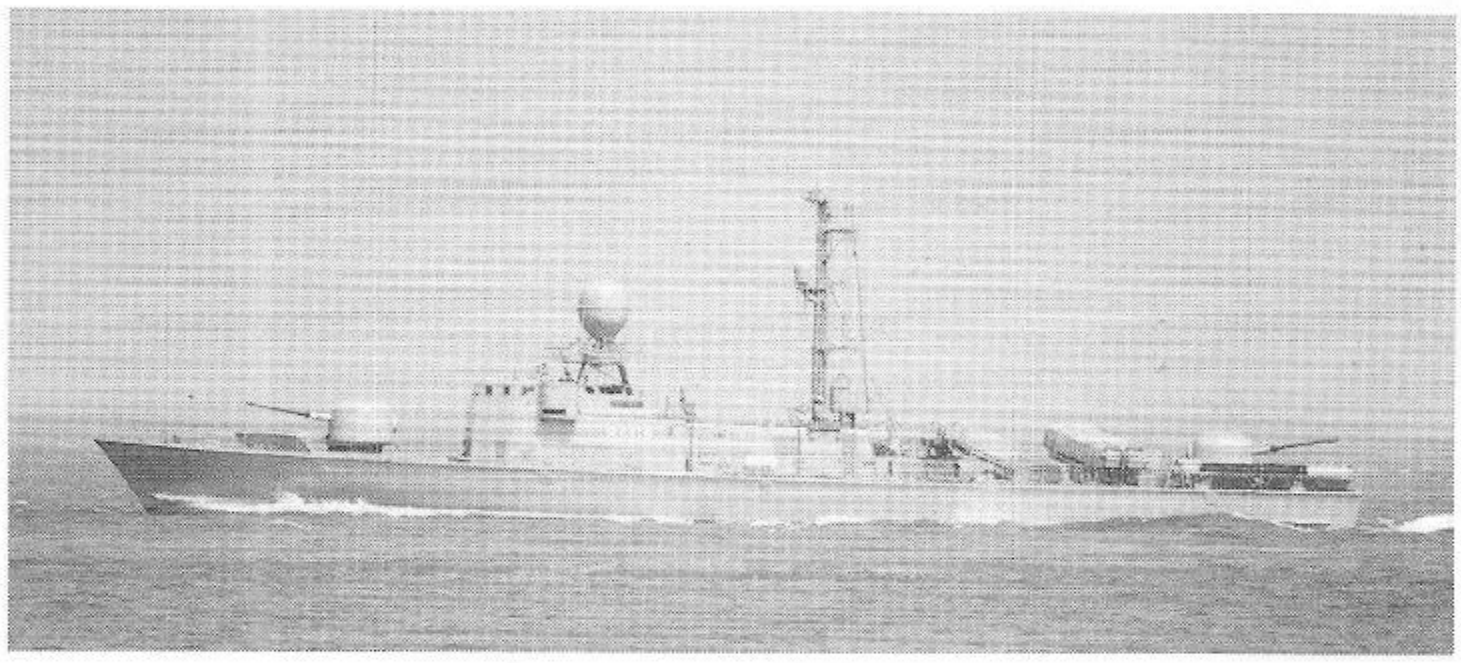
SURFACE-TO-AIR MISSILES (SAM)

RIM-116A Rolling Airframe Missile (RAM)

Since 1992 the 'Gepard' class has been receiving a standard, 19-cell launcher for the RIM-116A RAM (Rolling Airframe Missile) surface-to-air missile. This is installed on the stern; the installation includes a large, metal screen to protect the nearest Exocet launcher from the rocket efflux of the RAM missiles.

Specifications
Length: 2.79 m (9.15 ft)
Diameter: 12.7 cm (5 in)
Wing span: 43.4 cm (17 in)
Weight: 73.6 kg (162 lb)
Speed: Mach 2+
Range: 5 n miles (9.5 km)
Warhead: 9.09 kg (20 lb)
Guidance: Radar emitter and infra-red passive homing

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA.



Greif *(P 6116) after conversion to a Type 143B. Note the two 76 mm/62 guns, which distinguish this group from the Type 143A* (H & L van Ginderen Collection)

TUBES

The 'Albatros' class has two 533 mm (21 in) torpedo tubes for STN Atlas Seal torpedoes.

TORPEDOES

STN Atlas Seal torpedo

Specifications
Length: 6.55 m (21.5 ft) (with guidance wire dispenser)
Diameter: 533 mm (21 in)
Weight: 1,370 kg (3,021 lb)
Propulsion: Electric
Speed: 33 kts
Range: 10.75 n miles (20 km)
Warhead: 260 kg (573 lb)
Guidance: Wire and active/passive sonar

Manufacturer/Contractor
STN Atlas, Bremen, Germany.

GUNS

OTOBREDA 76/62 Compact

'Gepard' class. The 'Gepard' class has one OTO-BREDA 76/62 Compact mounting forward.

'Albatros' class. The Albatros class has two 76 mm guns; one forward, the other aft.

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Weight: 8.5 t (loaded)
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

12.7 mm machine gun

12.7 mm machine guns are fitted for operational deployments.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

DASA Telegon 6

All ships of both classes are fitted with the DASA Telegon 6 modular, high frequency, direction finding equipment.

Manufacturer/Contractor
DASA, Ulm, Germany.

ELECTRONIC COUNTERMEASURES (ECM)

DASA FL1800

'Gepard' class. These vessels have the DASA FL 1800 Stage II electronic warfare system, covering the H/J-bands and consisting of omnidirectional and planar direction-finding antennas, with elements covering five bands. The ECM element has a tracking processor which controls synchronous and asynchronous jamming. The Stage II system improves performance and adds a channelised and two fully integrated super-heterodyne receivers.

Manufacturer/Contractor
DASA, Ulm, Germany

DECOYS

Buck-Wegmann Hot Dog/Silver Dog

All ships, both 'Albatros' and 'Gepard' class have the Buck-Wegmann Hot Dog (infra-red) and Silver Dog (chaff) decoy launchers. These systems consist of 12 or 24 — 76 mm grenade launchers which weigh 115 kg (254 lb) or 220 kg (485 lb). Each group of three launcher tubes is 196 × 710 × 420 mm. The Hot Dog grenade weighs 0.74 kg (1.63 lb) while the Silver Dog one weighs 0.95 kg (2.1 lb), the chaff of the latter being deployed within 2 s of launching.

Manufacturer/Contractor

Buck-Wegmann, Germany

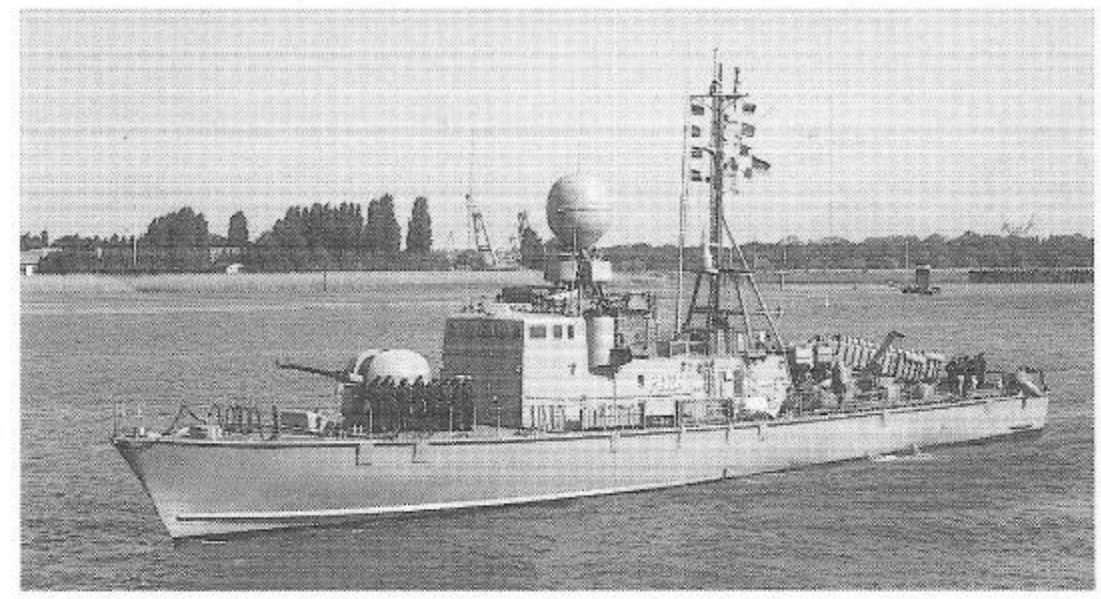
Racal-Thorn Octopus EW suite

'Albatros' class. This class is equipped with a Racal-Thorn Octopus electronic warfare suite based upon the Racal-Thorn Cutlass B1 ESM and Scorpion ECM systems with DASA threat library. The Cutlass uses the same antenna as RDL and provides bearings, CW bearing and frequency measurement over the E/J-band with instantaneous frequency measurement. The Scorpion is a wideband jammer covering the E/J-band. The dual-beam antenna can call upon 50 kW of radiated power and the system can deal with between five and eight targets.

Manufacturer/Contractor

Racal-Thorn, UK.

The RAM and Exocet launchers aboard Ozelot *(P 6128)* (H & L van Ginderen Collection)



Frettchen *(P 6126), showing the Signaal 'egg' containing the WM27 fire-control radar and the four receive antennas of the FL1800S ESM system* (H & L van Ginderen Collection)

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Both classes have a Signaal WM27 weapon control system with DASA AGIS tactical data system. The AGIS *(Automatisiertes Gefechts- und Informations-system für Schnellboote)* exchanges radar and communications data among FACs using two Univac 1830B mini-computers and a Link 11 datalink to feed data to the WM27 consoles. The WM27 radar-based weapon control system has a mainframe architecture based upon the SMR mini-computer with a two-man display and control console. It can operate against two targets simultaneously using one gun or a surface-to-surface missile.

RADARS

	WM27	3RM20
Maker	Signaal	SMA
Role	Weapon control	Search
Band	I	I
Beam	1.5, 7, 2.4°	0.8/2.0, 26°
Peak power	200 kW	7 kW
Gain	33.5 dB	27 dB
Pulsewidth	0.22, 0.45 µs	0.05, 0.15, 0.5, 1.5 µs
PRF	1,800, 3,600 pps	750, 1,500, 3,000, 6,000 pps
Scan rate	60 rpm	25 rpm
Typical range	16 n miles (30 km)	n/k

PROPULSION

'Gepard' class

Specifications

System: Diesel
Main machinery: 4 MTU MA 16V 956 SB80 diesels; 9.7 MW (13,200 hp)
Shafts: 4

'Albatros' class

Specifications

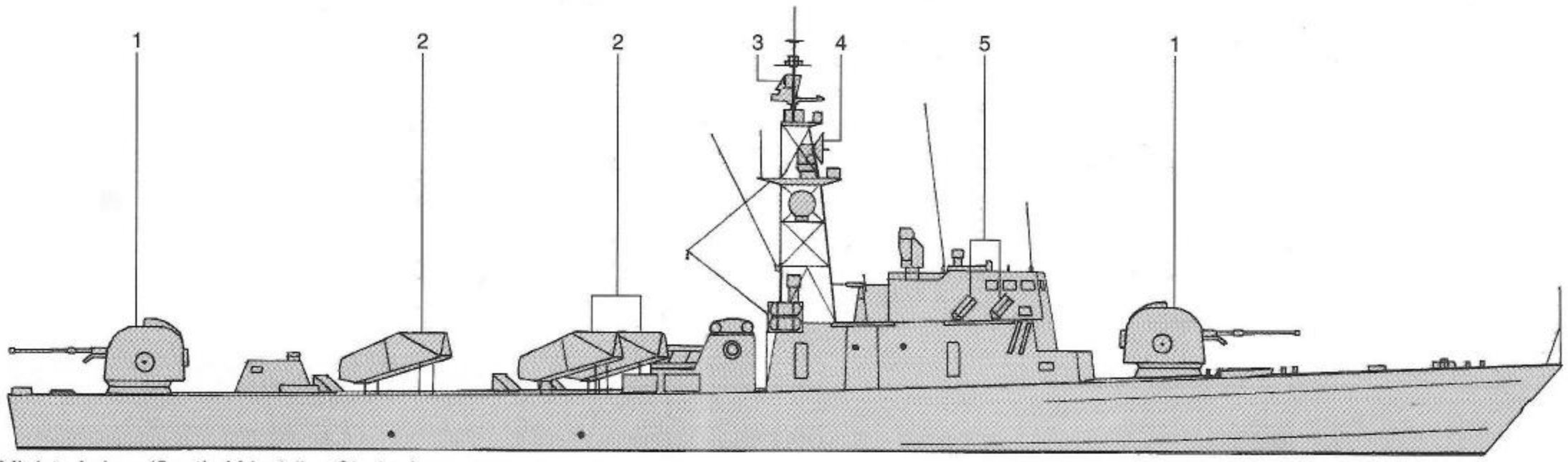
System: Diesel
Main machinery: 4 MTU MA 16V 956 TB92 diesels; 13 MW (17,700 hp)
Shafts: 4

FURTHER INFORMATION

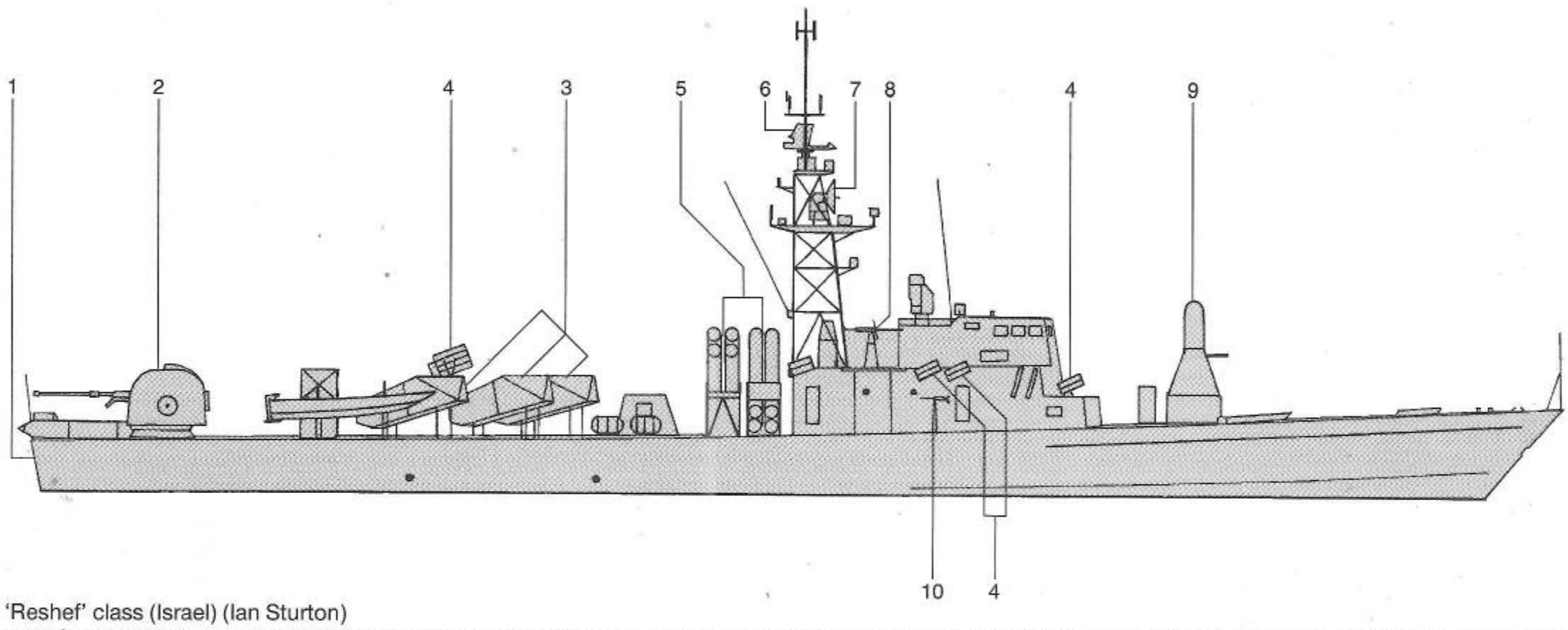
The S.71 design, officially designated Type 143 by the Federal German Navy, has a round-bilge hull of three-layer, diagonal-bonded wooden outer skins with welded alloy frames, bulkheads and deck beams, and welded steel fabrications for longitudinals, crossbeams and machinery platforms. It has 125 m² of living space and carries 116 tonnes of fuel, while the electricity system generates 540 kW.

The 'Albatros' class was originally designated the Type 143, with ten being ordered in 1972, which was followed by an order for ten 'Gepard' class (Type 143A) in 1978. The prime contractor was AEG-Telefunken (now STN Atlas), but with actual construction being carried out by Lürssen (14 hulls) and Kröger (six hulls). In 1994-95 the electronic systems of the 'Albatros' class (Type 143) was upgraded, resulting in them being redesignated Type 143B.

SA'AR 4/MINISTER



'Minister' class (South Africa) (Ian Sturton)
1 *OTOBREDA 76 mm (3 in/62 automatic gun* **2** *Skerpioen anti-ship missiles* **3** *Thomson-CSF Triton air/surface search radar* **4** *Alenia RTN-10X fire-control radar* **5** *Flare launchers*



'Reshef' class (Israel) (Ian Sturton)
1 *EDO 780 VDS (in some)* **2** *OTOBREDA 76 mm (3 in)/62 automatic gun* **3** *IAI Gabriel II anti-ship missiles (four or six)* **4** *Flare launcher* **5** *McDonnell Douglas Harpoon anti-ship missiles (four or eight)* **6** *Thomson-CSF TH-D 1040 air-search radar* **7** *Alenia Orion RTN-10X fire-control radar* **8** *Oerlikon 20 mm cannon* **9** *Hughes Mk 15 20 mm six-barrel CIWS* **10** *12.7 mm machine gun*

GENERAL SPECIFICATIONS

Country of origin: Israel
Operators: Chile ('Casmar' class), Israel ('Reshef' class), South Africa ('Minister' class)
Type: FAC, Missile

Class: SA'AR 4/MINISTER

Built: 19
Active: 17

Displacement:
standard: 415 t
full load: 450 t; 430 t (South Africa)

Dimensions
Length: 58 m (190.6 ft); 62.2 m (204 ft) (South Africa)
Beam: 7.8 m (25 ft)
Draught: 2.4 m (8 ft)

Speed: 32 kts
Range: 1,650 n miles (3,055 km) at 30 kts, 4,000 n miles (7,400 km) at 17.5 kts.

Complement: 51 (8 officers) (Chile); 45 (Israel); 47 (7 officers) (South Africa)

SHIPS

'Casma' class (Chile)

CASMA (30)
Builder Israel Shipyard, Haifa, Israel
Commissioned (Israeli Navy) Mar 1974 (*Romah*)
Transferred (Chile) Dec 1979

CHIPANA (31)
Builder Israel Shipyard, Haifa, Israel
Commissioned (Israeli Navy) Oct 1973 (*Keshet*)
Transferred (Chile) Jan 1981

'Reshef' class (Israel)

RESHEF
Builder Israel Shipyard, Haifa, Israel
Launched 19 Feb 1973
Commissioned Apr 1973

Kobie Coetse *(P 1568)* (H & L van Ginderen Collection)

YAFFO
Builder Israel Shipyard, Haifa, Israel
Launched 3 Feb 1975
Commissioned Apr 1975

NITZHON
Builder Israel Shipyard, Haifa, Israel
Launched 10 Jul 1978
Commissioned Sept 1978

ATSMOUT
Builder Israel Shipyard, Haifa, Israel
Launched 3 Dec 1978
Commissioned Feb 1979

MOLEDT
Builder Israel Shipyard, Haifa, Israel
Launched 22 Mar 1979
Commissioned May 1979

KOMEMIUT
Builder Israel Shipyard, Haifa, Israel
Launched 19 Jul 1978
Commissioned Aug 1980

'Minister' class (South Africa)

JAN SMUTS (P 1561)
Builder Israel Shipyard, Haifa, Israel
Commissioned 18 Jul 1977

P W BOTHA (P 1562)
Builder Israel Shipyard, Haifa, Israel
Commissioned 2 Dec 1977

FREDERIC CRESSWELL (P 1563)
Builder Israel Shipyard, Haifa, Israel
Comissioned 6 Apr 1978

JIM FOUCHE (P 1564)
Builder Sandock Austral, Durban, South Africa
Commissioned 22 Dec 1978

FRANS ERASMUS (P 1565)
Builder Sandock Austral, Durban, South Africa
Commissioned 27 Jul 1979

OSWALD PIROW (P 1566)
Builder Sandock Austral, Durban, South Africa
Commissioned 4 Mar 1980

HENDRIK MENTZ (P 1567)
Builder Sandock Austral, Durban, South Africa
Commissioned 11 Feb 1983

KOBIE COETSEE (P 1568)
Builder Sandock Austral, Durban, South Africa
Commissioned 11 Feb 1983

MAGNUS MALAN (P 1569)
Builder Sandock Austral, Durban, South Africa
Commissioned 4 Jul 1986

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

These FACs carry surface-to-surface missile launchers aft of the superstructure and forward of the after gun mounting. Israeli vessels have two launchers (twin or quad depending upon the mission) in crossover configuration immediately behind the superstructure facing port (forward launchers) and starboard (after set). Outboard angled, forward-facing launchers for Gabriel I (Chile), Gabriel II (Israel or South Africa, the latter as Skerpioen) are arranged in pairs either behind the Harpoons or (where only Gabriels are carried) behind the superstructure. Chilean vessels have four launchers, Israeli ones have four to six launchers while South African vessels carry up to eight.

Gabriel I

Specifications
Length: 3.35 m (11 ft)
Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)
Weight: 430 kg (950 lb)
Speed: Mach 0.7
Range: 10.75 n miles (20 km)
Warhead: 150 kg (330 lb)
Guidance: Semi-active radar and manual

Manufacturer/Contractor
Israel Aircraft Industries, Tel Aviv, Israel.

Gabriel II

Specifications
Length: 3.42 m (11.2 ft)
Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)
Weight: 522 kg (1,151 lb)
Speed: Mach 0.7
Range: 19 n miles (36 km)
Warhead: 150 kg (330 lb)
Guidance: Semi-active radar and manual

Manufacturer/Contractor
Israel Aircraft Industries, Tel Aviv, Israel.
Note: Licence-built in South Africa as Skerpioen.

Harpoon 1C

Specifications
Length: 4.63 m (15.18 ft) (with booster)
Diameter: 34 cm (13.4 in)
Wing span: 83 cm (32.67 in)
Weight: 681.9 kg (with booster)
Speed: Mach 0.85
Range: 67 n miles (124 km)
Warhead: 221.6 kg (500 lb)
Guidance: Inertial navigation and active radar

Manufacturer/Contractor
McDonnell Douglas Missile Systems Company, USA.

GUNS

The 'Sa'ar 4' and 'Minister' classes have two OTOBREDA 76/62 Compact mountings fore and aft, plus two US Navy Mk 10 single 20 mm Oerlikons. Some Israeli vessels replace the forward Compact mounting with a Phalanx close in weapon system.

OTOBREDA 76/62 Compact

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Weight: 8.5 t (loaded)
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Hughes Mk 15 CIWS Phalanx

Specifications
Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km)

Mounting
Weight: 5.42 t
Traverse: 310°
Elevation: −25 to +85°

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA.

US Navy Mk 10 20 mm Oerlikon

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Rate of fire: 450 rds/min
Range: 0.8 n miles (1.5 km)

Mounting
Weight: 499 kg (1,100 lb)
Traverse: 360°
Elevation: −15 to +90°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Elta MN-53

'Casma' (Chile), 'Minister' (South Africa). The ESM system is the Elta MN-53 passive intercept system which measures features including band, PRF and pulsewidth with both manual and automatic direction-finding and analysis. In South African vessels the MN-53 is being replaced by a new system developed by South African company Grinaker Electronics, but no further details are available.

Manufacturer/Contractor
Elta, Israel.

Elisra NS9003

'Reshef' (Israel). The Elisra NS9003 is an automatic, computer-controlled ESM system covering the E/J-bands with monopulse direction-finding and instantaneous frequency measurement. There are omni-directional and multibeam static antennas with direction-finding accuracy of 1° in I/J-bands and 3° in E/H-bands.

ELECTRONIC COUNTERMEASURES (ECM)

Elisra NS 9005 ECM

'Reshef' (Israel). Integrated with it is the NS 9005 noise and deception jammer covering the same bands using steerable antennas, low-power exciter and high-power MultiBeam Array Transmitter (MBAT).

Manufacturer/Contractor
Elisra, Israel.

Rattler

'Casma (Chile), 'Minister' (South Africa). The Rafael Rattler jammer can engage three targets covering the E/J-bands simultaneously. It uses a high-powered, broad band amplifier wth low-power exciter.

DECOYS

Elbit ACDS

This is supported by four single-tube decoy launchers and the Elbit Automatic Countermeasures Dispensing System (ACDS) with six 24-tube launchers. The launchers use the Rafael Short-Range Chaff Rocket (SRCR) and the Long-Range Chaff Rocket (LRCR), the launchers weighing 22 kg (48.5 lb) and 12.5 kg (27.5 lb) respectively. The rockets weigh 3.2 kg (7.0 lb) (SRCR) and 9.4 kg (20.7 lb) (LRCR).

Decoy launchers

'Reshef' (Israel). Israeli vessels have one 45-tube, four or six 24-tube, and four single-tube decoy launchers; all are of unidentified, but presumably Israeli, manufacture.

COMMAND AND CONTROL SYSTEM

WEAPONS CONTROL

IAI fire control

'Reshef' class (Israel), 'Casma' class (Chile). These vessels have an IAI fire-control system with a one-man display control and processing console which interfaces with Gabriel (and later Harpoon) surface-to-surface missiles and the main gun. In Israeli ships this receives data from an IAI datalink system.

UEC SAIS

'Casma' class (South Africa). The 'Minister' class has received a UEC SAIS (Surface Action Information System) tactical data handling system with datalink input. This is a distributed architecture system with two workstations, one of which is used by the ship's commander and the other by the tactical compiler.

SONAR

Some Israeli vessels operating in the Red Sea carry an EDO 780 lightweight variable depth sonar. This operates at 13 kHz with a 7.3 tonne body and it has a range of some 8.5 n miles (16 km).

RADARS

'CASMA' CLASS (CHILE)

	Neptune	EL/M-2221
Maker	Thomson-CSF	Elta
Role	Search	Weapon control
Band	H	I
Beam	2, 22°	n/k
Peak power	250 kW	n/k
Gain	38 dB	n/k
Pulsewidth	0.2, 0.5, 0.7 µs	n/k
PRF	n/k	n/k
Scan rate	12, 24 rpm	n/k
Typical range	24 n miles (45 km)	n/k

'RESHEF' CLASS (ISRAEL)

	Neptune	Orion
Maker	Thomson-CSF	Alenia
Role	Search	Weapon control
Band	H	I
Beam	2, 22°	n/k
Peak power	250 kW	200 kW
Gain	38 dB	n/k
Pulsewidth	0.2, 0.5, 0.7 µs	1.5 µs
PRF	n/k	450-550 pps
Scan rate	12, 24 rpm	n/k
Typical range	24 n miles (45 km)	n/k

'MINISTER' CLASS (SOUTH AFRICA)

	Triton	Orion
Maker	Thomson-CSF	Alenia
Role	Search	Weapon control
Band	H	I
Beam	2, 22°	n/k
Peak power	250 kW	200 kW
Gain	38 dB	n/k
Pulsewidth	0,2, 0.5, 0.7 µs	1.5 µs
PRF	n/k	450-550 pps
Scan rate	12, 24 rpm	n/k
Typical range	24 n miles (45 km)	n/k

PROPULSION

Specifications
System: Diesel
Main machinery: Chile: 4 MTU 16V 538 TB82; 8.74 MW (11,880 hp)
Israel, South Africa: 4 MTU 16V 956 TB91; 11.03 MW (15,000 hp)
Shafts: 4

FURTHER INFORMATION

These are larger steel-hulled versions of the earlier 'Sa'ar 3' class and were built by Israel Shipyards, Haifa between 1973 and 1980. The Israeli and South African vessels also carry two 12.7 mm machine guns. The Chilean vessels were transferred in 1979 and 1981, having served in the Israeli Navy since 1974 and 1973 respectively.

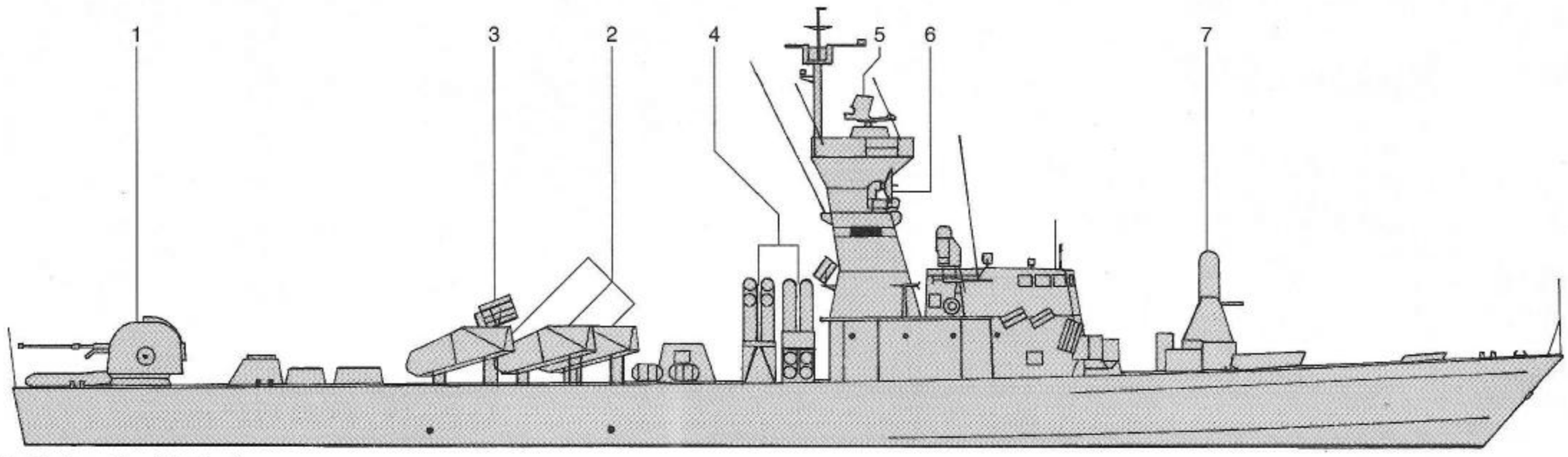
The first three South African vessels (*Jan Smuts, P W Botha* and *Frederic Cresswell*) were ordered in 1974 from the Haifa Shipyard and commissioned in 1977 and 1978. The remainder were built by the Sandrock Austral yard, Durban, South Africa and were commissioned between 1978 and 1986. Three improved vessels were ordered but later cancelled.

Between November 1986 and May 1989 *P W Botha, Kobie Coetsee* and *Oswald Pirow* were modernised with improved weapon control systems. Since 1991 a major upgrade has begun, involving improved command and weapon control system, new communications system, improved sensors and a new engine monitoring system, all of South African design and manufacture. *Frederic Cresswell* was the first to complete this programme in 1996 and will be followed by *Hendrik Mentz* and *Magnus Malan*.

South African Sa'ar 4 FAC-M Jan Smuts *(P 1561)* (H & L van Ginderen Collection)

Casma *(30) one of two Sa'ar 4 FAC-ms transferred to Chile in 1979/81* (Chilean Navy)

SA'AR 4.5 (HETZ/ALIYA)



'Hetz' class (Ian Sturton)
1 *OTOBREDA 76 mm (3 in)/62 automatic gun* **2** *IAI Gabriel II anti-ship missiles (six)* **3** *Flare launcher* **4** *McDonnell Douglas Harpoon anti-ship missiles (four)* **5** *Thomson-CSF TH-D 1040 Neptune air/surface search radar* **6** *Elta EL/M-2221 GM STGR fire-control radars (two)* **7** *Hughes Mk 15 20 mm Vulcan CIWS*

GENERAL SPECIFICATIONS

Operator: Israel
Type: FAC, Missile

Class: SA'AR 4.5 (HETZ/ALIYA)

Built: 7 (5 'Hetz', 2 'Aliya')
Active: 7 (5 'Hetz', 2 'Aliya')

Displacement:
full load: 488 t ('Hetz'); 498 t ('Aliya')

Dimensions
Length: 61.7 m (202.4 ft)
Beam: 7.6 m (24.9 ft)
Draught: 2.5 m (8.2 ft)

Speed: 31 kts
Range: 3,000 n miles (5,555 km) at 17 kts; 1,500 n miles (2,780 km) at 30 kts

Complement: 53

SHIPS

'Aliya' class

ALIYA
Builder Israeli Shipyard, Haifa, Israel
Launched 11 Jul 1980
Commissioned Aug 1980

GEOULA
Builder Israeli Shipyard, Haifa, Israel
Launched Oct 1980
Commissioned 31 Dec 1980

'Hetz' class

ROMAT
Builder Israeli Shipyard, Haifa, Israel
Launched 30 Oct 1981
Commissioned Oct 1981

KESHET
Builder Israeli Shipyard, Haifa, Israel
Launched Oct 1982
Commissioned Nov 1982

HETZ
Builder Israeli Shipyard, Haifa, Israel
Launched Oct 1990
Commissioned Feb 1991

KIDON
Builder Israeli Shipyard, Haifa, Israel
Launched 4 Jul 1974
Commissioned Sep 1974
Converted to Hetz Standard 7 Feb 1994

TARSHISH
Builder Israeli Shipyard, Haifa, Israel
Launched 17 Jan 1975
Commissioned Mar 1975
Converted to Hetz standard 12 Dec 1995

WEAPONS SYSTEMS

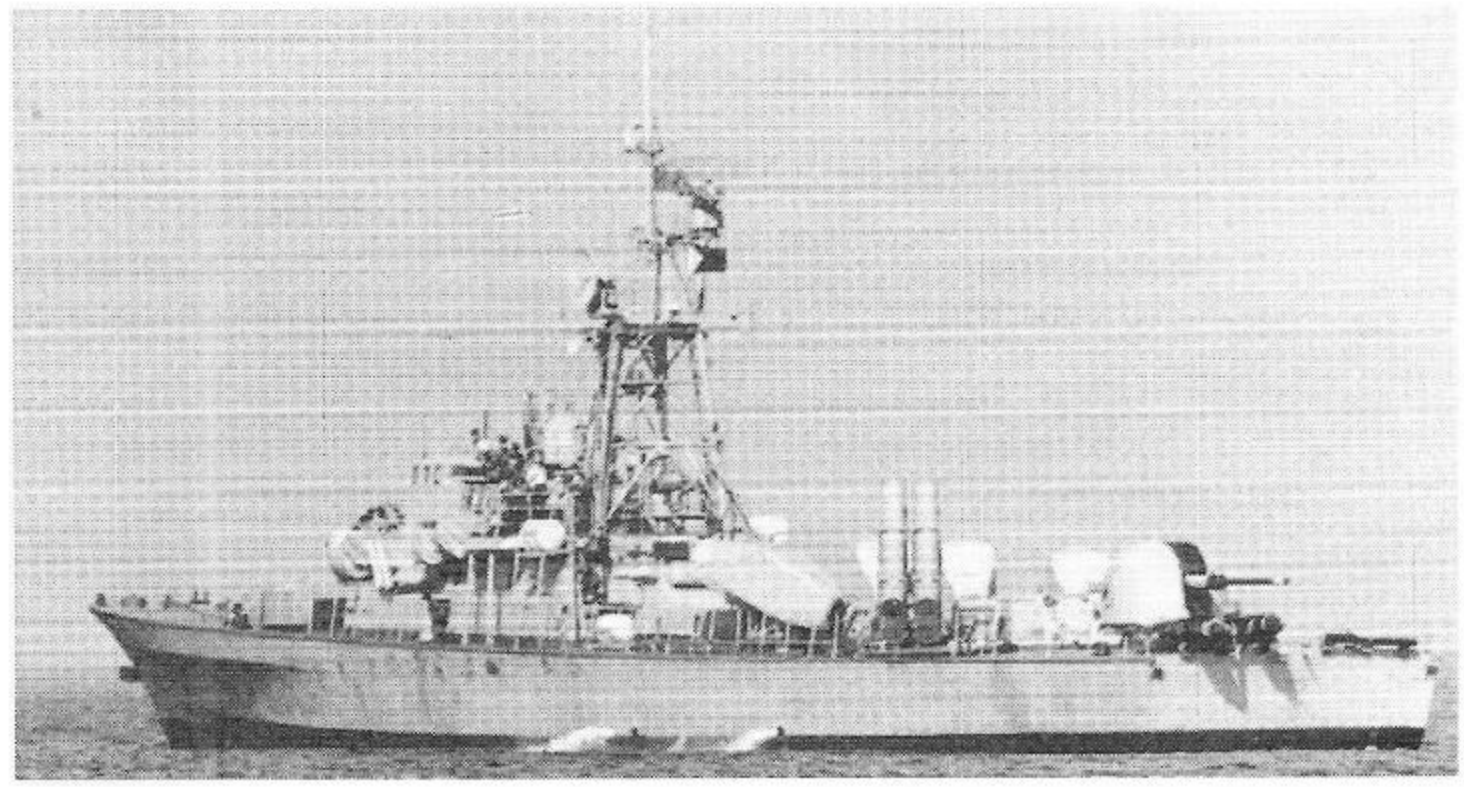
ANTI-SHIP MISSILES

The 'Sa'ar 4.5' class carries two kinds of anti-ship missile aft of the superstructure and forward of the after gun mounting. Immediately behind the superstructure are two twin launchers for the McDonnell Douglas Harpoon IC in crossover configuration with the forward pair facing port and the starboard pair facing starboard. Behind them are two ('Aliya') or three ('Hetz') pairs of outboard-angled, forward-facing, launchers for IAI Gabriel II.

Specifications
Harpoon 1C
Length: 4.63 m (15.18 ft) (with booster)
Diameter: 34 cm (13.38 in)
Wing span: 83 cm (32.67 in)
Weight: 681.9 kg (1,504 lb) (with booster)
Speed: Mach 0.85
Range: 67 n miles (124 km)
Warhead: 221.6 kg (500 lb)
Guidance: Inertial navigation and active radar

Manufacturer/Contractor
McDonnell Douglas Missile Systems Company, USA.

Specifications
Gabriel II
Length: 3.42 m (11.2 ft)



A 'Hetz' class FAC-Missile of the Israeli Navy. This rebuild of existing hulls, incorporating some new equipment, but including much old, refurbished equipment from older vessels, is a good bargain — reputedly costing less than US$10 million per vessel (IAI)

Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)
Weight: 522 kg (1,151 lb)
Speed: Mach 0.7
Range: 19 n miles (36 km)
Warhead: 150 kg (330 lb)
Guidance: Semi-active radar and manual

Manufacturer/Contractor
Israel Aircraft Industries. Tel Aviv, Israel.

SURFACE-TO-AIR MISSILES (SAM)

The modernised 'Hetz' class carries eight-cell silos of IAI Barak 1 point defence missiles. Between two and four such silos are carried.

Specifications
Barak 1
Length: 2.17 m (7.1 ft)
Diameter: 17 cm (6.7 in)
Wing span: 68.4 cm (27 in)
Weight: 97.9 kg (216 lb)
Speed: Mach 2
Range: 6.5 n miles (12 km)
Warhead: 22 kg (48.5 lb)
Guidance: Command to line of sight

Manufacturer/Contractor
Israel Aircraft Industries, Tel Aviv, Israel.

GUNS

'Hetz' class. The class carries a Mk 15 Phalanx close in weapon system forward of the bridge and two US Navy Mk 10 single 20 mm Oerlikons in the superstructure.

'Aliya' class. The 'Aliya' class also carries an OTO-BREDA 76/62 Compact mounting at the stern.

OTOBREDA 76 (3 in) 62 Compact

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Weight: 8.5 t (loaded)
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Hughes Phalanx Mk 15 20 mm CIWS

Specifications
Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km)

Mounting
Weight: 5.42 t
Traverse: 310°
Elevation: −25 to +85°

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA.

US Navy Mk 10 20 mm Oerlikon

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Rate of fire: 450 rds/min
Range: 0.8 n miles (1.5 km)

Mounting
Weight: 499 kg (1,100 lb)
Traverse: 360°
Elevation: −15 to +90°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Elisra NS9003 ESM system

Both classes have the Elisra NS9003 ESM and Elisra NS9005 ECM systems. The NS9003 is an automatic, computer-controlled ESM system covering the E/J-bands with monopulse direction-finding and instantaneous frequency measurement. There are omnidirectional and multibeam static antennas with direction-finding accuracy of 1° in I/J-bands and 3° in E/H-bands.

Elisra NS9005 ECM system

Integrated with the NS9003 is the NS9005, a noise and deception jammer covering the same bands using steerable antennas, low-power exciter and high-power MultiBeam Array Transmitter (MBAT). This is supported by a 45-tube, four or six 24-tube and four single-tube decoy launchers of unidentified manufacture.

Manufacturer/Contractor
Elisra, Israel.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Elbit Naval Tactical Command and Control System (NTCCS)

The ships have an Elbit Naval Tactical Command and Control System (NTCCS) supported by an IAI datalink. The NTCCS is a distributed architecture system based upon Motorola 68020 and 68040 processors using two workstations. The system can handle about 100 targets simultaneously.

Manufacturer/Contractor
Elbit, Israel.

ELECTRO-OPTIC SENSORS

There are two directors, an Officine Galileo OG 20 on the superstructure and an Elop Multisensor Stabilised Integrated System (MSIS) in the mast.

Officine Galileo OG 20

Specifications
Weight: n/k
Elevation: n/k
Sensors: Optical

MSIS

Weight: 60 kg (132 lb)
Elevation: −15 to +85°
Sensors: Thermal imager, TV camera, laser rangefinder

RADARS

The class uses the Neptune search radar and, for weapon control, either two Elta EL/M-2221GM ('Hetz') or an Alenia Orion RTN-10 ('Aliya').

Type	Neptune	RTV-10X (Orion) (two)	EL/M-2221GM (two)
Maker	Thomson-CSF	Alenia	Elta
Role	Search	Weapon control	Weapon control
Frequency	H-band	I-band	I-band
Beam	2 22°	n/k	n/k
Peak power	250 kW	200 kW	n/k
Gain	38 dB	n/k	n/k
Pulsewidth	0,2, 0.5 0.7 µs	1.5 µs	n/k
PRF	n/k	450-550 pps	n/k
Scan rate	12, 24 rpm	n/k	n/k
Typical range	24 n miles (45 km)	n/k	n/k

AVIATION

HELICOPTERS

AIRCRAFT ('Aliya' class)

Eurocopter SA 366G Dauphin

Specifications
Role: Reconnaissance and over-the-horizon targeting
Rotor diameter: 11.93 m (39.14 ft)
Length: 11.44 m (37.5 ft)
Height: 4.07 m (13.35 ft)
Operating weight, empty: 2,300 kg (5,070 lb)
Max take-off weight: 4.050 kg (8,928 lb)
Max level speed: 140 kts (260 km/h)
Engine: 2 Avco Lycoming LTS101-750A-1 turboshafts each rated at 507 kW (680 shp)
Sensors: Unknown radar and MSIS electro-optical
Weapons: None

PROPULSION

Specifications
System: Diesel
Main machinery: 4 Bazan-built MTU 16V 956 TB91 diesels; 11.03 MW (15,000 hp)
Shafts: 4

FURTHER INFORMATION

PROGRAMME

This class has a complicated background. Originally there were four ships with a common hull, of which two were built as helicopter carriers ('Aliya' class — *Aliya* and *Geoula*) and two as FAC-Missiles ('Romat' class — *Romat* and *Keshet*). In addition, Israel shipbuilding then built a third 'Romat' class ship, named *Nirit*, using its own funds, which was eventually taken over in an unfinished state by the navy in 1989.

'ALIYAH' CLASS

The 'Aliya' class uses a lengthened Reshef (Sa'ar 4) hull and has a hangar and flight deck to enable it to operate a single Dauphin helicopter. This enables it to accommodate only two Harpoon launchers which are fitted between the hangar and the mast, and four Gabriel II missile launchers which are mounted on the foredeck, immediately in front of the bridge. The single Mk 15 Vulcan CIWS is mounted in the eyes of the ship. The helicopter is required to enable task groups of which the 'Aliya' class vessel will be the leader, to launch their Harpoon missiles at targets over the horizon, with the helicopter providing mid-course corrections.

HETZ CLASS

The two 'Romat' class ships have an identical hull to the 'Aliya' class, but without the helicopter facilities, which enables them to accommodate more weapons, including four Harpoon and six Gabriel II missiles, a 76 mm/62 gun and a Mk 15 CIWS. When *Nirit* was bought by the government, however, it was completed to a new standard, with Barak SAMs, improved electronics and a large tower mast, under the 'Nirit programme.' These improvements are now being incorporated into the original two ships in the class — *Romat* and *Keshet* — as well as into *Kidon* and *Tarshish*, which were originally built as Sa'ar 4 class vessels, being commissioned in 1973 and 1975, respectively. *Nirit's* name has been changed to *Hetz*, and all five vessels are now known as the 'Hetz' class.

It is anticipated that the remaining six vessels of the 'Reshet' (Sa'ar 4) class will be converted to Hetz class standards at a rate of one per year.

Hetz, *in harbour. Note the heavy armament and the characteristic bulky mast*

BREDA BMB 230

GENERAL SPECIFICATIONS

Country of origin: Italy
Operator: Thailand ('Ratcharit' class)
Type: FAC, Missile

Class: BREDA BMB 230

Built: 3
Active: 3

Displacement:
standard: 235 t
full load: 270 t

Dimensions
Length: 49.8 m (163.4 ft)
Beam: 7.5 m (24.6 ft)
Draught: 2.3 m (7.5 ft)

Speed: 37 kts (20 kts on two engines)
Range: 2,000 n miles (3,700 km) at 15 kts

Complement: 45 (7 officers)

SHIPS

RATCHARIT (321)	
Builder	C N Breda, Venezia, Italy
Launched	30 Jul 1978
Commissioned	10 Aug 1979

WITTHAYAKHOM (322)	
Builder	CN Breda, Venezia, Italy
Launched	2 Sep 1978
Commissioned	12 Nov 1979

UDOMDET (323)	
Builder	CN Breda, Venezia, Italy
Launched	28 Sep 1978
Commissioned	21 Feb 1980

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Aerospatiale Exocet MM 38

There are four launchers for Aerospatiale Exocet MM 38 anti-ship missiles aft of the superstructure and forward of the rear gun mounting. They are forward-facing in crossover configuration with the forward pair facing port and the after pair facing starboard.

Specifications
Length: 5.21 m (17.08 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 22.5 n miles (42 km)
Warhead: 165 kg (365 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles.

GUNS

An OTOBREDA 76/62 Compact is installed forward of the bridge and a single OTOBREDA Bofors 40 mm L/70 at the stern.

OTOBREDA 76/62 Compact

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Weight: 8.5 t (loaded)
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm L/70

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 300 rds/min
Range: 6.75 n miles (12.5 km)

Mounting
Weight: n/k
Traverse: 360°
Elevation: n/k

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-Thorn RDL-2

The 'Ratcharit' class has the Racal-Thorn RDL-2 ESM system, which covers the 1-18.5 GHz range. In addition to the automatic pulse analyser, it includes a frequency measurement capability.

Manufacturer/Contractor
Racal-Thorn, UK.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Signaal WM25

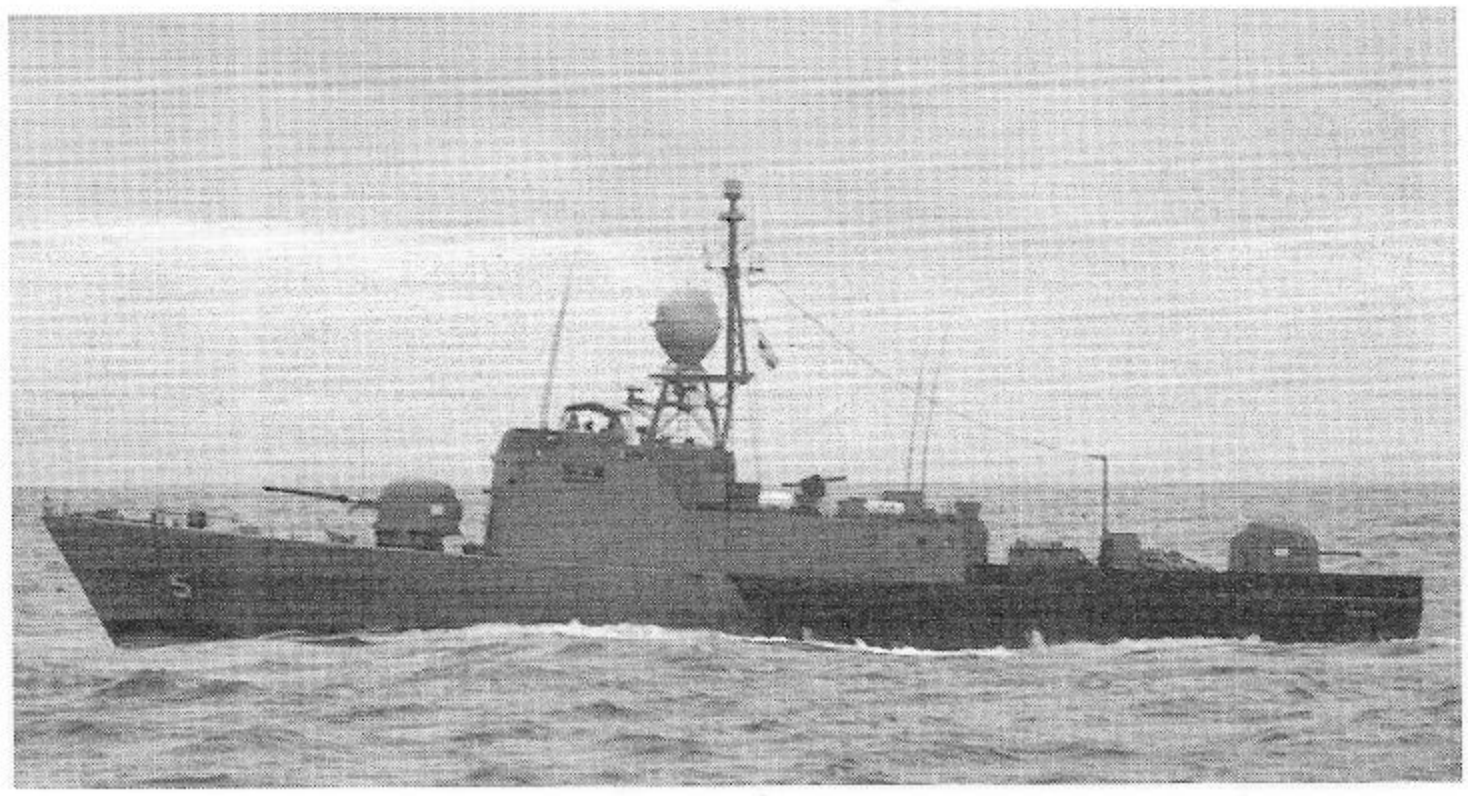
The 'Ratcharit' class has a Signaal WM25 radar-based weapon control system with a mainframe architecture, based upon the SMR mini-computer, and a two-man display and control console. It can operate against two targets simultaneously using one gun or a surface-to-surface missile.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

Signaal WM25

Specifications
Role: Weapon control
Band: I



Witthayakhom *(322)* shown here with her old number (Royal Thai Navy)

Beam: 1.5, 7, 2.4°
Peak power: 200 kW
Gain: 33.5 dB
Pulsewidth: 0.22, 0.45 µs
PRF: 1,800, 3,600 pps
Scan rate: 60 rpm
Typical range: 16 n miles (30 km)

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Racal-Decca Type 1226

Specifications
Role: Surface search
Frequency: I-band
Beam: 1.2°
Peak power: 25 kW
Gain: n/k
Pulsewidth: 0.05, 0.25, 1.0 µs
PRF: 1,300 pps
Scan rate: 25 rpm
Typical range: 20 n miles (37 km)

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

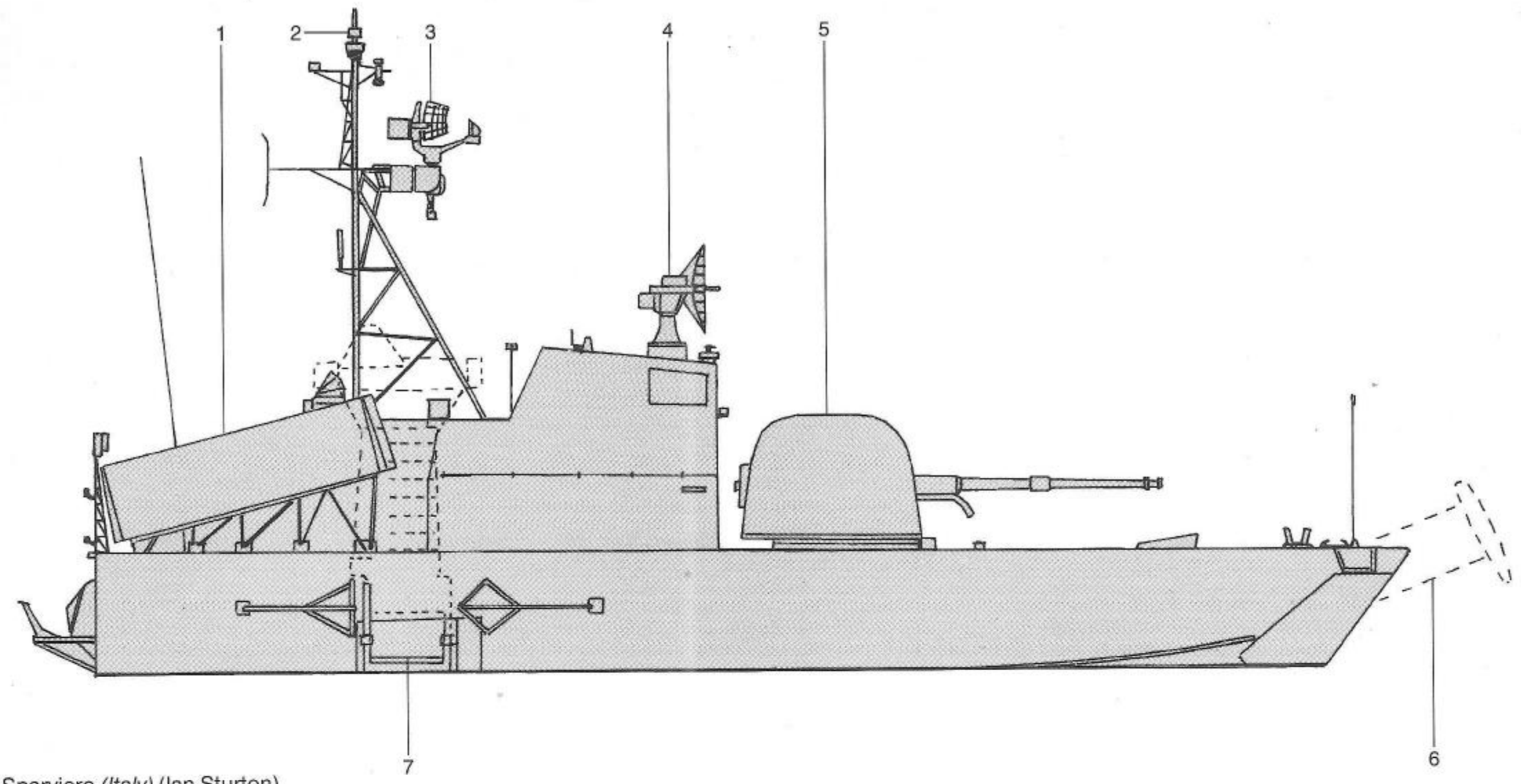
Specifications
System: diesel
Main machinery: 3 MTU MD20V 538 TB91 diesels; 8.47 MW (11,520 hp)
Shafts: 3 with controllable pitch propellers

FURTHER INFORMATION

These vessels, with steel hulls and aluminium alloy superstructures, were ordered from CN Breda, Venice, in 1976, and commissioned between 1979 and 1980.

They are a standard Breda BMB 230 design.

SPARVIERO/PG 01



Sparviero *(Italy)* (Ian Sturton)
1 *Otomat Teseo Mk 2 anti-ship missiles (two)* **2** *DASA Telegon 4 HF/DF system* **3** *SMA SPQ-70 surface search/navigation radar* **4** *Alenia RTN-10X weapon control radar* **5** *OTOBREDA 76 mm (3 in)/62 compact automatic gun* **6** Beam hydrofoil (two) **7** Bow hydrofoil (two)

GENERAL SPECIFICATIONS

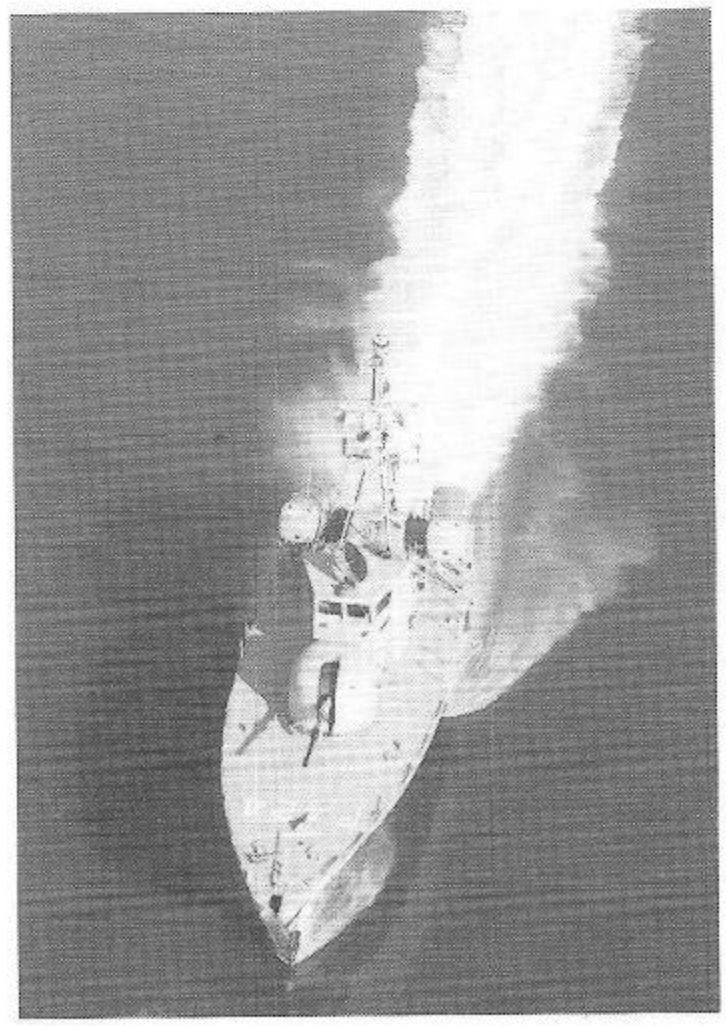
Operators: Italy ('Sparviero'), Japan ('PG 01')
Type: FAC, hydrofoil, missile

Class: SPARVIERO/PG 01

Built: 10
Active: 9

TABLE I: PARTICULARS

	Italy	Japan
	'Sparviero' class	**'PG 01' class**
Displacement		
full load	60.6 t	50 t
Dimensions		
Length		
hullborne	23 m (75.4 ft)	21.8 m (71.5 ft)
foillborne	24.6 m (80.7 ft)	24.6 m (80.7 ft)
beam	7 m (22.9 ft)	7 m (22.9 ft)
draught		
hullborne	1.6 m (5.2 ft)	1.4 m (4.6 ft)
foilborne	4.4 m (14.4 ft)	4.4 m (14.4 ft)
Speed		
hull, diesels	8 kts	8 kts
foils	48 kts	46 kts
Range		
hullborne	1,200 n miles (2,222 km) at 8 kts	1,200 n miles (2,222 km) at 8 kts
foilborne	400 n miles (740 km) at 45 kts	400 n miles (740 km) at 45 kts
Complement	10 (2 officers)	12 (2 officers)



Grifone (Fincantieri)

SHIPS

Italy

NIBBIO (P 421)
Builder Fincantieri, Muggiano, Italy
Launched 29 Feb 1980
Commissioned 6 Mar 1982

FALCONE (P 422)
Builder Fincantieri, Muggiano, Italy
Launched 27 Oct 1980
Commissioned 6 Mar 1982

ASTORE (P 423)
Builder Fincantieri, Muggiano, Italy
Launched 20 Jul 1981
Commissioned 5 Feb 1983

GRIFONE (P 424)
Builder Fincantieri, Muggiano, Italy
Launched 1 Dec 1981
Commissioned 5 Feb 1983

GHEPPIO (P 425)
Builder Fincantieri, Muggiano, Italy
Launched 24 Jun 1982
Commissioned 20 Jan 1983

CONDOR (P 426)
Builder Fincantieri, Muggiano, Italy
Launched 25 Jan 1983
Commissioned 18 Jan 1984

Japan

PG 01 (821)
Builder Sumitomo, Uraga, Japan
Launched 17 Jul 1992
Commissioned 22 Mar 1993

PG 02 (822)
Builder Sumitomo, Uraga, Japan
Launched 17 Jul 1992
Commissioned 22 Mar 1993

PG 03 (823)
Builder Sumitomo, Uraga, Japan
Launched 15 Jun 1994
Commissioned 17 Mar 1995

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

These have launchers for anti-ship missiles right aft and trained forward. Italian vessels carry two Matra/Alenia Otomat Mk 2 while Japanese vessels carry four Mitsubishi SSM-1B, a naval development of a land-based missile.

Otomat Mk 2

Specifications
Length: 4.46 m (14.62 ft)
Diameter: 46 cm (18 in)
Wing span: 1.36 m (4.46 ft)
Weight: 770 kg (1,697.8 lb) (with boosters)
Speed: Mach 0.9
Range: 35 n miles (65 km) (Longer ranges require helicopter support)
Warhead: 210 kg (465 lb)
Guidance: Inertial with active radar homing

Manufacturers/Contractors
Alenia Missile Systems/Matra BAe Dynamics.

Mitsubishi SSM-1B

Specifications
Length: 5.08 m (16.66 ft)
Diameter: 34 cm (13.38 in)
Wing span: n/k
Weight: 660 kg (1,455 lb)
Speed: Mach 0.9
Range: 80 n miles (150 km)
Warhead: 225 kg (496 lb)
Guidance: Inertial navigation with active radar homing

Manufacturer/Contractor
Mitsubishi Heavy Industries, Tokyo, Japan.

GUNS

Italian craft mount a single OTOBREDA 76/62 Compact gun forward, while Japanese craft have a single 20 mm Sea Vulcan 20.

OTOBREDA 76/62 Compact

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

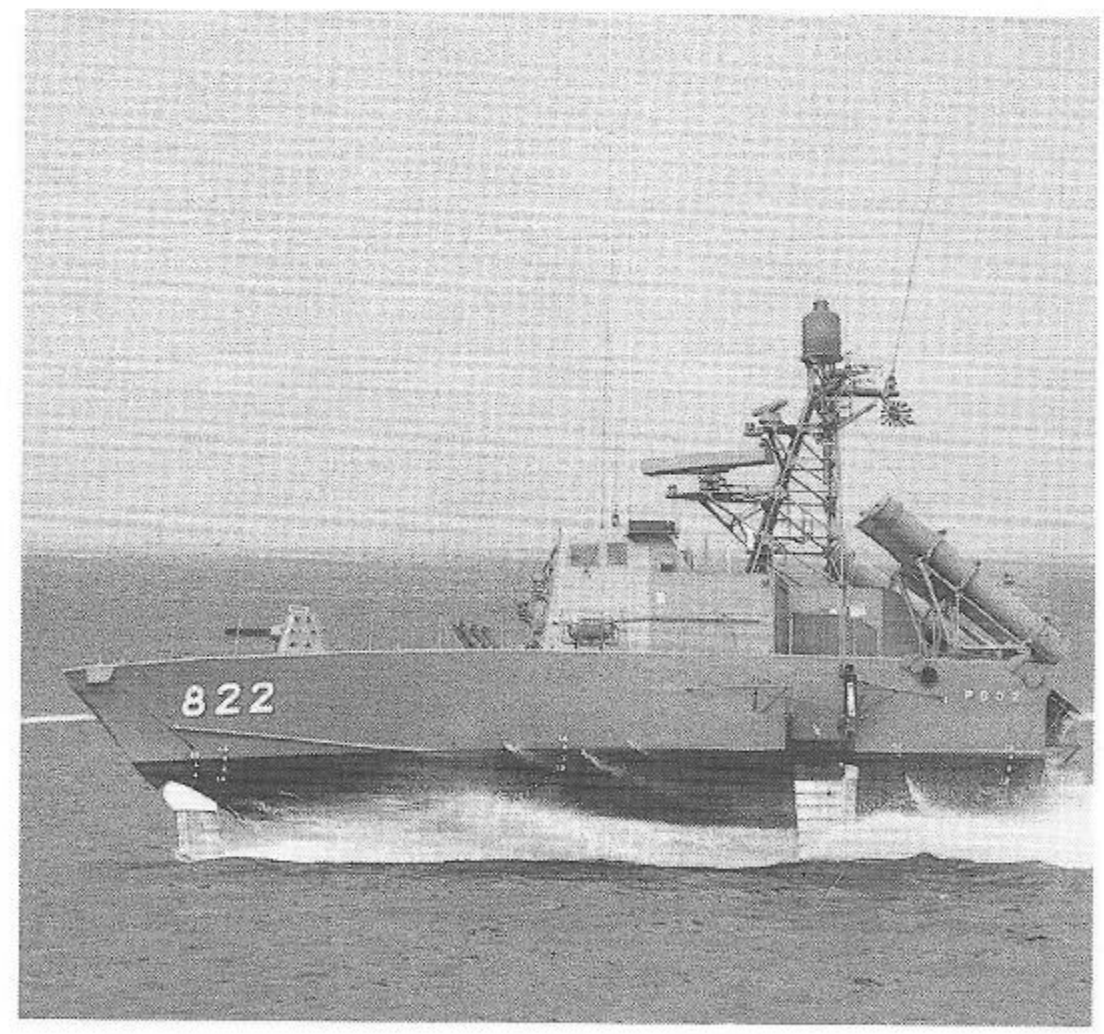
Lockheed Sea Vulcan 20

Specifications
Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire: 1,500 rds/min
Range: 1 n mile (2 km)

Mounting
Traverse: 360°
Elevation: −10 to +55°

Manufacturer/Contractor
Lockheed Martin, Armament Systems, USA.

Gheppio *(P 425). Note the folded hydrofoils, with the OTOBREDA 76 mm gun setting the scale for this small vessel* (Camil Busquets i Vilanova)



PG 02 *(822) of the JMSDF. Maximum speed is 48 knots and these vessels are intended for high-speed interceptions. Note the Sea Vulcan 3-barrel 20 mm on the foredeck; SRBOC chaff launchers immediately before the bridge; and the short mast with surface search and navigation radars and topped by an ESM array. Main weapons are four Mitsubishi SSM-1B mounted on the stern* (Hachiro Nakai)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Elettronica Farad ESM

Italian craft are fitted with the Elettronica Farad ESM system with warning display, direction-finding processor and pulse recognition processor.

Manufacturer/Contractor
Elettronica, Italy

DASA Telegon 4

They also have a DASA Telegon 4 high-frequency direction-finding system with egg-shaped ferrite antenna which limits it to intercepting ground waves.

Manufacturer/Contractor
DASA, Ulm, Germany.

Japan

Japanese craft have an unidentified ESM system.

COUNTERMEASURES

No information is available on Italian systems and while Japanese craft are known to carry an ECM system, no further details are available.

Loral Hycor Mk 36 SRBOC

The Japanese craft have a Mod 1 (Super Rapid Bloom Offboard Countermeasures) decoy system with two Mk 137 launchers, each with six barrels. These are 160 × 43 × 86 cm mortar systems which fire a variety of 130 mm chaff and infra-red munitions from cartridges weighing 3.8/22.7 kg (8.4/50 lb) which create chaff clouds up to 2.5 n miles (4.5 km) from the ship.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

The Italian craft have an Alenia NA 10 radar-based *weapon control system. This has an autonomous one-*man control and display console with a mini-computer and it can control up to three guns and a surface-to-surface missile. No equivalent system is believed to be in Japanese craft although they do have a Link 11 datalink.

RADARS

Italy

Type	MM/SPQ-701	Orion (RTN-10)
Maker	SMA	Alenia
Role	Search	Weapon control
Band	I	I
Beam	0.6°	n/k
Peak power	180 kW	200 kW
Gain	n/k	n/k
Pulsewidth	0.15, 1.5 µs	1.5 µs
PRF	450-550, 2,500-3,000 pps	450-550 pps
Scan rate	15 rpm	n/k

Note
In Italian Navy service the Orion RTN-10 is designated MM/SPG-70.

Japan
Japanese ships have an unidentified I-band search radar.

PROPULSION

Italy, Hullborne

Specifications
System: Diesel
Main machinery: 1 Isotta Fraschini ID 36 N6V; 213 kW (290 hp)
Shafts: 1 retractable

Foilborne

System: Gas turbine
Main machinery: 1 Rolls-Royce Proteus 15M560; 3.17 MW (4,250 hp)
Waterjet: 1

Japan, Hullborne

System: Diesel
Main machinery: 1 diesel of unknown type
Shafts: 1 retractable

Foilborne

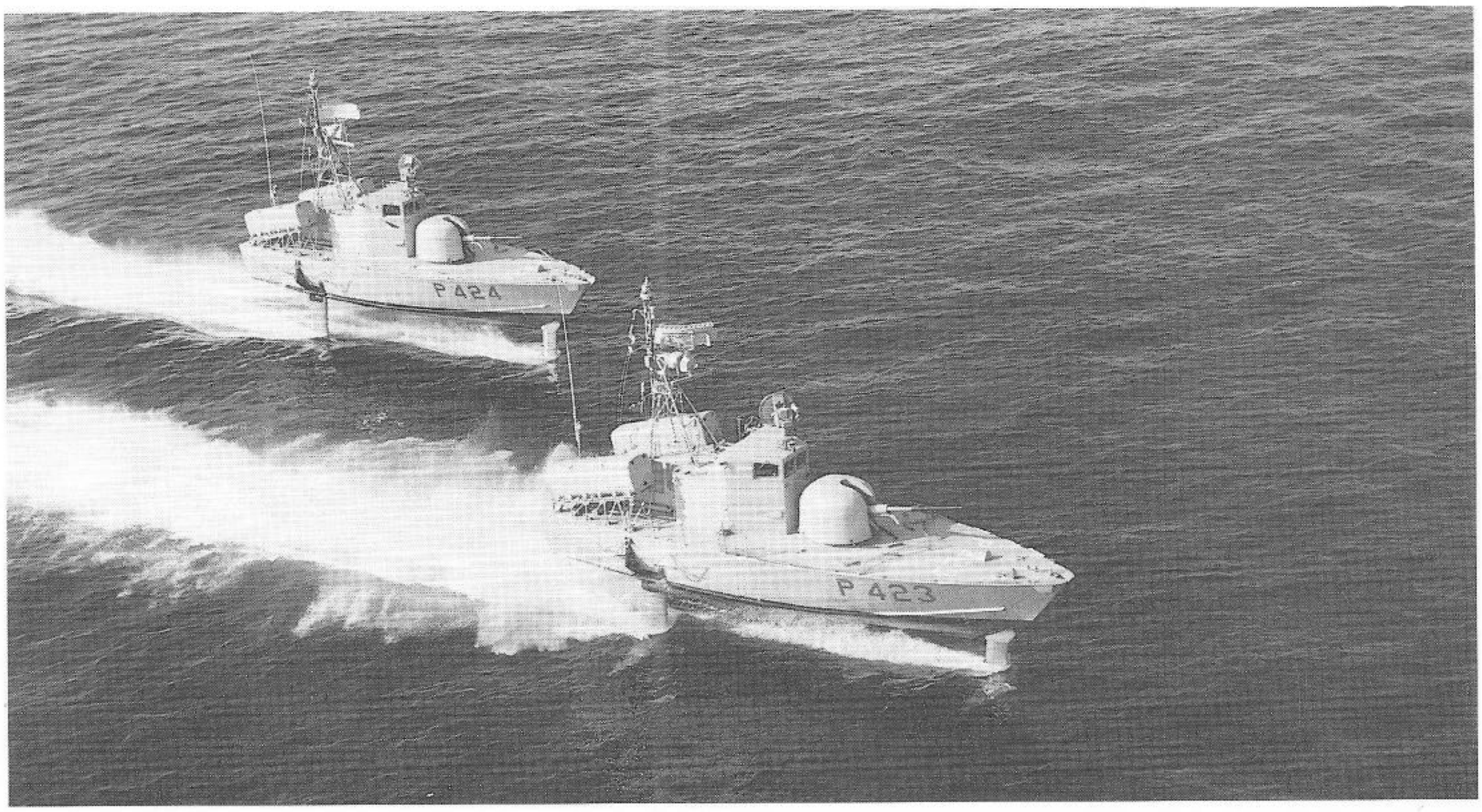
System: Gas turbine
Main machinery: 1 IHI-built GE LM 1500; 4.12 MW (5,522 hp)
Waterjet: 1

FURTHER INFORMATION

These vessels, reportedly based on the American Tucumari design, have aluminium hull and superstructure. The Italian vessels were ordered in 1977 from Fincantieri, Muggiano, Italy and commissioned between 1982 and 1984. They were originally powered by a General Motors 6V-53N diesel, but this was replaced circa 1992/1993 by the current Isotta-Fraschini engine. Plans exist to install a new gas turbine. The vessels carry 11 tonnes of fuel and have no accommodation, being designed for missions of short duration.

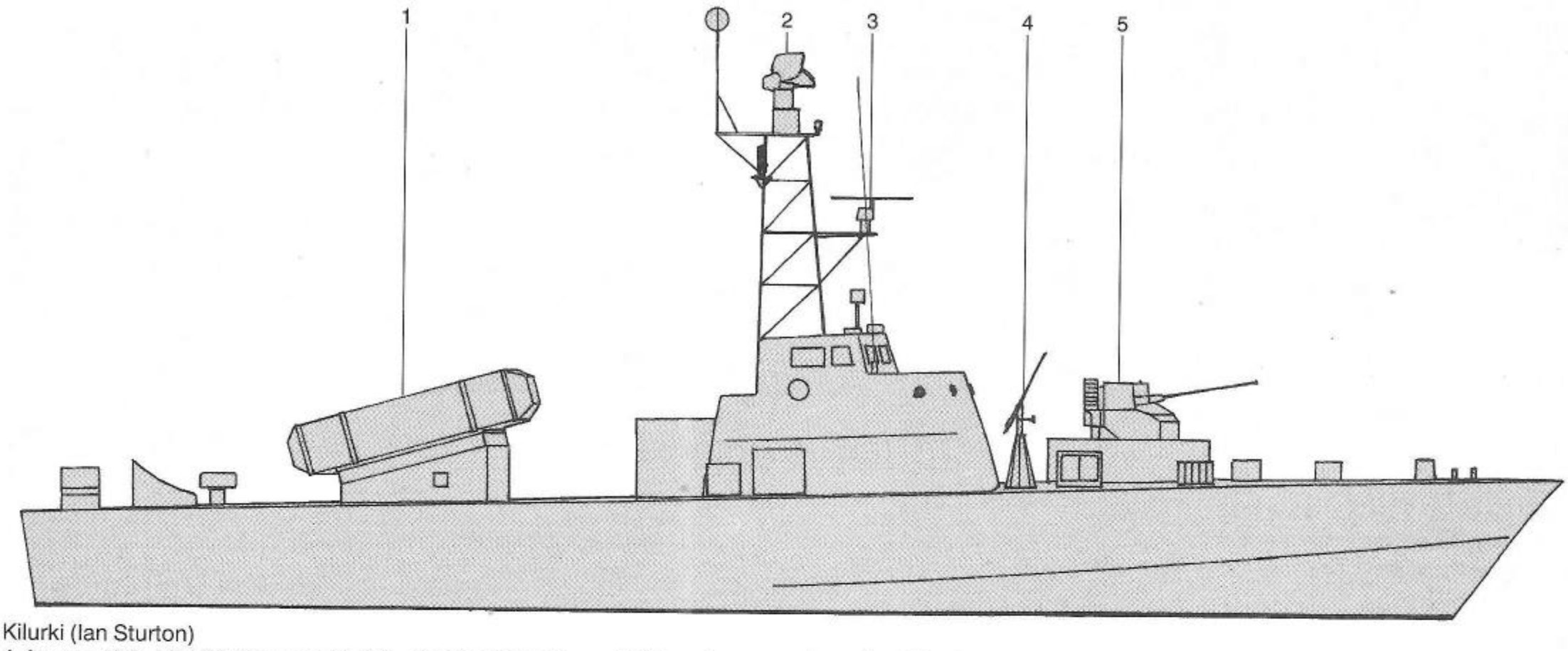
The Japanese versions, built under licence by Sumitomo of Uraga, Japan, were ordered in 1990 and commissioned between 1993 and 1995. Four were planned but only three authorised.

Hydrofoil boats are not as popular as in the early 1980s and it was somewhat surprising that the JMSDF selected the type.



Astore *and* Grifone *of the Italian Navy at speed* (Fincantieri)

KILURKI



Kilurki (Ian Sturton)
1 *Aerospatiale MM 38 Exocet anti-ship missiles* **2** *Raytheon 1645 surface search radar* **3** *Navigation radar; type unknown* **4** *M2HB 12.7 mm machine gun* **5** *USN/Bofors 40 mm/70*

GENERAL SPECIFICATIONS

Operator: Korea, Republic (South Korea)
Type: FAC, Missile

Class: KILURKI

Built: 2
Active: 2

Displacement:
standard: 120 t
full load: 140 t

Dimensions
Length: 33.9 m (108.9 ft)
Beam: 6.9 m (22.6 ft)
Draught: 2.4 m (7.9 ft)

Speed: 40 kts
Range: 800 n miles (1,480 km) at 17 kts

Complement: 29 (5 officers)

SHIPS

KILURKI 71 (PKM 271)
Builder Korea Tacoma, Masan, South Korea
Completed 1972-73

KILURKI 72 (PKM 272)
Builder Korea Tacoma, Masan, South Korea
Completed 1972-73

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Exocet MM 38
These vessels carry two forward-pointing launchers for Aerospatiale Exocet MM 38 anti-ship missiles aft of the bridge and angled outboard.

Specifications
Length: 5.21 m (17.08 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 22.5 n miles (42 km)
Warhead: 165 kg (365 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, Paris, France.

GUNS

Mk 3 Bofors 40 mm L/60
A single US Navy Mk 3 Bofors 40 mm L/60 is installed forward of the bridge.

Specifications
Gun
Calibre: 40 mm
Length of barrel: 56 calibres
Muzzle velocity: 881 m/s (2,890 ft/s)
Rate of fire: 60 rds/min
Range: 5.5 n miles (10 km)

Mounting
Weight: 2 t
Traverse: 360°
Elevation: −6 to +90°

M2HB 12.7 mm machine guns
Two M2HB machine guns are carried

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

The ships carry a UP-17 IFF system but nothing else is known of their electronic warfare equipment.

COMMAND AND CONTROL SYSTEMS

RADAR

Raytheon 1645

Specifications
Role: Search
Band: I
Beam: 4, 25°
Peak power: 4 kW
Gain: n/k
Pulsewidth: 0.08, 0.5, 0.25 µs
PRF: 750, 1,500, 2,250 pps
Scan rate: 24 rpm
Typical range: 32 n miles (59 km)

Manufacturer/Contractor
Raytheon, USA.

PROPULSION

Specifications
System: Diesel
Main machinery:
PKM 271: 2 MTU MB 20V 672 TY 90; 4.26 MW (5,800 hp)
PKM 272: 3 MTU MD 16V 538 TB90; 6.61 MW (9,000 hp)
Shafts:
PKM 271: 2
PKM 272: 3

FURTHER INFORMATION

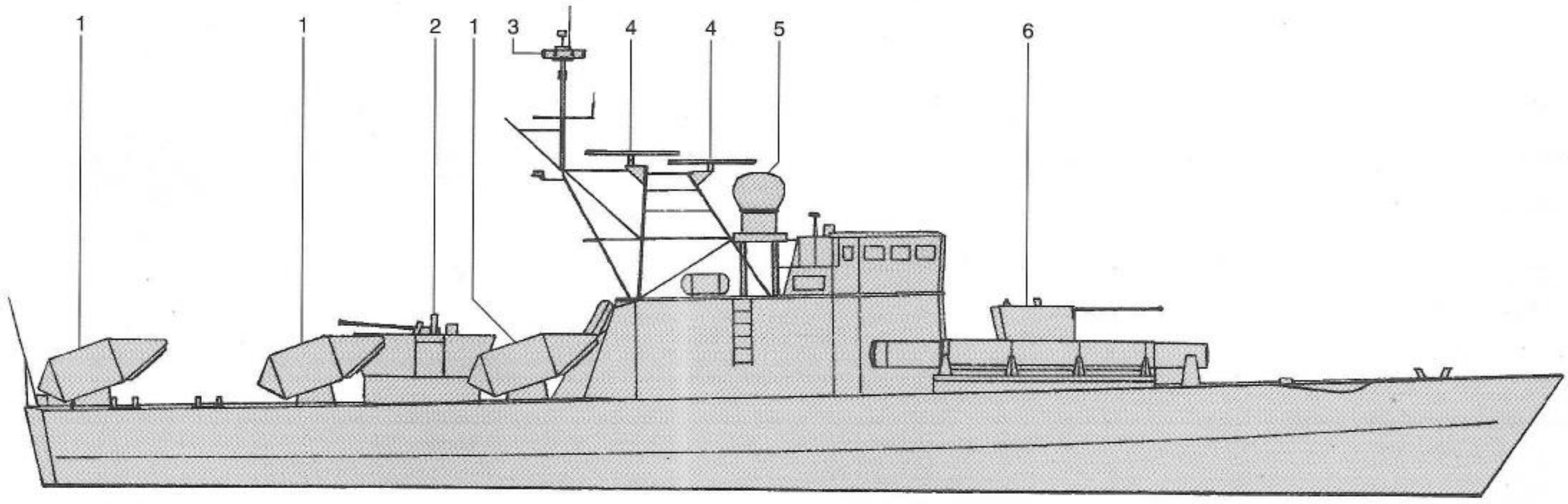
These steel-hulled vessels with aluminium superstructures were built by Korea Tacoma in 1971/1972.

Photographs of these boats show two radar antennas on the mast.

'Kilurki' class FAC (pennant number has been deleted by censor) (G Jacobs)

Kilurki 72 *(PKM 272). This is the three-engined version* (G Jacobs)

HAUK/HUGIN (KAPAREN)



Hauk (Ian Sturton)
1 *NFT Penguin Mk 2 anti-ship missiles (total six)* **2** *Rheinmetall Rh-202 20 mm cannon (being replaced by Mistral SAM)* **3** *ARGOSystem AR-700A ESM* **4** *Racal-Decca TM 1226 radar* **5** *Radome* **6** *Bofors SAK 40 40 mm/70-350*

GENERAL SPECIFICATIONS

Operators: Norway ('Hauk' class), Sweden ('Hugin'/'Kaparen' classes)
Type: FAC, Missile

Class: HAUK

Built: 26
Active: 26

Displacement:
standard: 120 t (Norway)
full load: 160 t (Norway); 150/170 t (Sweden before/after modernisation)

Dimensions
Length: 36.5 m (120 ft)
Beam: 6.2 m (20.3 ft) (Norway); 6.3 m (20.7 ft) (Sweden)

Draught: 1.8 m (5.9 ft) (Norway); 1.7 m (5.6 ft) (Sweden)

Speed: 32 kts (Norway); 36 kts (Sweden)
Range: 440 n miles (815 km) at 30 kts (Norway)

Complement: 24 (6 officers) (Norway); 22 (3 officers) (Sweden)

SHIPS

'Hauk' class (Norway)

HAUK (P 986)
Builder Bergens Mek Verksteder, Bergen, Norway
Commissioned 17 Aug 1977

ORN (P 987)
Builder Bergens Mek Verksteder, Bergen, Norway
Commissioned 19 Jan 1979

TERNE (P 988)
Builder Bergens Mek Verksteder, Bergen, Norway
Commissioned 13 Mar 1979

TJELD (P 989)
Builder Bergens Mek Verksteder, Bergen, Norway
Commissioned 25 May 1979

SKARV (P 990)
Builder Bergens Mek Verksteder, Bergen, Norway
Commissioned 17 Jul 1979

TEIST (P 991)
Builder Bergens Mek Verksteder, Bergen, Norway
Commissioned 11 Sep 1979

JO (P 992)
Builder Bergens Mek Verksteder, Bergen, Norway
Commissioned 1 Nov 1979

LOM (P 993)
Builder Bergens Mek Verksteder, Bergen, Norway
Commissioned 15 Jan 1980

STEGG (P 994)
Builder Bergens Mek Verksteder, Bergen, Norway
Commissioned 18 Mar 1980

FALK (P 995)
Builder Bergens Mek Verksteder, Bergen, Norway
Commissioned 30 Apr 1980

RAVN (P 996)
Builder Westamarin A/S, Alta, Norway
Commissioned 20 May 1980

GRIBB (P 997)
Builder Westamarin A/S, Alta, Norway
Commissioned 10 Jul 1980

GEIR (P 998)
Builder Westamarin A/S, Alta, Norway
Commissioned 16 Sep 1980

ERLE (P 999)
Builder Westamarin A/S, Alta, Norway
Commissioned 10 Dec 1980

'Hugin' class (Sweden)

HUGIN (P 151)
Builder Bergens MV, Bergen, Norway
Commissioned 3 Jul 1978

MUNIN (P 152)
Builder Bergens MV, Bergen, Norway
Commissioned 3 Jul 1978

MODE (P 154)
Builder Westamarin A/S, Alta, Norway
Commissioned 12 Jan 1979

VIDAR (P 156)
Builder Westamarin A/S, Alta, Norway
Commissioned 10 Aug 1979

'Kaparen' class (Sweden)

KAPAREN (P 159)
Builder Bergens MV, Bergen, Noway
Commissioned 7 Aug 1980
Modernised 1991-1994

VAKTAREN (P 160)
Builder Bergens MV, Bergen, Norway
Commissioned 19 Sep 1980
Modernised 1991-1994

SNAPPHANEN (P 161)
Builder Bergens MV, Bergen, Norway
Commissioned 14 Jan 1980
Modernised 1991-1994

SPEJAREN (P 162)
Builder Bergens MV, Bergen, Norway
Commissioned 21 Mar 1980
Modernised 1991-1994

STYRBJÖRN (P 163)
Builder Bergens MV, Bergen, Norway
Commissioned 15 Jun 1980
Modernised 1991-1994

STARKODDER (P 164)
Builder Bergens MV, Bergen, Norway
Commissioned 24 Aug 1981
Modernised 1991-1994

TORDÖN (P 165)
Builder Bergens MV, Bergen, Norway
Commissioned 26 Oct 1981
Modernised 1991-1994

TIRFING (P 166)
Builder Bergens MV, Bergen, Norway
Commissioned 23 Jan 1982

Modernised 1991-1994

WEAPONS SYSTEMS

ANTI-SHIP MISSILES

Penguin Mk 2

These FACs have up to six forward-facing launchers for NFT Penguin Mk 2 anti-ship missiles on the after deck in outward angled pairs.

Specifications
Length: 3.0 m (9.84 ft)
Diameter: 28 cm (11.02 in)
Wing span: 1.42 m (4.65 ft)
Weight: 340 kg (750 lb)
Speed: Mach 0.8
Range: 14 n miles (27 km)
Warhead: 120 kg (264.6 lb)
Guidance: Inertial navigation with infra-red homing

Manufacturer/Contractor
NFT, Kongsberg, Norway.

SURFACE-TO-AIR MISSILES (SAM)

Mistral

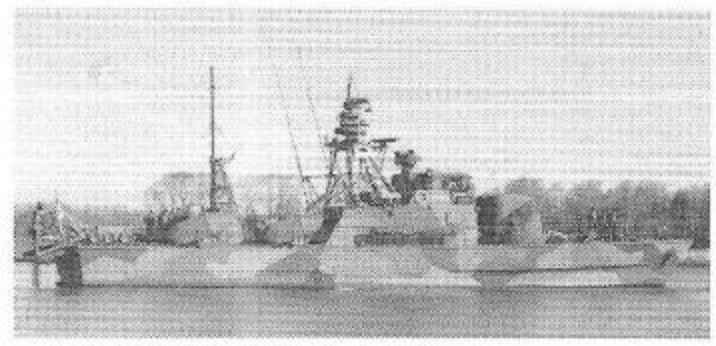
'Hauk' class (Norway) only. Since 1994 the Norwegian vessels have received the Sinbad launcher system with two Matra Mistral point defence missiles.

Specifications
Length: 1.81 m (5.9 ft)
Diameter: 9.2 cm (3.6 in)
Wing span: 11.1 cm (4.4 in)
Weight: 18.4 kg (40.5 lb)
Speed: Mach 2.6
Range: 2.7 n miles (5 km)
Warhead: 2.95 kg (6.5 lb)
Guidance: Infra-red passive homing

Manufacturer/Contractor
Matra BAe Dynamics.

TUBES

'Hauk' class (Norway) only. The Norwegian vessels have two 533 mm (21 in) torpedo tubes forward of the bridge and these fire Bofors Tp 617 torpedoes.



Snapphanen *(P 161). One of the modernised 'Kaparen' class, this has a VDS at the stern. Note also the depth charges and four Penguin anti-ship missiles* (Hartmet Ehlers)

TORPEDOES

Bofors Tp 617

Specifications
Length: 6.98 m (23.0 ft)
Diameter: 533 mm (21 in)
Weight: 1,860 kg (4,101 lb)
Propulsion: Hydrogen peroxide/alcohol
Speed: 45 kts
Range: 10.75 n miles (20 km)
Warhead: 240 kg (529 lb)
Guidance: Wire and active/passive sonar

Manufacturer/Contractor
Bofors, Sweden

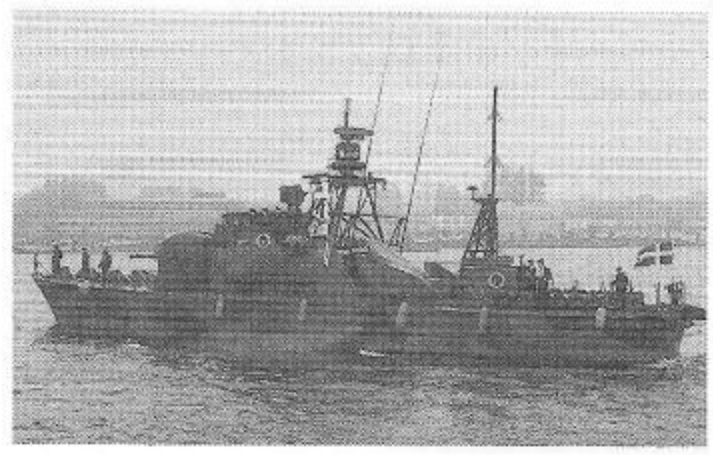
GUNS

'Hauk' class (Norway only. The Norwegian ships have a Bofors 40 mm SAK 40 L/70-350 gun forward of the bridge. They also had a Rheinmetall Rh-202 20 mm gun but this is now being replaced by the Mistral system.

'Hugin'/Kaparen' classes (Sweden) only. Swedish vessels have a Bofors single 57 mm SAK 57 Mk 1 forward of the bridge.

Bofors SAK 57 Mk 1

Specifications
Gun
Calibre: 57 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,020 m/s (3,346 ft/s)
Rate of fire: 200 rds/min
Range: 9 n miles (17 km)



Tordön *(P 165) with two Penguin launchers in the forward position and the remainder of the quarterdeck given over to mines, of which a maximum of 24 can be carried* (Dieter Wolf)

Mounting
Traverse: 360°
Elevation: −10 to +75°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Bofors SAK 40 L/70-350

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 300 rds/min
Range: 6.75 n miles (12.5 km)

Mounting
Traverse: 360°
Elevation: −9 to +85°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

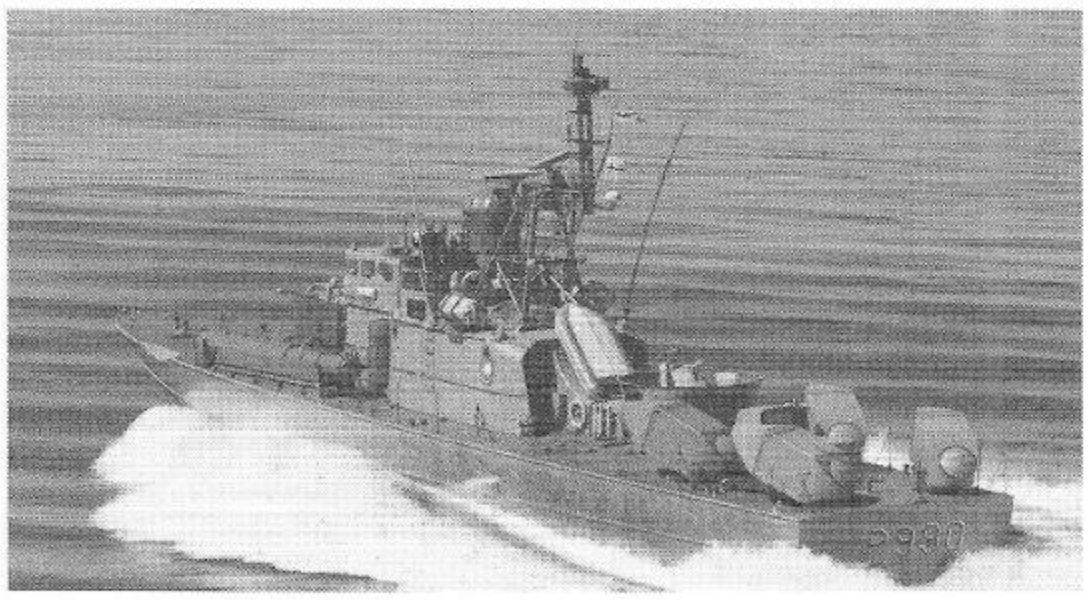
ASW WEAPONS

Saab Elma

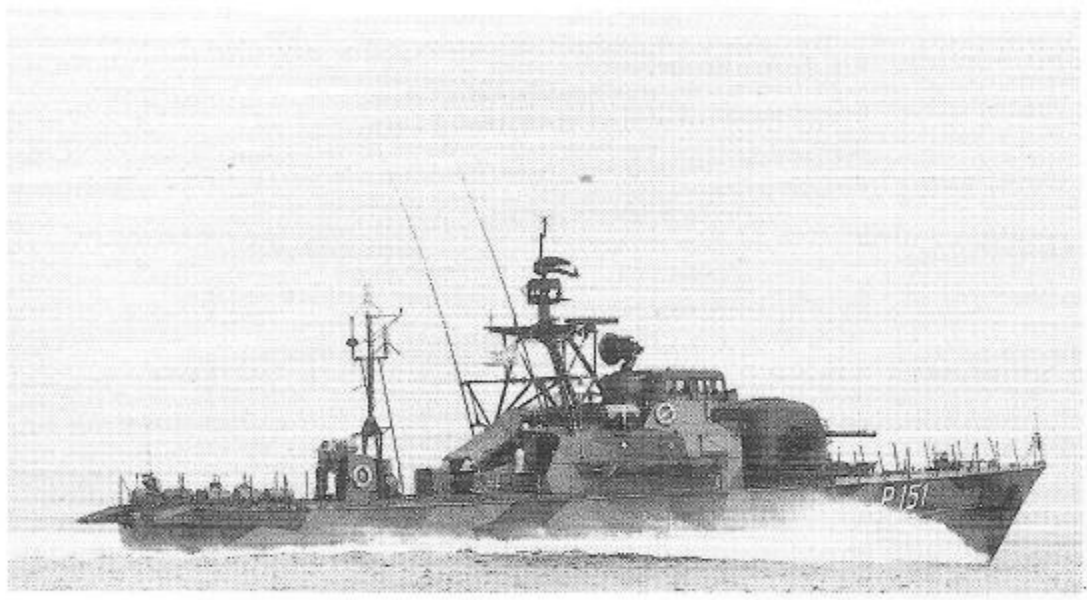
Hugin/Kaparen classes (Sweden) only. Swedish vessels have the Saab Elma ASW mortar system with four launchers.

Depth Charges

Hugin/Kaparen classes (Sweden) only. The Swedish vessels are fitted with two depth-charge racks.



Skarv *(P 990) one of 14 'Hauk' class FACs of the Royal Norwegian Navy. Note the 533 mm torpedo tube, Rheinmetall Rh-202 20 mm gun (abaft the upturned boat) and four Penguin Mk 2 anti-ship missile launchers* (Antonio Moreno)



Hugin *(P 151) one of the four unmodernised Swedish FACs. The hull is the same as the Norwegian 'Hauk' class, but the armament is different, as are the sensors. Note the depth charges being carried on the quarterdeck and the two chutes over the stern* (H & L van Ginderen Collection)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

ARGO AR-700A

'Hauk' class (Norway) only. Norwegian ships have the AR-700A receiver system which covers the C/J-bands. The wide open, monopulse, direction-finding and parallel instantaneous frequency receiver approach ensures there is no channelisation or band-stepping to degrade performance.

Manufacturer/Contractor
ARGOSystems, USA

Saab EWS-905

'Hugin/Kaparen' classes (Sweden) only. The EWS is designed to identify targets detected by the ship's radar with the antenna automatically turning in the appropriate direction. The system has surveillance, alert and decision modes with the display showing band, pulse interval/length and scan time. It automatically triggers the decoy launchers.

Manufacturer/Contractor
CelsiusTech, Sweden.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

NFT MSI-80S tactical system

'Hauk' class (Norway) only. For weapon control, Norwegian vessels have an NFT MSI-80S electro-optical weapon control system. This is a mainframe architecture system based upon the KS500 mini-computer with a console which has tactical situation (with radar input from the twin 1226 radars), electro-optical sensor and weapon control displays. The system also has a torpedo control panel.

Manufacturer/Contractor
NFT, Kongsberg, Norway.

CelsiusTech 9LV 200 Mk 2 (Sweden)

'Hugin/Kaparen' classes (Sweden) only. The 9LV 200 Mk 2 is a radar-based weapon control system of mainframe architecture using the Phillips P800 minicomputer for the control of one medium and one light calibre gun mounting as well as surface-to-surface missiles. There is a tactical display system and two gun control displays, for ASuW and AAW operations.

Manufacturer/Contractor
CelsiusTech, Sweden.

RADARS

Racal-Decca TM 1226 (two sets)

'Hauk' class (Norway) only.

Specifications
TM 1226 (2)
Role: Search
Frequency: I-band
Beam: 1.2°
Peak power: 25 kW
Pulse rate: 0.05, 0.25, 1.0 µs
PRF: 1,300 pps
Scan rate: 25 rpm
Typical range: 20 n miles (37 km)

Manufacturer/Contractor
Racal Decca.

Ørn (P 987). Note the twin 1226 radar antennas which are part of the MSI-80S tactical command system
(H & L van Ginderen Collection)

'Hugin/Kaparen' classes (Sweden) only.

Type	Skanter 16	9GR600
Maker	Terma	CelsiusTech
Role	Search	Weapon control
Frequency	I-band	I-band
Beam	1°	1.1, 7°
Peak power	20 kW	200 kW
Gain	n/k	35.5 dB
Pulsewidth	0.06, 0.6 µs	0.25, 1 µs
PRF	2,200, 4,400 pps	1,000, 3,000 pps
Scan rate	20-48 rpm	60 rpm
Typical range	n/k	n/k

SONARS

Simrad SQ-3D/SF

Norwegian vessels have a hull-mounted SQ-3D/SF sonar system, which operates at 24 kHz with a peak power of 4 kW and performs automatic search in azimuth of 360° and in elevation of 90° with a range of 1.5 n miles (2.5 km).

Simrad SA 950/ST 570 Toadfish

The Swedish 'Kaparen' class has a Simrad SA 950 hull-mounted and a Simrad ST 570 Toadfish variable depth sonar. The SA 950 is a mine detection/avoidance sonar operating at 95 kHz with beams covering 45° in azimuth, the antenna being trainable (±190°) and tiltable (−90 to +10°). The Toadfish is a lightweight active sonar operating at 57 kHz and creating 64 digitally formed beams with a range of 6.5 n miles (12 km).

ELECTRO-OPTIC SENSORS

Norway

The MSI-80S includes a director with low-light television, infra-red, optical, and a 5 MW Nd:YAG laser-rangefinder sensor collimated to the TV camera which has a 2.8° field of view.

Manufacturer/Contractor
NFT, Kongsberg, Norway.

PROPULSION

'Hauk' class (Norway).

Specifications
System: Diesel
Main machinery: 2 MTU 16V 538 TB92; 5 MW (6,820 hp)
Shafts: 2

'Hugin/Kaparen' class (Sweden).

Specifications
System: Diesel
Main machinery:
'Kaparen' class: 2 MTU 16V 396 TB94; 4.26 MW (5,800 hp)
'Hugin' class: 2 MTU 20V 672 TY90; 4.26 MW (5,800 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

Ordered for the Norwegian Navy in 1975, this class was built by Bergens Mek Verksteder (10 vessels) and Westamarin A/S, Alta (the former Westermoens Baatbyggeri).

In 1971, a prototype FAC similar to the 'Hauk' class was ordered from Bergens MV for Sweden as the Jägaren. Following extensive trials, a slightly modified version was ordered in 1975 as the 'Hugin' class, being built largely at Bergens MV (except for *Mode* and *Vidar*, which were built at Westamarin) and they were commissioned between 1978 and 1982.

DESIGN

The hull of the 'Hugin' class is made of welded steel, with GRP superstructure, and divided into nine watertight compartments. The engines were originally installed in the 'Plejad' class FACs (as Daimler Benz Type 518) but were reconditioned before installation in the new ships. Electrical power is provided by two Hitzinger 100 kVA generators.

The SAK 57 includes mounting rails for eight 103 mm illuminant rockets. Swedish vessels also have two racks of depth charges and mine rails for 24 mines, which may be installed instead of missile launchers.

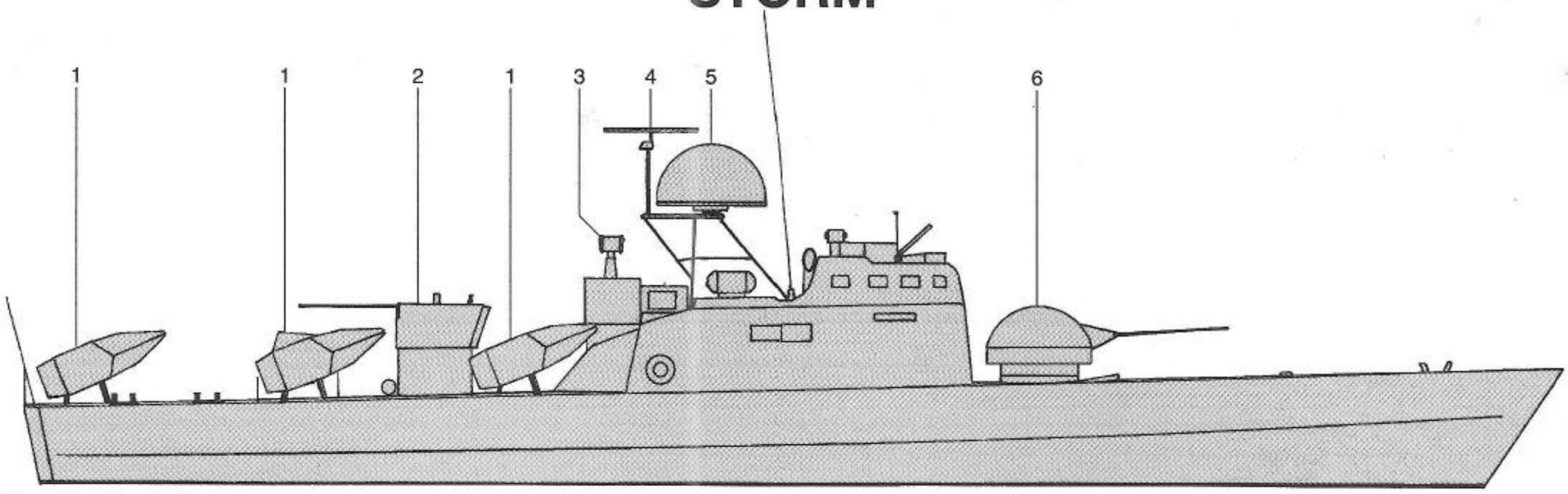
Orignially the Swedish craft were treated as one ('Hugin') class, but between 1991 and 1994 P159-P166 received half-life modernisation, which included new MTU 16V 396 TB94 engines, giving them improved loiter capacity, and the replacement of SQ-3D/SF sonars. As a result, these FACs are now known as the 'Kaparen' class.

RESERVE

Four of the Swedish boats were laid up in reserve in July 1994:

Magne (P 153)
Vale (P 155)
Mjölner (P 157)
Mysing (P 158)

STORM



Storm (Ian Sturton)
1 *Penguin Mk 1 anti-ship missile (total six)* **2** *Bofors SAK 40L/70-350 40 mm gun (in open mount)* **3** *Saab TVT-300 electro-optical tracker* **4** *Racal-Decca TM 1226 navigation radar* **5** *Nera SR-1A ESM* **6** *Bofors TAK 76 76 mm/50 automatic gun*

GENERAL SPECIFICATIONS

Operator: Norway
Type: FAC, Missile

Class: STORM

Built: 20
Active: 8

Displacement:
standard: 100 t
full load: 138 t

Dimensions
Length: 36.5 m (120 ft)
Beam: 6.2 m (20.3 ft)
Draught: 1.8 m (5.9 ft)

Speed: 32 kts
Range: 550 n miles (1,020 km) at 32 kts

Complement: 22 (6 officers)

SHIPS

BLINK (P 961)
Builder Bergens Mek Verksteder, Norway
Commissioned 18 Dec 1965

KJEKK (P 965)
Builder Bergens Mek Verksteder, Norway
Commissioned 1966

DJERV (P 966)
Builder Westermoen, Mandal, Norway
Commissioned 1966

SKUDD (P 967)
Builder Bergens Mek Verksteder, Norway
Commissioned 1966

STEIL (P 969)
Builder Westermoen, Mandal, Norway
Commissioned 1967

HVASS (P 972)
Builder Westermoen, Mandal, Norway
Commissioned 1967

Hvass *(P 972)* (H & L van Ginderen Collection)

BRASK (P 977)
Builder Bergens Mek Verksteder, Norway
Commissioned 1967

GNIST (P 979)
Builder Berkens Mek Verksteder, Norway
Commissioned 1968

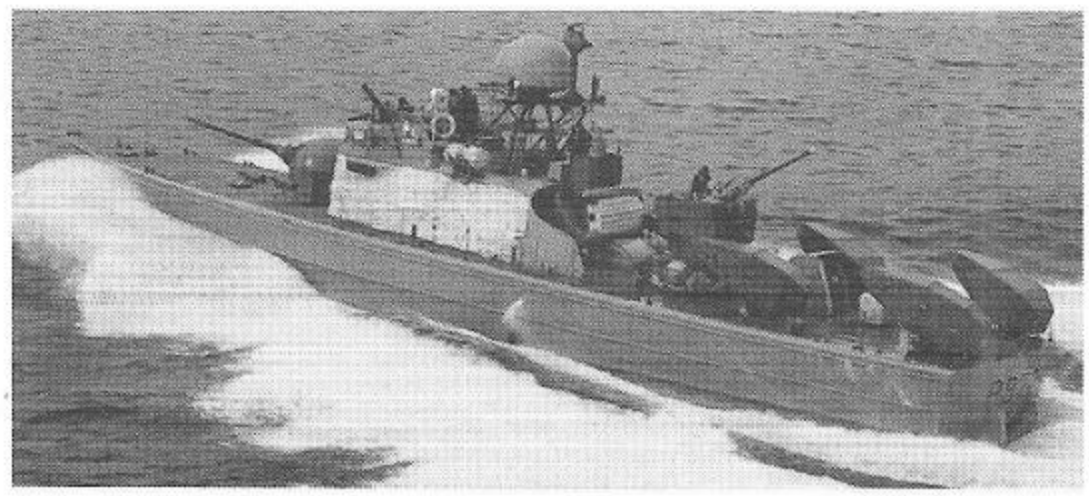
WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

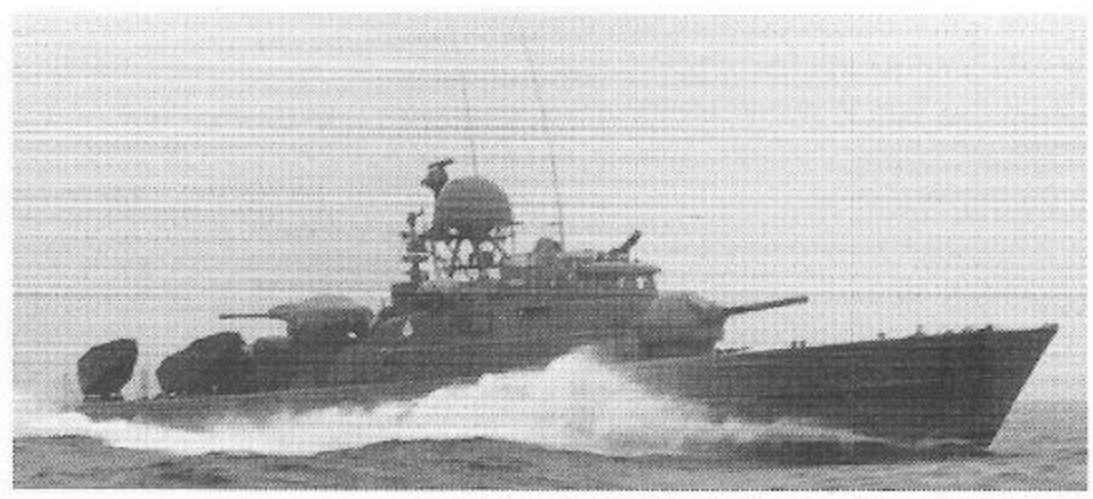
Penguin Mk 1

The 'Storm' class carries up to six NFT Penguin Mk 1 anti-ship missiles with the launchers facing forward, but angled outboard, in pairs on the afterdeck.

Specifications
Length: 3.0 m (9.84 ft)
Diameter: 28 cm (11.02 in)
Wing span: 1.42 m (4.65 ft)
Weight: 330 kg (727.6 lb)
Speed: Mach 0.7
Range: 10 n miles (18.5 km)
Warhead: 120 kg (264.6 lb)
Guidance: Inertial navigation with infra-red homing



Hvass *(P 972). Note the four Penguin anti-ship missiles on the afterdeck — a further two can be mounted abreast the gun.* (Jane's/David Miller)



Steil *(P 969) at speed. The Bofors TAK 76 on the foredeck has a maximum elevation of +30°, limiting it to anti-surface engagements.*

Manufacturer/Contractor
NFT, Kongsberg, Norway.

GUNS

A Bofors TAK 76 single 76 mm gun is installed forward of the bridge and a Bofors 40 mm SAK 40 L/70-350 aft of the superstructure. Note that since the maximum elevation of the TAK 76 is +30°, it has no air defence capability.

Bofors TAK 76

Specifications
Gun
Calibre: 76 mm
Length of barrel: 50 calibres
Muzzle velocity: 825 m/s (2,706 ft/s)
Rate of fire: 30 rds/min
Range: 6.8 n miles (12.5 km)

Mounting
Traverse: 350°
Elevation: −10 to +30°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Bofors SAK 40 L/70-350

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 300 rds/min
Range: 6.75 n miles (12.5 km)

Mounting
Traverse: 360°
Elevation: −9 to +85°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Nera SR-1A

These ships carry the Nera SR-1A radar-intercept receiver with rotating antenna (rotating at up to 5,000 rpm) and fixed octagonal horn array. The system covers the E/J-bands (2.5-18 GHz) with a bearing accuracy of 3.5° and 22.5° per antenna group. (Nera A/S no longer manufactures defence equipment).

COMMAND AND CONTROL SYSTEMS

Signaal WM26

The 'Storm' class has a Signaal WM26 radar-based weapon control system. This has a mainframe architecture based upon the SMR mini-computer with a two-man display and control console. It can operate against one target using either a gun or a surface-to-surface missile. It is the only one in the 'WM' series not to use the Signaal 'egg'.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

Type	TM 1226	WM26
Maker	Racal-Decca	Signaal
Role	Search	Weapon control
Band	I	I
Beam	1.2°	1.5, 7, 2.4°
Peak power	25 kW	180 kW
Gain	n/k	33.5 dB
Pulsewidth	0.05, 0.25, 1.0 µs	0.22, 0.45 µs
PRF	1,300 pps	1,800,3,600 pps
Scan rate	25 rpm	60 rpm
Typical range	20 n miles (37 km)	15 n miles (28 km)

ELECTRO-OPTIC SENSORS

Saab Dynamics TVT-300

A Saab Dynamics TVT-300 electro-optical tracker is carried aft of the main mast.

Specifications
TVT-300
Weight: 160 kg (353 lb)
Elevation: −30 to +85°
Sensors: TV camera

Manufacturer/Contractor
CelsiusTech, Sweden.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU MB 16V 538 TB90; 4.41 MW (6,000 hp)
Shafts: 2

FURTHER INFORMATION

This class was originally designed as Motor Gun Boats, with the prototype, *Storm*, being completed in 1963. The remainder were built between 1965 and 1968 and received missile systems from 1970 onwards when they also received the TVT 300 and laser rangefinder electro-optical systems, while TM 1226 radar replaced the TM 909. In addition to the weapons mentioned above, two depth charge rails may be fitted in place of the after missile launchers. Three disarmed vessels were transferred to Estonia, Latvia and Lithuania as patrol boats in 1994.

KOMAR (PROJECT 183R)/SHANTOU/SOHUNG

GENERAL SPECIFICATIONS

Country of origin: Russia
Operators: North Korea ('Komar', 'Shantou', 'Sohung'), Syria ('Komar')

Type: FAC, Torpedo ('Shantou'); FAC, Missile ('Komar'/'Sohung')

Class: KOMAR (PROJECT 183R)/SHANTOU/SOHUNG

Built: 702 ('Shantou'), 152 ('Komar'), 6 ('Sohung')

SHIPS

North Korea: Hull numbers not known
Syria: 44, 45, 46

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Korean 'Komar'/'Sohung' class vessels have two launchers beside the rear of the superstructure and these have either Russian SS-N-2a 'Styx' or its Chinese derivative CSS-N-1.

SS-N-2a 'Styx'

Specifications
Length: 5.8 m (19 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.9 ft)
Weight: 2,870 kg (6,328 lb) (with booster)
Speed: Mach 0.9
Range: 24 n miles (45 km)
Warhead: 454 kg (1,001 lb)
Guidance: Autopilot with active radar

Manufacturer/Contractor
Raduga, Russia.

SY-1 (CSS-N-1 'Scrubbrush')

Specifications
Length: 5.8 m (19 ft)
Diameter: 76 cm (30 ins)
Wing span: 2.4 m (7.8 ft)
Weight: 2,300 kg (5,071 lb) excluding 570 kg (1,257 lb) boosters
Speed: Mach 0.9
Range: 21.5 n miles (40 km)
Warhead: 454 kg (1,001 lb)
Guidance: Autopilot and active radar

TUBES

The 'Shantou' class carries two 533 mm (21 in) torpedo tubes with torpedoes of unknown type.

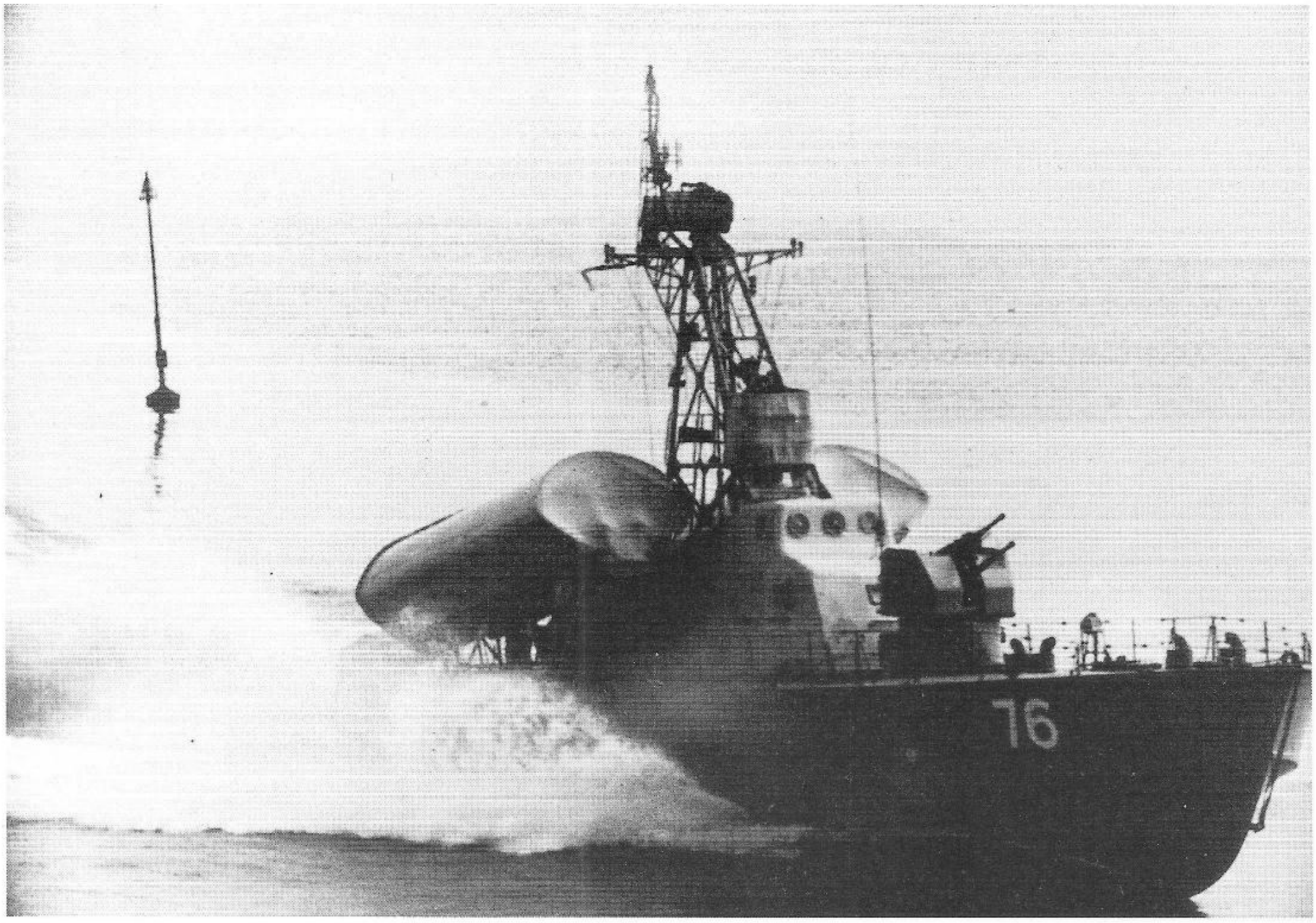
GUNS

The 'Shantou' class has gun mountings forward of the bridge and at the stern. These mountings consist of 2-M-3 twin 25 mm or 70K single 37 mm. The 'Komar'/'Sohung' class carries a 2-M-3 twin 25 mm gun mounted forward of the bridge.

70K

Specifications
Gun
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 880 m/s (2,887 ft/s)
Rate of fire: 80 rds/min
Range: 2.2 n miles (4 km)

Mounting
Weight: 1.75 t
Traverse: 360°
Elevation: −10 to +85°



A Russian-built 'Komar' class FAC-M, with the relatively small boat totally dominated by the two launcher-containers for SS-N-2a Styx missiles (US Navy)

2-M-3

Gun
Calibre: 25 mm
Length of barrel: 60 calibres

Muzzle velocity: n/k
Rate of fire: 450 rds/min/barrel
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,180 ft)

Mounting
Weight: 1.7 t (loaded)
Traverse: 360°
Elevation: −10 to +85°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Apart from the use of 'Square Head' IFF by the 'Komar'/'Sohung' classes nothing is known of the electronic warfare systems in these vessels.

COMMAND AND CONTROL SYSTEMS

RADARS

Skin Head — 'Shantou'

Specifications
Role: Surface search/fire control
Frequency: F-band
Beam: 17°

Peak power: 80 kW
Pulsewidth: 1 µs
PRF: 400 pps
Typical range: 17 n miles (31.5 km)

Note
This radar has the Russian designation Zarnista.

Square Tie — 'Komar'/'Sohung'

Specifications
Role: Search
Frequency: I-band
Peak power: 20 kW
PRF: 1,000, 2,000, 4,000 pps
Scan rate: 5, 15 rpm
Typical range: 25 n miles (46 km)

PROPULSION

Specifications
System: Diesel
Main machinery: 4 Type M 50; 3.3 MW (4,400 hp)
Shafts: 4

FURTHER INFORMATION

The steel-framed, wooden hard-chine hull, Project 183 Motor Torpedo Boat was designed by a design bureau run by the secret police (NKVD) and built between 1952 and 1960. They were known in the West as 'P6' (although some were also designated 'P8' and 'P10') and proved very successful, with some 190 (30 per cent) being transferred later by the Soviet Union to its (then) allies and friends. Some of the North Korean vessels have hydrofoils. The 'Shantou' (or 'Swatow') was a steel-hulled version built in China between 1956 and 1966, of which 20 were transferred to allies and friendly nations.

With the development of the P15 (SS-N-2A 'Styx') anti-ship missile and pending the introduction of the 'Osa' class (Project 205) the design was adapted for missiles as Project 183R. They were built from December 1959 and December 1965 and received the NATO designation 'Komar'. It is reported that 77 (68 per cent) were transferred to allied or friendly navies with the Korean 'Komars' transferred from the Soviet Union and later given steel hulls to replace their wooden ones. China built 40 'Komar' class then the 'Hegu' class. The 'Sohung' class is a copy of the 'Komar' class built from 1980/1981 although it is unclear whether or not they have wooden or steel hulls. The Syrian vessels were laid up between 1987 and 1990, but were then refitted and returned to service.

In addition to the FACs, 60 'MO-VI' (Project 199) patrol boats using the Project 183 hull were also produced.

Only some 37 remain in service, plus the Egyptian-developed '6 October' class; see separate entry.

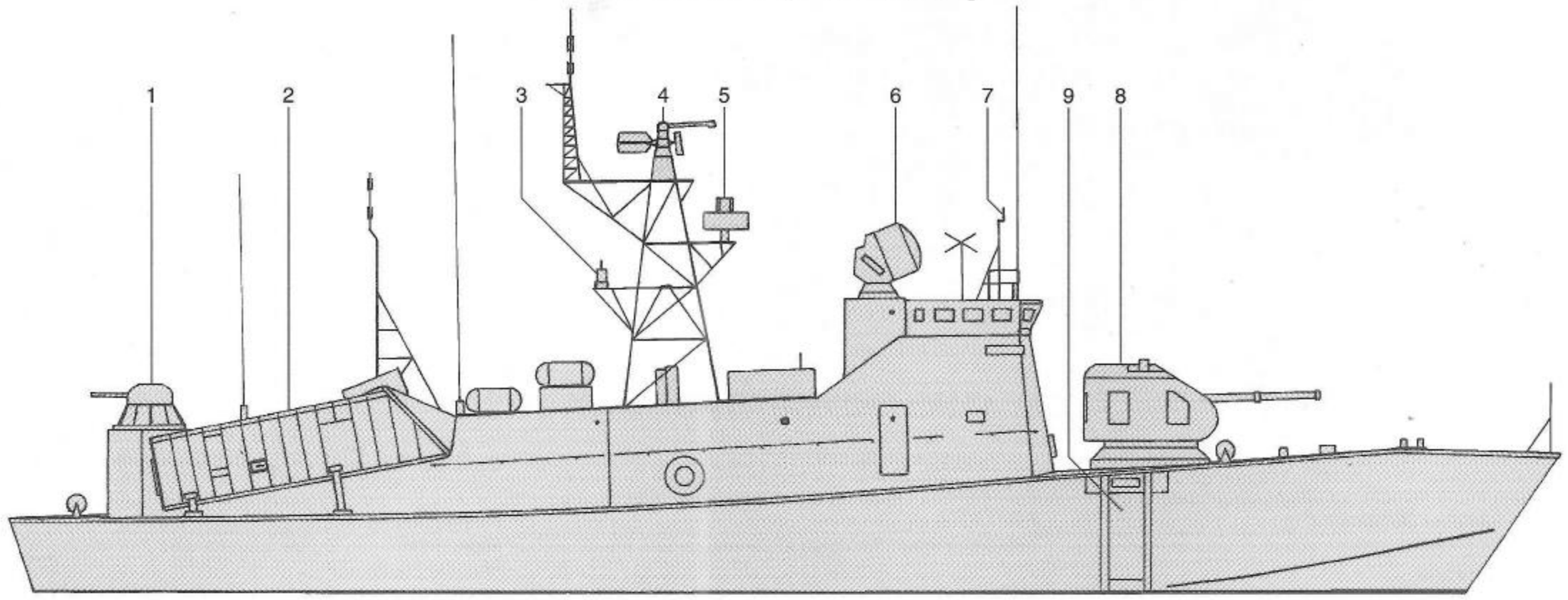
An Egyptian 'Komar' class boat launched an SS-N-2a missile attack on 21 October 1967 from inside the breakwater of Port Said. Three of the missiles hit the Israeli destroyer *Elath* (ex-British *Zealous*) with heavy loss of life; the first time a ship-launched missile sank a major warship.

TABLE I: PARTICULARS

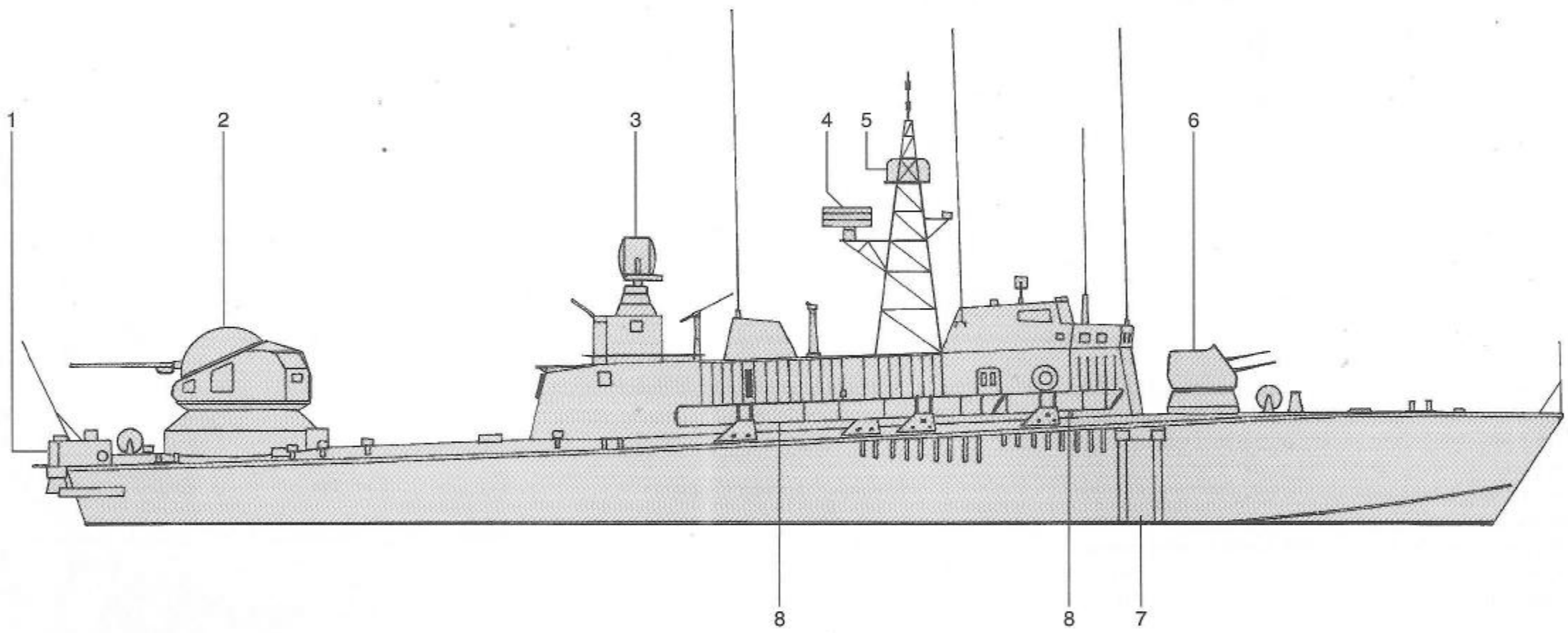
	Komar	P6
Active	N Korea - 16 Syria - 3	N Korea - 18
Displacement		
standard	75 t	64 t
full load	85 t	73 t
Dimensions		
length	25.6 m (84.0 ft)	26.9 m (85.3 ft)
beam	7.3 m (24.0 ft)	6.1 m (20.0 ft)
draught	1.8 m (5.9 ft)	1.5 m (4.9 ft)
Speed	40 kts	45 kts
Range	400 n miles (740 km) at 30 kts	450 n miles (830 km) at 30 kts; 600 n miles (1,110 km) at 15 kts
Complement	19	15

A 'Komar' class FAC-M

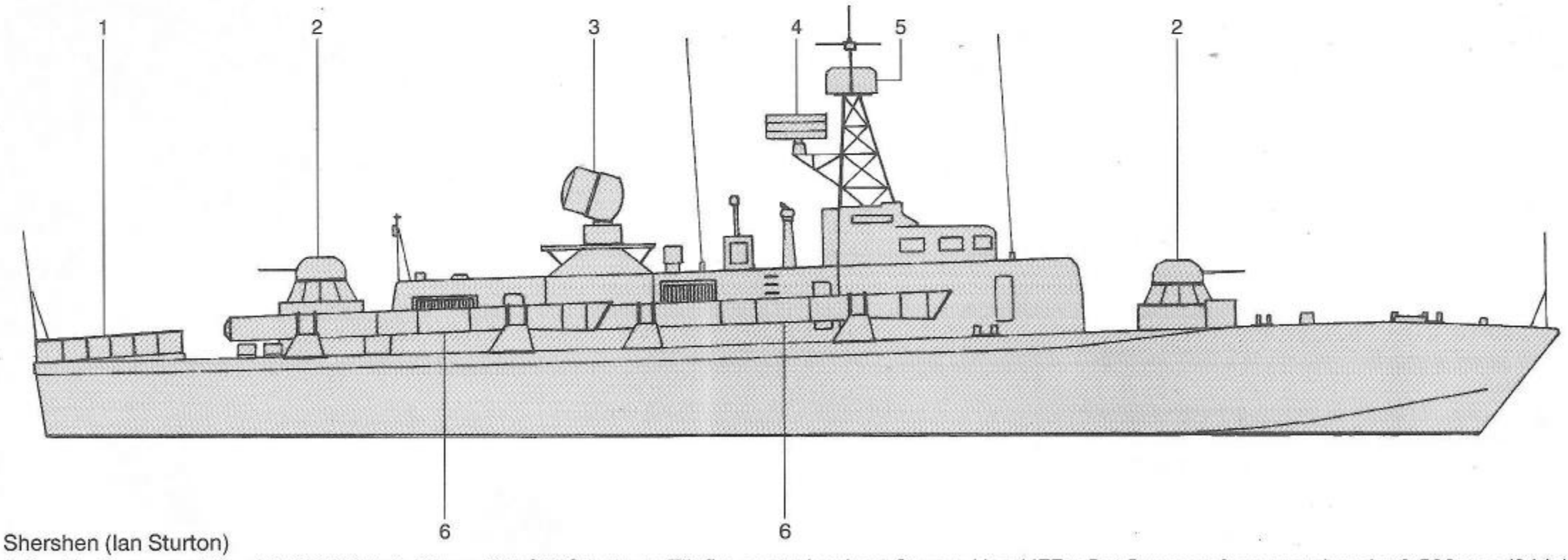
PROJECT 206 (SHERSHEN (206); TURYA (206M); MATKA (206MP)



Matka (Ian Sturton)
1 *AK-630 six-barrel 30 mm CIWS* **2** *SS-N-2c/d 'Styx' anti-ship missile (two)* **3** *Clay Brick ESM* **4** *Plank Shave air/surface search radar* **5** *Square Head IFF* **6** *Bass Tilt fire-control radar* **7** *SRN-207 navigation radar* **8** *AK-176M 76 mm/60 automatic gun* **9** *Hydrofoil leg*



Turya (Ian Sturton)
1 *Foal Tail variable depth sonar* **2** *ZIF-72 twin 57 mm/75 automatic guns* **3** *Muff Cob fire-control radar* **4** *Square Head IFF* **5** *Pot Drum surface search radar* **6** *2-M-3 twin 25 mm/60 cannon in open mount* **7** *Hydrofoil leg* **8** *533 mm (21 in) torpedo tubes (four)*



Shershen (Ian Sturton)
1 *Depth-charge rack (two)* **2** *AK-630 twin 30 mm/65 CIWS* **3** *Drum Tilt fire-control radar* **4** *Square Head IFF* **5** *Pot Drum surface search radar* **6** *533 mm (21 in) torpedo tubes*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operators: 'Shershen' - Croatia, Vietnam; 'Turya' - Cambodia, Cuba, Russia, Vietnam; 'Matka' - Russia

Type: 'Shershen' - FAC, torpedo; 'Turya' - FAC, hydrofoil, torpedo; 'Matka' - FAC, hydrofoil, missile

Class: SHERSHEN (PROJECT 206)/TURYA (PROJECT 206M)/MATKA (PROJECT 206MP)

TABLE I: PARTICULARS

	Shershen (Project 206)	Turya (Project 206M)		Matka (Project 206MP)	
		Hullborne	Foilborne	Hullborne	Foilborne
Built	133		48		20
Active	17		31		6
Displacement					
standard	145 t		190 t		225 t
full load	170 t		250 t		260 t
Dimensions					
length	34.7 m (113.8 ft)		39.6 m (129.9 ft)		39.6 m (129.9 ft)
beam	6.7 m (22.3 ft)	7.6 m (24.9 ft)	12.5 m (41 ft)	7.6 m (24.9 ft)	12.5 m (41 ft)
draught	1.5 m (4.9 ft)	1.8 m (5.9 ft)	4 m (13.1 ft)	2.1 m (6.9 ft)	4.0 m (13.1 ft)
Speed	45 kts	14 kts	40 kts	14 kts	40 kts
Range	850 n miles (1,575 km) at 30 kts	1,450 n miles (2,685 km) at 14 kts	600 n miles (1,110 km) at 35 kts	1,500 n miles (2,780 km) at 14 kts	600 n miles (1,110 km) at 35 kts
Complement	23	30 (5 officers)		33	

SHIPS

'Shershen' class

Croatia

VUKOVAR (51)
Builder Kraljevica Shipyard, Yugoslavia
Commissioned (Yugoslavia) 1970
Transferred (Croatia) 1991

Vietnam
Transferred 1973 — 2; 1979 — 4; 1980 — 4; 1983 — 6

Cambodia

'Turya' class
Transferred 1984 — 1; 1985 — 1

Cuba
Transferred 1979 — 2; 1980 — 2; 1981 — 2; 1983 — 3
Numbers of current craft 101, 102, 108, 112, 130, 165, 178, 180, 193

Russia
Builder Petrovsky, Kolpino, St Petersburg; Vladivostok.
Entered service 1972-78

Vietnam
Transferred 1984 — 3; 1986 — 2

'Matka' class
Builder Kolpino, St Petersburg, Russia.
Entered service 1978-83

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

SS-N-2C

The 'Matka' class carries two forward-facing launchers for SS-N-2c/d 'Styx' anti-ship missiles on either side of the after superstructure. The Russian designation for SS-N-2c is P-21 Rubezh and for SS-N-2d it is P-22 Rubezh.

SS-N-2c 'Styx'

Specifications
Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.9 ft)
Weight: 3,070 kg (6,769 lb) (with booster)
Speed: Mach 0.9
Range: 46 n miles (5/85 km)
Warhead: 454 kg (1,001 lb)
Guidance: Autopilot with active radar

Manufacturer/Contractor
Raduga, Russia.

SS-N-2d 'Styx'

Specifications
Length: 6.55 m (21.5 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.9 ft)
Weight: 3,170 kg (6,990 lb) (with booster)
Speed: Mach 0.9
Range: 54 n miles (100 km)
Warhead: 454 kg (1,001 lb)
Guidance: Autopilot with active radar

Manufacturer/Contractor
Raduga, Russia.

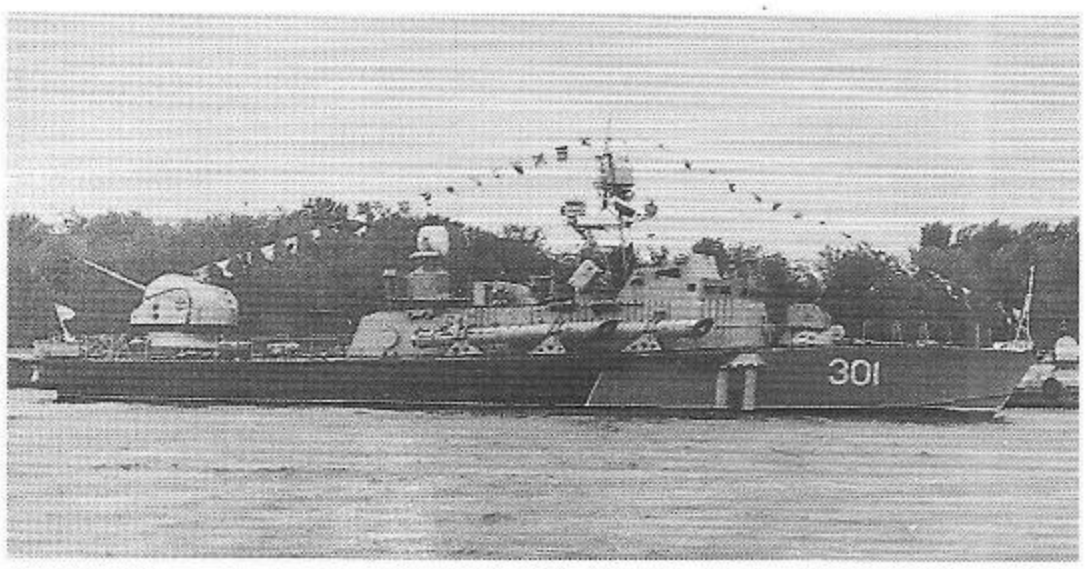
SURFACE-TO-AIR MISSILES (SAM)

SA-N-5

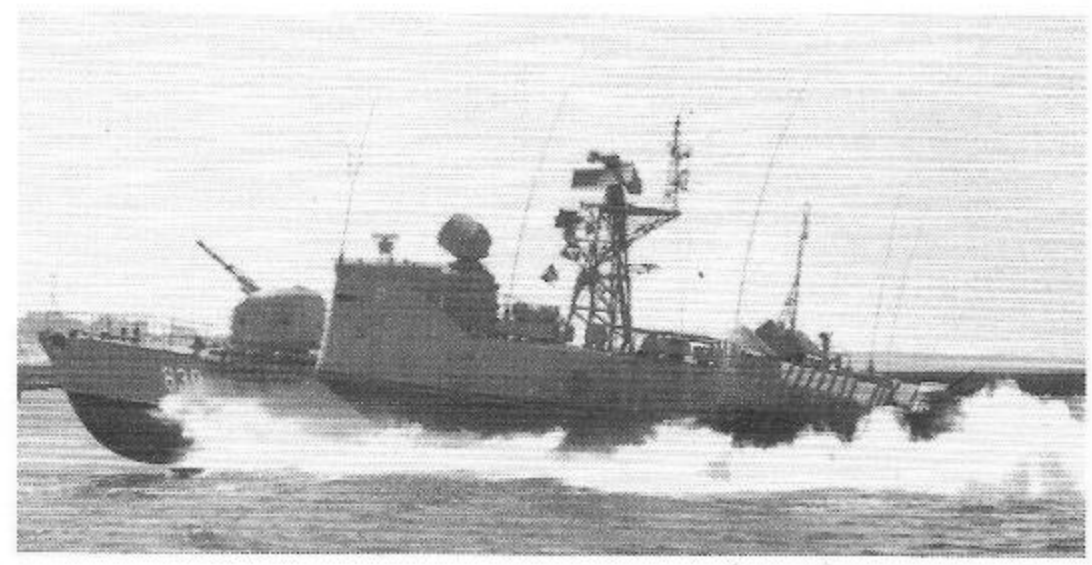
Vietnamese 'Shershen' class and some 'Matka' class vessels carry a quad launcher for SA-N-5 'Grail' point defence missiles. Cuban 'Turya' class ships carry man-portable SA-N-5 'Grail' surface-to-air missiles.

SA-N-5 'Grail' (Russian designation Strela 2)

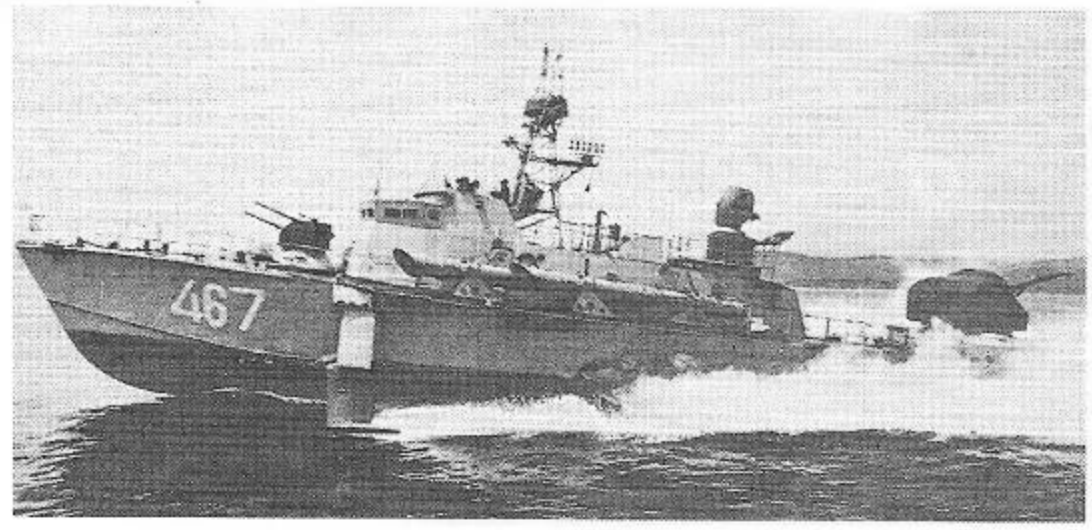
Specifications
Length: 1.45 m (3.2 ft)
Diameter: 7 cm (2.75 in)
Wing span: n/k
Weight: 9.97 kg (22 lb)
Speed: Mach 1.7
Range: 2.6 n miles (5.5 km)



'Turya' class. Note torpedo tubes and 57 mm gun aft (B Lemachko)



'Matka' missile launcher caps are open (Hartmut Ehlers)



'Turya' class (Type 206M) patrol boat. Note the use of hydrofoils (Almaz)

'Turya' class, without torpedo tubes

Warhead: 1.1 kg (2.4 lb)
Guidance: Infra-red passive homing

Manufacturer/Contractor
Fakel, Russia.

TUBES

'Shershen' class. Four 533 mm tubes for SAET-60 torpedoes.
'Turya' class. Some 'Turya' class for export (Cuba, Vietnam) carry four 533 mm (21 in) torpedo tubes with SAET-65E torpedoes while others have four 40 cm (16 in) torpedo tubes but the model of torpedo is unknown.

TORPEDOES

SAET-65E

Specifications
Length: 7.8 m (25.6 ft)
Diameter: 533 mm (21 in)
Weight: 1,700 kg (3,748.5 lb)
Propulsion: Electric
Speed: 35 kts
Range: 10.75 n miles (20 km)
Warhead: 372 kg (820 lb)
Guidance: Passive sonar

SAET-60

Specifications
Length: 7.8 m (25.6 ft)
Diameter: 533 mm (21 in)
Weight: 1,600 kg (3,528 lb)
Propulsion: Electric
Speed: 40 kts
Range: 8.1 n miles (15 km)
Warhead: 400 kg (882 lb)
Guidance: Passive sonar

TABLE II: GUNS

	AK-176	ZIF-72	AK-230	AK-630	2-M-3
Calibre	76 mm	57 mm	30 mm	30 mm	25 mm
Barrel length	59 calibres	75 calibres	64.2 calibres	65 calibres	60 calibres
Muzzle velocity	980 m/s (3,215 ft/s)	1,000 m/s (3,281 ft/s)	1,050 m/s (3,445 ft/s)	890 m/s (2,920 ft/s)	n/k
Rate of fire	120 rds/min	120 rds/min/ barrel	1,000 rds/min/ barrel	5,000 rds/min	450 rds/min/ barrel
Range					
anti-surface	3.75 n miles (7 km)	3.25 n miles (6 km)	2.2 n miles (4 km)	2.5 n miles (5 km)	1.5 n miles (2.75 km)
anti-air		6,000 m (19,680 ft)	4,000 m (13,120 ft)		2,800 m (9,180 ft)
Weight	13 t	25 t	1.9 t	1.9 t	1.7 t (loaded)
Traverse	360°	200°	360°	360°	360°
Elevation	−3 to +85°	−10 to +85°	−12 to +87°	−12 to +88°	−10 to +85°
Manufacturer/ Contractor	Not known	Not known	Not known	Tula Machine Works	Not known

GUNS

'Shershen' class. Two AK-230 twin 30 mm gun mountings: one is forward of the bridge, the other at the stern.

'Turya' class. One ZIF-72 twin 57 mm at the stern; one 2-M-3 twin 25 mm mounting forward of the bridge.
'Matka' class. One AK-176 single 76 mm gun forward of the bridge; one AK-630 close-in weapon system at the stern.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

'Shershen' class
This class has 'High Pole' and 'Square Head' IFF system but nothing is known of other electronic warfare systems.

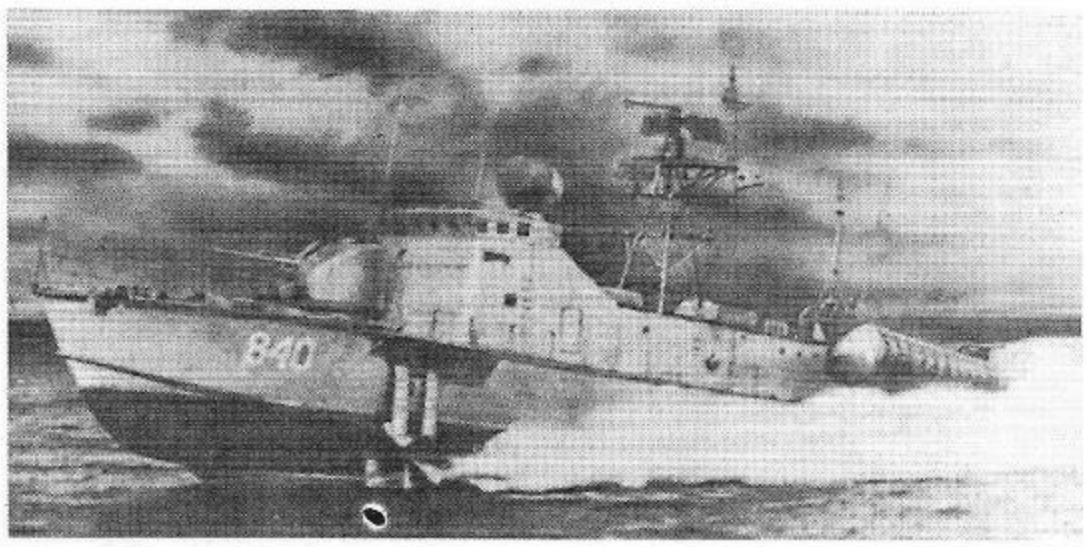
'Turya' class
These ships have 'Bell Nip' (Kursk) short-range J/K-band deception jammer with two radomes each with an omni-receiver which feeds a frequency memory loop which the antenna uses to transmit the deception signals. Russian vessels have 'Brick Plug' ESM systems while all carry 'High Pole B' and 'Square Head' IFF systems.

'Matka' class
This class has 'Clay Brick' ESM system, of which no details are available, and an IFF system which is 'High Pole B', 'Salt Pot B' or 'Square Head'.

ELECTRONIC COUNTERMEASURES (ECM)

'Shershen' and 'Turya' classes
Not known.

'Matka'
Two PK-16 decoy launchers are fitted.



Cuban 'Turya'

A 'Matka' class patrol hydrofoil (Almaz)

COMMAND AND CONTROL SYSTEMS

The 'Shershen' class has the OTA-53-206 torpedo fire-control system based upon radar, but no further details are available.

RADARS

'Shershen'

Type	'Pot Head'	'Drum Tilt'
Maker	n/k	n/k
Role	Search	Weapon control
Band	H/I	H/I
Beam	3°	n/k
Peak power	100 kW	100 kW
Pulsewidth	0.3/0.5 µs	n/k
PRF	1,600/3,300 pps	2,245, 4,490, 8,980 pps
Scan rate	2.5/8 rpm	n/k
Typical range	n/k	22 n miles (41 km)

'Turya'

Type	'Pot Drum'	'Peel Cone'	'Muff Cob'	'Drum Tilt'
Role	Search	Search	Weapon control	Weapon control
Frequency	H/I-band	E-band	G/H-band	H/I-band
Beam	3°	n/k	n/k	n/k
Peak power	100 kW	n/k	n/k	100 kW
Gain	n/k	n/k	n/k	n/k
Pulsewidth	0.25/1 µs	n/k	n/k	n/k
PRF	1,600/3,300 pps	n/k	n/k	2,245, 4,490, 8,980 pps
Scan rate	2.5/8 rpm	n/k	n/k	n/k
Typical range	n/k	n/k	n/k	22 n miles (41 km)

'Matka'

Type	'Plank Shave'	'Bass Tilt'	SRN-207
Maker	n/k	n/k	n/k
Role	Search	Weapon control	
Band	I	I	I
Typical range	16 n miles (30 km)	n/k	n/k

Note
'Bass Tilt' has the Russian designation MR 123 Vympel, 'Drum Tilt' is MR 104 Rys, 'Plank Shave' is Garpun, 'Muff Cob' is MR 103 Bars, 'Pot Drum' is MR 102 Reya.
'Pot Drum' and 'Muff Cob' are used in Cambodian, Cuban, Russian and Vietnamese 'Turya' class ships.

SONAR

A 'Foal Tail' high-frequency, variable depth sonar is used in Russian 'Turya' class vessels and also in some Cuban and Vietnamese ones.

ELECTRO-OPTIC SENSORS

Two 'Hood Wink' electro-optical directors are fitted in the 'Matka' class.

PROPULSION

'Shershen'

Specifications
System: Diesel
Main machinery: 3 M 503A 5.9 MW (8,025 hp)
Shafts: 3

'Turya'/'Matka'

Specifications
System: Diesel
Main machinery: 3 Type M 504 7.94 MW (10,800 hp)
Shafts: 3

FURTHER INFORMATION

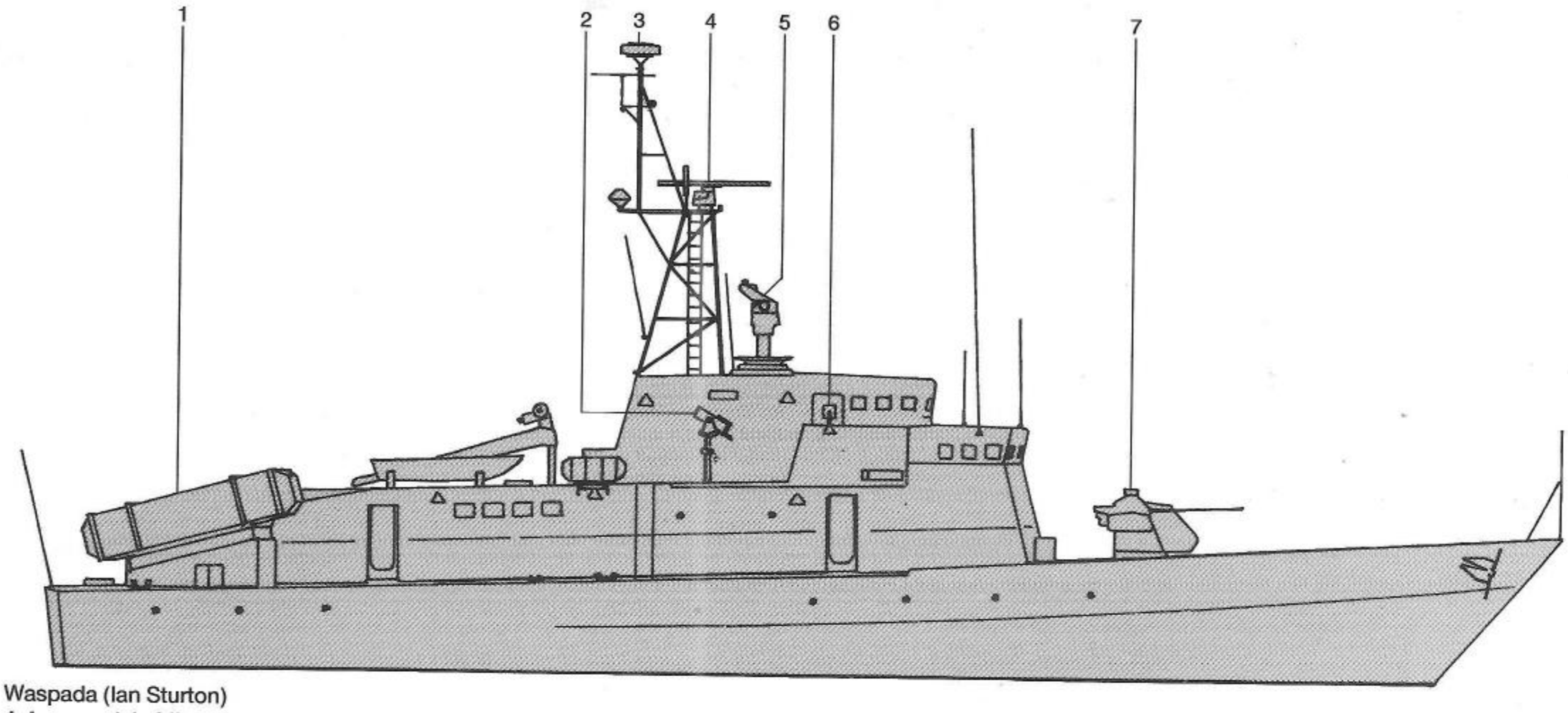
The Project 206 was designed as a round-bilge successor to the Project 183 ('P6') class and was intended to provide a common hull for a family of small combatants for a variety of roles. The lead boat was built by Zelenodolsk, Yaroslavl, Russia, with the remainder of the class being built between 1960 and 1971 at St Petersburg and Vladivostok; it was given the reporting name 'Shershen' by NATO. Some 75 vessels no longer required by the Soviet Navy were transferred to allies and friends, but there was also a specialised export version, designated Project 206E (NATO = 'Mol'), of which about a twelve were produced. A further 12 craft were built by the Tito Shipyard at Kraljevica in Yugoslavia between 1966 and 1971, and the Croatian 'Shershen' is the only known survivor of this group.

The hydrofoil version was produced as Project 206M and given the Russian class name 'Storm', although some later had their single forward foil removed. They were built between 1972 and 1987 by Leningrad's (now St Petersburg's) Kolpino and Petrovsky yards as well as by a yard in Vladivostok. In addition to the weapon systems noted above they also carry two racks of depth charges. Some 19 vessels were transferred to allies and friends while 18 export versions were built as Project 206ME. The Cambodian 'Turya' class was transferred between 1984 and 1985 without either torpedo tubes or sonars and this also applies to two of the Vietnamese vessels which were delivered in 1984 and 1986.

A missile-equipped version of the Project 206M was developed as Project 206MR and given the class name 'Vikhr'. They were built by the Kolpino Shipyard, Leningrad (now St Petersburg) between 1977 and 1983 and given the NATO designation 'Matka.' However, production was superseded by the 'Tarantul' class corvette. The vessels in the Baltic were scrapped, leaving only those in the Black Sea operational.

A patrol boat version was produced as Project 206EP by the Ulis yard in Vladivostok and exported to Guinea and Guinea-Bissau. With the Russian design designation 02065 Vikhr, it received the NATO designation 'Bogomol'. All are reported to be non-operational due to a lack of spares and poor maintenance.

WASPADA



Waspada (Ian Sturton)
1 *Aerospatiale MM 38 Exocet anti-ship missile (two)* **2** *2 in rocket launcher* **3** *Racal-Decca RDL radar warning* **4** *Racal-Decca TM 1629A surface search radar* **5** *BAe Sea Archer fire director* **6** *7.62 mm machine gun* **7** *Royal Ordance GCM-AO1 twin 30 mm Oerlikon*

GENERAL SPECIFICATIONS

Country of origin: Singapore
Operator: Brunei
Type: FAC, Missile

Class: WASPADA

Built: 3
Active: 3

Displacement:
standard: n/k
full load: 208 t

Dimensions
Length: 36.9 m (121 ft)
Beam: 7.2 m (23.5 ft)
Draught: 1.8 m (6 ft)

Speed: 32 kts
Range: 1,200 n miles (2,220 km) at 14 kts

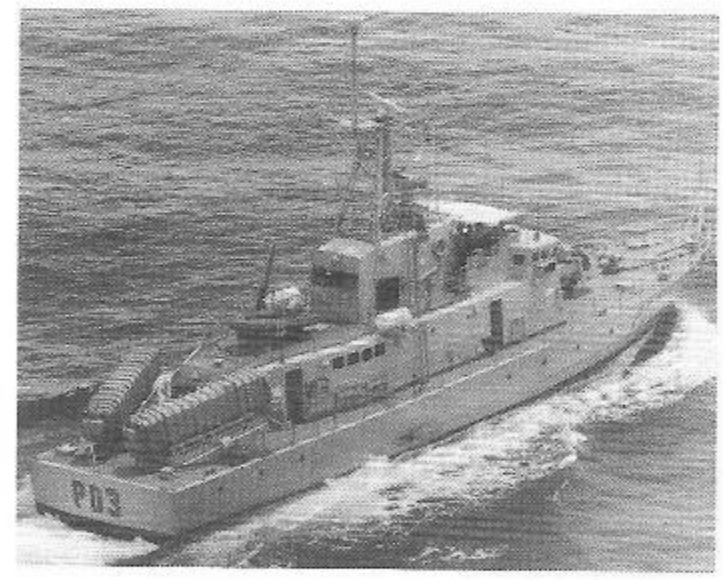
Complement: 24 (4 officers)

SHIPS

WASPADA (P 02)
Builder Vosper, Singpore
Launched Aug 1977
Commissioned 2 Aug 1978

PEJUANG (P 03)
Builder Vosper, Singapore
Launched Mar 1978
Commissioned 25 Mar 1979

SETERIA (P 04)
Builder Vosper, Singapore
Launched Jun 1978
Commissioned 22 Jun 1979



Pejuang *(P 03). Note the twin MM 38 Exocet launchers and the open upper bridge*
(H & L van Ginderen Collection)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Aerospatiale Exocet MM 38
This class carries two Exocet MM 38 anti-ship missile launchers facing forward and outboard at the rear of the superstructure.

Specifications
Length: 5.21 m (17.08 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)

Waspada *(P 02) in Penang harbour. Main armament consists of two MM 38 Exocet missiles and a twin Oerlikon 30 mm mount on the foredeck; a 7.62 mm machine gun can be seen on the bridge wing (below the nameboard). This vessel has an enclosed upper bridge to enable it to be used for training* (J Mortimer)

Speed: Mach 0.9
Range: 22.5 n miles (42 km)
Warhead: 165 kg (365 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, France.

GUNS

Royal Ordnance GCM-AO1 twin 30 mm Oerlikon
A Royal Ordnance GCM-AO1 twin 30 mm Oerlikon mounting is installed on the foredeck.

Specifications
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 650 rds/min/gun
Range:
anti-surface: 1.5 n miles (3 km)
anti-air: 3,500 m (11,500 ft)

Mounting
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
Royal Ordnance, UK.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

The ESM system is a Racal-Thorn RDL 1 whose antenna consists of two semicircular units which wrap around the mast. It covers 2-11.5 GHz and features the APA-1C automatic pulse analyser.

COMMAND AND CONTROL SYSTEMS

BAe Sea Archer 1
These ships have the British Aerospace Systems and Equipment Sea Archer 1 which is an electro-optical fire-control system of mainframe architecture with a single console. It can control one medium and one light calibre mounting simultaneously.

Manufacturer/Contractor
BAe, UK.

RADARS

Racal-Decca TM 1629AC

Specifications
Role: Surface search
Band: I-band
Beam: 1.2°
Peak power: 6 kW
Pulsewidth: 0.75 µs
PRF: 850 pps
Scan rate: 25 rpm
Typical range: 20 n miles (37 km)

Manufacturer/Contractor
Racal-Decca.

ELECTRO-OPTIC SENSORS

MSI Defence Systems OFD

The OFD (Optical Fire Director) is part of the Sea Archer system and is essentially a sighting device which can be controlled either manually or remotely.

Specifications
Weight: 485 kg (1,069 lb)
Elevation: −20 to +70°
Sensors: Optical

Manufacturer/Contractor
MSI Defence Systems, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 20V 538 TB91 diesels; 5.63 MW (7,680 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These three ships were built by Vosper (Singapore) for Brunei and were commissioned in 1978 and 1979. They were modernised starting in 1988, the work including improved fire-control systems and new ESM equipment. There are also plans to fit MM 40 Exocet in due course.

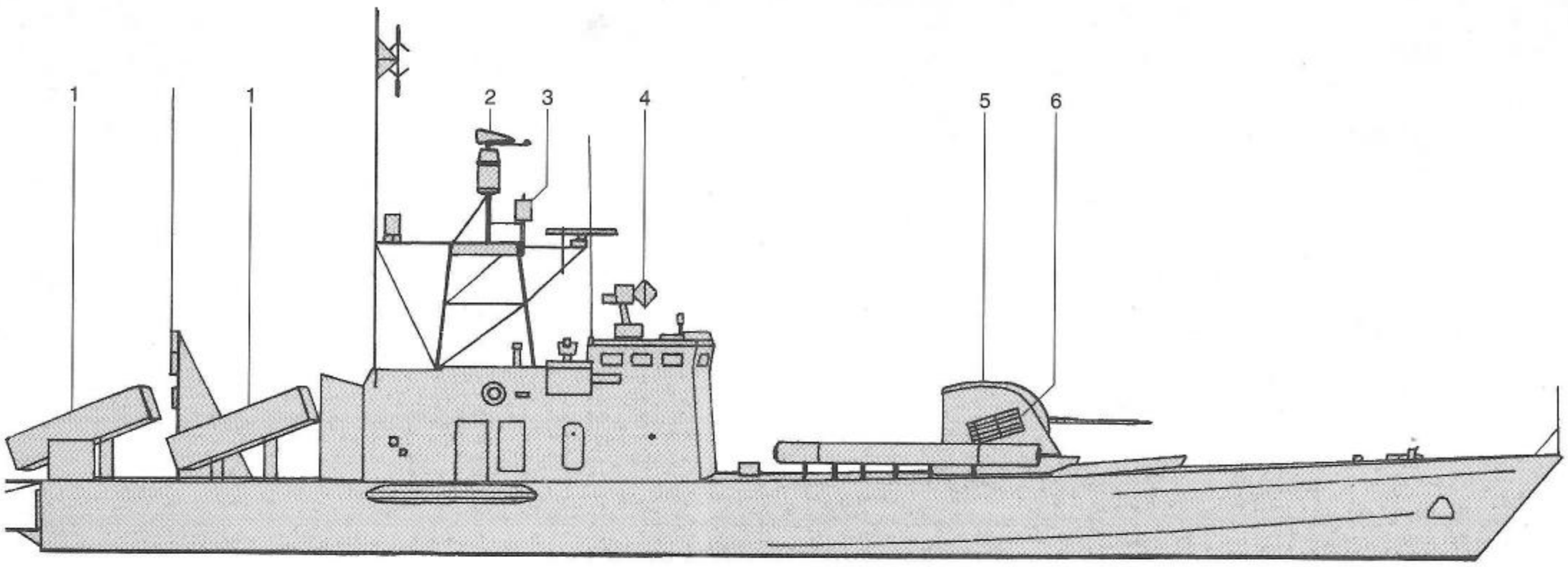
DESIGN

These vessels have welded steel hulls and aluminium alloy superstructure. The hulls have five watertight compartments and the ships carry 16 tonnes of fuel. There are two auxiliary diesel-generator sets providing a 440 V, three-phase, 60 Hz AC, and a single-phase, 60 Hz, 230 V AC electricity supply. *Pejuang* and *Seteria* have open upper bridges but *Waspada* has an enclosed one for training purposes.

These vessels also carry two 7.62 mm machine guns and two 50 mm MOD(N)2 illuminant launchers.

Seteria *(P 04)* (H & L van Ginderen Collection)

NORRKÖPPING (SPICA II)



Norrköpping (Ian Sturton)
1 *Saab RBS-15M anti-ship missiles (maximum eight)* **2** *CelsiusTech Sea Giraffe 50HC surface search radar* **3** *ARGOSystems AR700 ESM receiver* **4** *CelsiusTech 9GR600 weapon control radar* **5** *Bofors SAK 57 Mk 1 57 mm/70 automatic gun* **6** *103 mm flare launch racks*

GENERAL SPECIFICATIONS

Operator: Sweden
Type: FAC, Missile

Class: NORRKÖPPING

Built: 12
Active: 12

Displacement:
standard: 190 t
full load: 230 t

Dimensions
Length: 43.6 m (143 ft)

Beam: 7.1 m (23.3 ft)
Draught: 2.4 m (7.4 ft)

Speed: 40.5 kts

Complement: 27 (7 officers)

SHIPS

NORRKÖPPING (R 131)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 16 Nov 1972
Commissioned 11 May 1973

NYNÄSHAMN (R 132)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 24 Apr 1973
Commissioned 28 Sep 1973

NORRTÄLJE (R 133)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 18 Sep 1973
Commissioned 1 Feb 1974

VARBERG (R 134)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 2 Feb 1974
Commissioned 14 Jun 1974

VÄSTERÅS (R 135)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 15 May 1974
Commissioned 25 Oct 1974

VÄSTERVIK (R 136)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 2 Sep 1974
Commissioned 15 Jan 1975

UMEÅ (R 137)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 15 Jan 1975
Commissioned 7 May 1975

PITEÅ (R 138)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 12 May 1975
Commissioned 12 Sep 1975

LULEÅ (R 139)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 19 Aug 1975
Commissioned 28 Nov 1975

HALMSTAD (R 140)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 17 Oct 1975
Commissioned 9 Apr 1976

STRÖMSTAD (R 141)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 26 Apr 1976
Commissioned 24 Sep 1976

YSTAD (R 142)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 3 Sep 1976
Commissioned 10 Jan 1976

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Saab RBS 15M

These vessels carry up to eight launchers for the Saab Dynamics' RBS-15M anti-ship missile on the afterdeck.

Specifications
Length: 4.35 m (14.26 ft)
Diameter: 50 cm (19.68 in)
Wing span: 1.4 m (4.6 ft)
Weight: 780 kg (1,720 lb) (with boosters)
Speed: Mach 0.8
Range: 38 n miles (70 km)
Warhead: 200 kg (440 lb)
Guidance: Inertial navigation with active radar homing

Manufacturer/Contractor
Saab Missiles AB, Sweden.

TORPEDOES

Six 533 mm (21 in) torpedo tubes can be fitted in place of missile launchers. Torpedoes are FFV Tp 613 anti-surface type, which use wire guidance for ranges up to 8.2 n miles (15 km).

GUNS

Bofors SAK 57 Mk 1

A single 57 mm Bofors SAK 57 Mk 1 is mounted forward of the bridge. There are 103 mm flare launchers on either side of the turret.

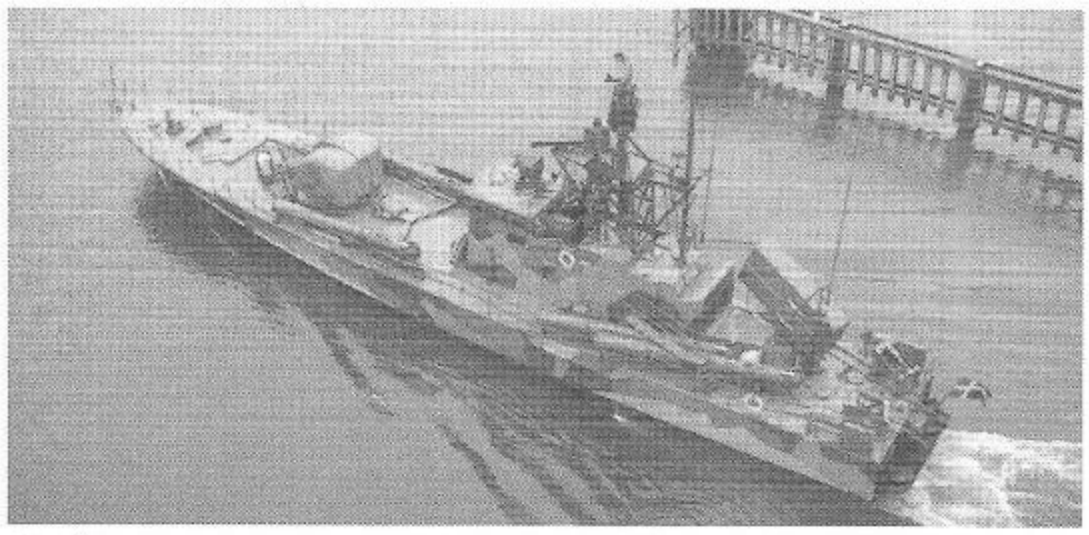
Specifications
Gun
Calibre: 57 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,020 m/s (3,346 ft/s)
Rate of fire: 200 rds/min
Range: 9 n miles (17 km)

Mounting
Traverse: 360°
Elevation: −10 to +75°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

MINES

Minerails can be carried aft.



Umeå *(R 137). On this occasion it is armed with two Saab RBS-15M missiles to starboard and two torpedo tubes to port. Note also the mine racks at the stern*
(Antonio Moreno)

Varberg *(R 134). Note 57 mm gun on foredeck with flare launch rails on either side of the turret. Masthead radar is the CelsiusTech Sea Giraffe 50HC*
(Jane's/H M Steele)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

The class have either Argo AR700 or Racal-Thorn (formerly MEL) Susie-1 ESM systems.

ARGOSystems AR700

The AR700 radar receiver covers the 0.5-18 GHz frequency bands.

Manufacturer/Contractor
ARGOSystems, USA.

Racal-Thorn Susie ESM

Susie-1 is a solid-state system operating in the E/J-band range which automatically correlates band, pulsewidth and bearing then displays the data with an accuracy of 3.5° in fine mode. The system can automatically track up to seven signals.

Manufacturer/Contractor
Racal-Thorn, UK.

ELECTRONIC COUNTERMEASURES (ECM)

CelsiusTech Philax

The 'Norköpping' class has the CelsiusTech Philax decoy launcher system. This consists of trainable 875 × 720 × 950 mm (34 × 28 × 37 in) launchers weighing 180 kg (397 lb). Each has four magazines with 36 × 40 mm (1.41 × 1.5 in) chaff or infra-red payload grenades. The former fire at intervals of 0.1 second per magazine and within 1 second create a 1,000 m² (3,281 sq ft) decoy cloud while the infra-red ones cover both the 3-5 µm and 8-14 µm bands.

Manufacturer/Contractor
CelsiusTech, Sweden.

COMMAND AND CONTROL SYSTEMS

CelsiusTech 9LV200

The 'Norrköpping' class has a CelsiusTech 9LV200 weapon control system with CelsiusTech MARIL 800 tactical data system and datalink. The MARIL *(Marinen Eldlegnings)* is a tactical picture compilation system with a mainframe architecture based upon two Censor 932E mini-computers and a single display console. The 9LV200 Mk 2 is a radar-based weapon control system of mainframe architecture using the Philips P800 mini-computer for the control of one medium and one light calibre gun mounting as well as surface-to-surface missiles. There is a tactical display system and two gun control displays, for ASuW and AAW operations.

Manufacturer/Contractor
CelsiusTech, Sweden.

RADARS

Type	Sea Giraffe 50HC	9GR600
Maker	Ericsson	CelsiusTech
Role	Search	Weapon control
Frequency	G-band	I-band
Beam	2.1°	1.1 × 7°
Peak power	15 kW	200 kW
Gain	30 dB	35.5 dB

Type	Sea Giraffe 50HC	9GR600
Pulsewidth	0.3 µs	0.25, 1 µs
PRF	1,000-7,000 pps	1,000, 3,000 pps
Scan rate	30, 60 rpm	60 rpm
Typical range	54 n miles (100 km)	n/k

PROPULSION

Specifications
System: Gas turbine
Main machinery: 3 Rolls-Royce Proteus, 9.5 MW (12,750 hp)
Shafts: 3 with controllable pitch propellers

FURTHER INFORMATION

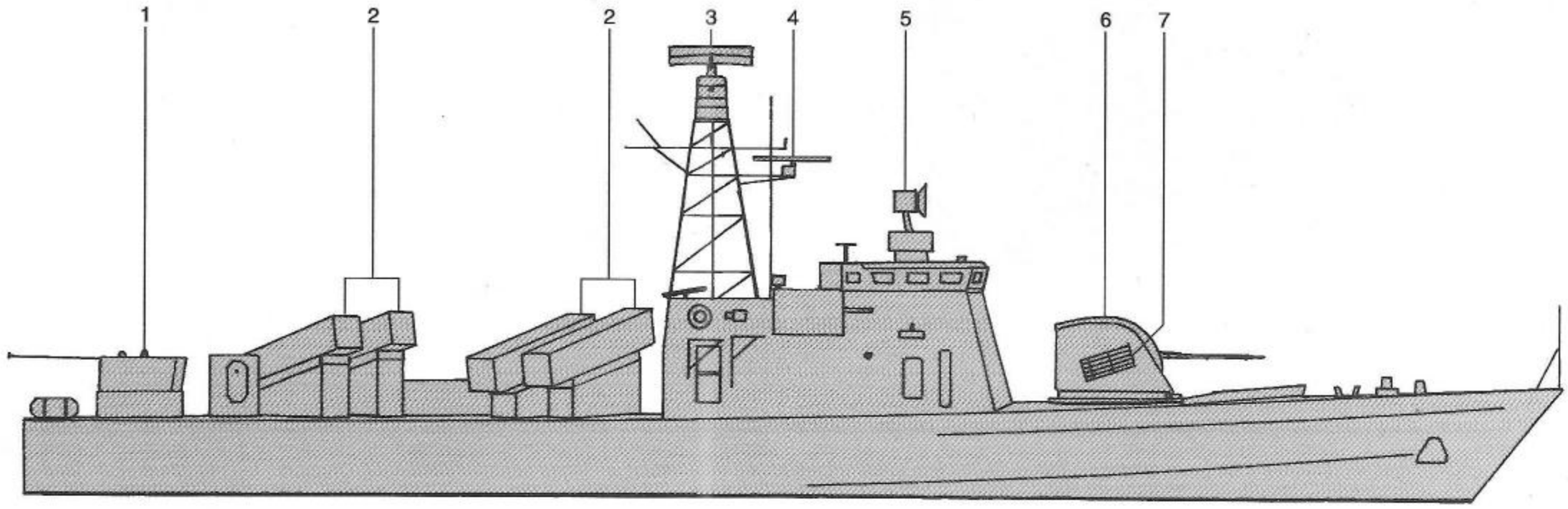
PROGRAMME

This class, also known as 'Spica II', was constructed between 1972 and 1975.

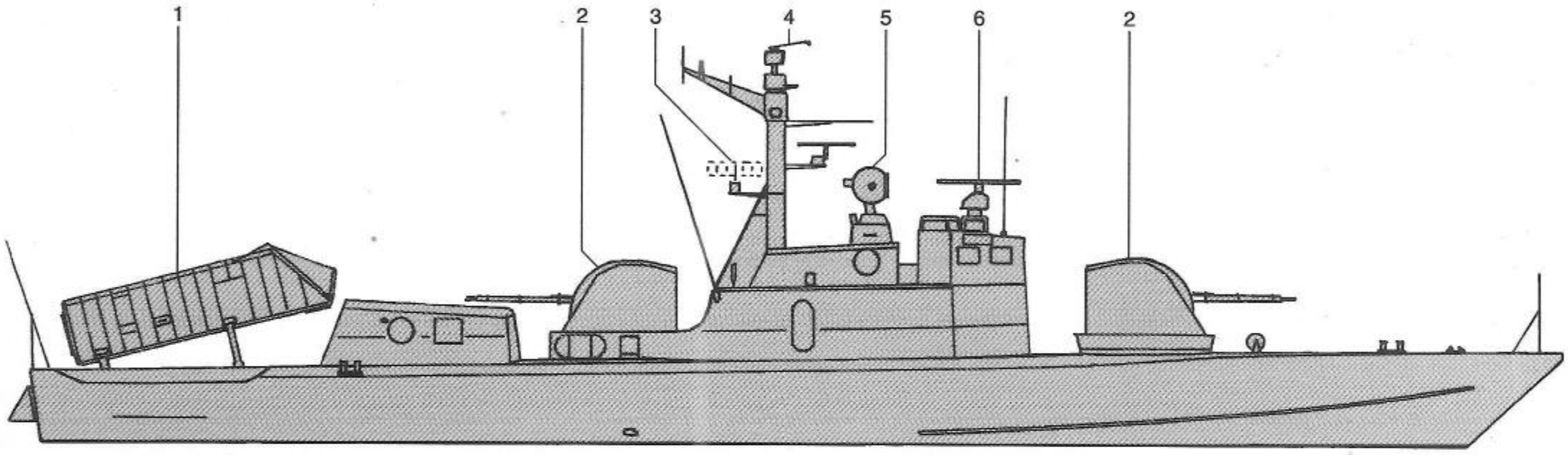
DESIGN

The 'Norrköpping' class has a steel, round-bilge hull with six watertight compartments and can float even if two adjacent compartments are flooded. Electricity is provided through three-phase alternators with a capacity of 200 kVA, 60 Hz (450 V). They were originally armed with six 533 mm (21 in) torpedo tubes but between 1980 and 1984 these were replaced by missile launchers, and concurrently the Skanter 009 radar was replaced by the Sea Giraffe. The Mk 2 version of 9LV200 replaced the Mk 1 version and Maril was incorporated. *Halmstad, Lulea, Norrköpping, Nynäshamn, Pitea* and *Ystad* are having their 9LV200 systems upgraded with new hardware and software to maintain them in operational service until 2010. *Ystad* was the first to be upgraded in December 1995.

SPICA I/KONCAR (TYPE 240)



'Handalan' class (Malaysia) (Ian Sturton)
1 *Bofors SAK 402/70-350 40 mm cannon* **2** *Aerospatiale MM 38 Exocet anti-ship missiles* **3** *CelsiusTech (Philips) 9GR 600 surface search radar* **4** *Racal-Decca 616 navigation radar* **5** *CelsiusTech (Philips) 9LV 212 fire-control radar* **6** *Bofors 57 mm/70 Mk 1* **7** *103 mm flare launcher tubes*



'Koncar' class (Yugoslavia) (Ian Sturton)
1 *SS-N-2b Styx anti-ship missiles (two)* **2** *Bofors 57 mm/70* **3** *Square Head IFF interrogator* **4** *Surface search radar* **5** *CelsiusTech (Philips) TAB fire control* **6** *Racal-Decca 1226 navigation radar*

GENERAL SPECIFICATIONS

Country of origin: Sweden
Operators: Malaysia ('Handalan'), Yugoslavia/Croatia ('Koncar')
Type: FAC, Missile
Class: SPICA I/KONCAR (TYPE 240)

TABLE I: PARTICULARS

	Spica I Sweden	Handalan Malaysia	Koncar Yugoslavia/Croatia
Built	6	4	6
Active	0	4	Yugoslavia — 5 Croatia — 1
Dispacement			
standard	200 t	200 t	200 t
full load	235 t	240 t	242 t
Dimensions			
length (oa)	42.5 m (140.1 ft)	43.6 m (142.6 ft)	45 m (147.6 ft)
beam	7.1 m (23.3 ft)	7.1 m (23.3 ft)	8.4 m (27.6 ft)
draught	1.6 m (5.5 ft)	2.4 m (7.4 ft)	2.5 m (8.2 ft)
Speed	40 kts	34.5 kts	39 kts
Range		1,850 n miles (3,425 km) at 14 kts; 500 n miles (925 km) at 35 kts	880 n miles (1,630 km) at 23 kts on diesels
Complement	30	39 (5 officers)	30 (5 officers)

SHIPS

'Koncar' class — Croatia

SIBENIC (21)
Builder Tito Shipyard, Kraljevica, Yugoslavia
Launched 28 Aug 1977
Commissioned (Yugoslav Navy) Mar 1978 (*Vlado Cvetkvic* (RT 402))
Taken over (Croatian Navy) 1991

'Handalan' class — Malaysia

HANDALAN (3511)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 11 Nov 1978
Commissioned 26 Oct 1979

PERKASA (3512)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 11 Nov 1978
Commissioned 26 Oct 1979

PENDEKAR (3513)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 11 Nov 1978
Commissioned 26 Oct 1979

GEMPITA (3514)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 11 Nov 1978
Commissioned 26 Oct 1979

Koncar class — Yugoslavia

RADE KONCAR (401)
Builder Tito Shipyard, Kraljevica, Yugoslavia
Launched 15 Oct 1976
Commissioned Apr 1977

RAMIZ SADIKU (403)
Builder Tito Shipyard, Kraljevica, Yugoslavia
Launched 1978
Commissioned Sep 1978

HASAN ZAHIROVIĆ LACA (404)
Builder Tito Shipyard, Kraljevica, Yugoslavia
Launched 1978
Commissioned Dec 1978

ORCE NIKOLOV (405)
Builder Tito Shipyard, Kraljevica, Yugoslavia
Launched 1979
Commissioned Aug 1979

ANTE BANINA (406)
Builder Tito Shipyard, Kraljevica, Yugoslavia
Launched 1979
Commissioned Nov 1980

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

The 'Spica I' class has four forward-facing launchers in crossover configuration behind the superstructure. The forward pair face to port and the after pair face starboard. Malaysian vessels use Aerospatiale Exocet MM 38, the Croatian 'Koncar' class has Saab Dynamics RBS 15M anti-ship missiles while Yugoslav vessels have SS-N-2b 'Styx'.

Exocet MM 38

Specifications
Length: 5.21 m (17.08 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 2-22.5 n miles (4-42 km)
Warhead: 165 kg (365 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, France.

RBS 15M

Specifications
Length: 4.35 m (14.26 ft)
Diameter: 50 cm (19.68 in)
Wing span: 1.4 m (4.6 ft)
Weight: 780 kg (1,720 lb) (with boosters)
Speed: Mach 0.8
Range: 38 n miles (70 km)
Warhead: 200 kg (440 lb)
Guidance: Inertial navigation with active radar homing

Manufacturer/Contractor
Saab Missiles AB, Sweden.

SS-N-2b 'Styx'

Specifications
Length: 5.8 m (19 ft)
Diameter: 76 cm (30 in)
Wing span: 2.4 m (7.9 ft)
Weight: 2,870 kg (6,328 lb) (with booster)
Speed: Mach 0.9
Range: 43 n miles (80 km)
Warhead: 454 kg (1,001 lb)
Guidance: Autopilot with active radar

Manufacturer/Contractor
Raduga, Russia.

GUNS

'Handalan' class (Malaysia). The Malaysian vessels have a single 57 mm Bofors SAK 57 Mk 1 forward and a Bofors 40 mm SAK 40 L/70-350 aft of the missile launchers.

'Koncar' class (Yugoslavia/Croatia). There are two gun mountings in the 'Koncar' class; either two Bofors SAK 57 Mk 2 or one SAK 57 and an AK-630.

Bofors SAK 57 Mk 1

Specifications
Gun
Calibre: 57 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,020 m/s (3,346 ft/s)
Rate of fire: 200 rds/min
Range: 9 n miles (17 km)

Mounting
Traverse: 360°
Elevation: −10 to +75°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Bofors SAK 57 Mk 2

Specifications
Gun
Calibre: 57 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,020 m/s (3,346 ft/s)
Rate of fire: 220 rds/min
Range: 9 n miles (17 km)

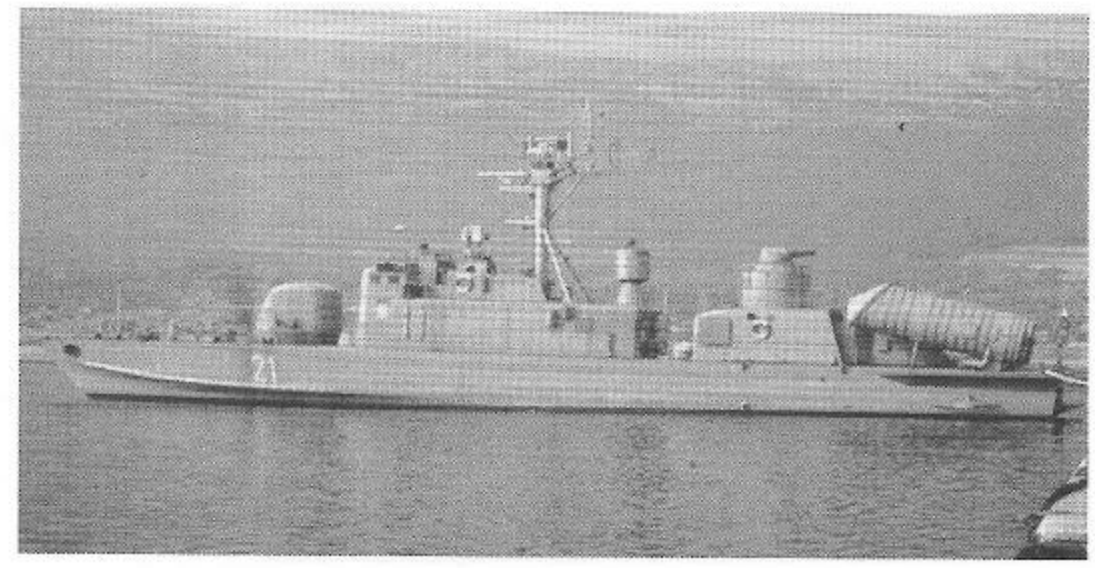
Mounting
Traverse: 360°
Elevation: −10 to +77°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Bofors SAK 40 L/70-350

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 300 rds/min
Range: 6.75 n miles (12.5 km)

Pendekar *(3513) one of four 'Spica-M' class FACs built for the Royal Malaysian Navy. The bridge was moved forward in these vessels to enable four Exocet launchers to be mounted* (John Mortimer)



Sibenic *(21) of the Croatian Navy was originally one of six vessels built for the Yugoslav Navy and based on the Swedish Spica design. The bridge is further forward as in the Malaysian Spica-M, but the Yugoslav Navy selected SS-N-2 Styx in preference to Exocet. The Croatians have now replaced SS-N-2 by Saab RBS-15* (L Poggiali)

Mounting
Traverse: 360°
Elevation: −9 to +85°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

AK-630

Specifications
Gun
Calibre: 30 mm
Length of barrel: 65 calibres
Muzzle velocity: 890 m/s (2,920 ft/s)
Rate of fire: 5,000 rds/min
Range: 2.5 n miles (5 km)

Mounting
Traverse: 360°
Elevation: −12 to +88°

Manufacturer/Contractor
Tula Machine Works, Russia.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-Thorn Susie-1 system
'Handalan' class (Malaysia) only. Susie-1 is a solid-state system operating in the E/J-band range which automatically correlates band, pulsewidth and bearing then displays the data with an accuracy of 3.5° in fine mode. The system can automatically track up to seven signals.

ELECTRONIC COUNTERMEASURES (ECM)

ML Aviation Barricade
'Koncar' class (Yugoslavia, Croatia). This lightweight chaff launcher system uses spin-stabilised 57 mm rockets whose launcher consists of frames which point in various directions at different angles of elevation. They fire short-range rockets which create chaff clouds up to 60 m (197 ft) from the ship and long-range rockets whose clouds are deployed between 400 and 2,000 m (1,312 and 6,562 ft) of the ship. The short-range Pallisade rockets weigh 2.1 kg (4.6 lb) while the longer-ranged Stockade rockets (which are also available with infra-red payloads) weigh 1.77/1.88 kg (3.9/4.1 lb).

COMMAND AND CONTROL SYSTEM

CelsiusTech 9LV Mk 2
Both classes of 'Spica I' have CelsiusTech 9LV Mk 2 radar-based weapon control systems. These have a mainframe architecture using the Philiips P800 minicomputer for the control of one medium and one light calibre gun mounting as well as surface-to-surface missiles. There is a tactical display system and two gun control displays, for ASuW and AAW operations.

Manufacturer/Contractor
CelsiusTech, Sweden.

RADARS

'Handalan' class (Malaysia)

Type	616	9GR600 (× 2)
Maker	Racal-Decca	CelsiusTech
Role	Search	Weapon control
Frequency	I band	I band
Beam	1.2°	1.1 × 7°
Peak power	25 kW	200 kW
Gain	n/k	35.5 dB
Pulse rate	0.05, 0.25, 1.0 µs	0.25, 1.0 µs
PRF	1,300 pps	1,000, 3,000 pps
Scan rate	25 rpm	60 rpm
Typical range	20 n miles (37 km)	n/k

'Koncar' class (Yugoslavia, Croatia)

Type	TM 1226	9GR600
Maker	Racal-Decca	CelsiusTech
Role	Search	Weapon control
Frequency	I band	I band
Beam	1.2°	1.1 × 7°
Peak power	25 kW	200 kW
Gain	n/k	35.5 dB
Pulse rate	0.05, 0.25, 1.0 µs	0.25, 1.0 µs
PRF	1,300 pps	1,000, 3,000 pps
Scan rate	25 rpm	60 rpm
Typical range	20 n miles (37 km)	n/k

PROPULSION

'Handalan' class (Malaysia)

Specifications
System: Diesel
Main machinery: 3 MTU 16V 538 TB91; 6.75 MW (9,180 hp)
Shafts: 3

'Koncar' class (Yugoslavia, Croatia)

Specifications
System: Combined diesel and gas turbine (CODAG)
Main machinery: 2 MTU 20V 538 TB92 diesels; 6.27 MW (8,530 hp); 2 Rolls-Royce Proteus gas turbines; 5.37 MW (7,200 hp)
Shafts: 4

FURTHER INFORMATION

PROGRAMME

Six boats of the 'Spica I' class, with steel hull and aluminium alloy superstructure, were built for the Swedish Navy in the mid-1960s and have since been deleted. A modified design ('Spica M') for Malaysia was ordered from Karlskronavarvet in 1976 and was commissioned in one large group on 26 October 1979.

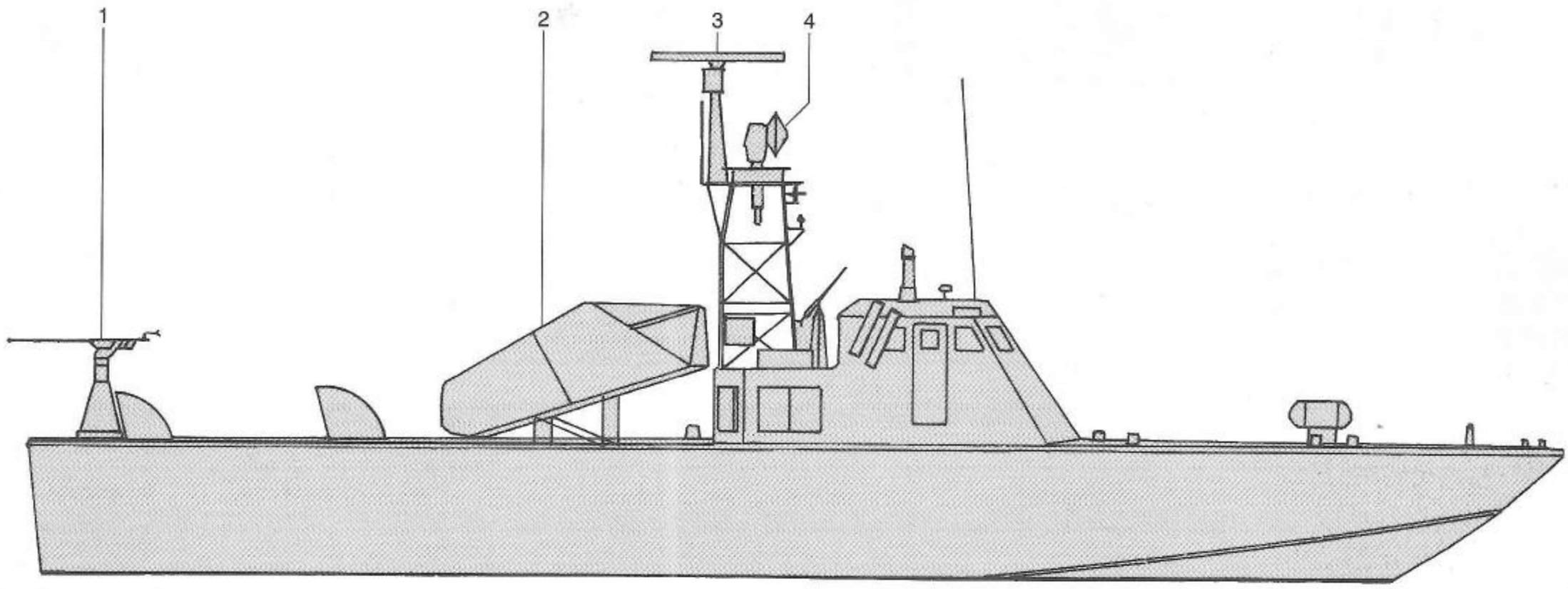
The 'Koncar' or Type 240 class was designed by the Naval Shipping Institute in Zagreb based upon the 'Spica' class as built for Malaysia with bridge amidships.

DESIGN

In this version the bridge was moved forward to enable MM 38 Exocet launchers to be accommodated aft, and the vessels had Simrad SU hull-mounted sonar, although this was later removed when an ASW upgrade plan was abandoned. These vessels carry 80 tonnes of fuel and have an electricity generating system producing 400 kW.

Originally the Yugoslav ships had 'Styx' anti-ship missiles and two SAK 57, but the aft one has been replaced by an AK-630. They also have a 128 mm rocket launcher for illuminants. Their electricity generation systems produce 300 kW.

HAI OU



Hai Ou (Ian Sturton)
1 *20 mm Type 75 cannon* **2** *Hsiung Feng I anti-ship missile (two)* **3** *Canadian Marconi LN 66* **4** *RCA R76 C5 fire-control radar*

GENERAL SPECIFICATIONS

Country of origin: Israel
Operator: Taiwan, Republic of China
Type: FAC, Missile

Class: HAI OU

Built: 49
Active: 49

Displacement:
full load: 47 t

Dimensions
Length: 21.6 m (70.8 ft)
Beam: 5.5 m (18 ft)
Draught: 1 m (3.3 ft)

Speed: 36 kts
Range: 700 n miles (1,300 km) at 32 kts

Complement: 10

SHIPS

FABG 5/12
FABG 14/21
FABG 23/30
FABG 32/39
FABG 41/57

(FABG 5, 6 built by Israeli Aircraft Industries (RAMTA) in Israel. Remainder built by China Ship Building, Kaohsiung, Taiwan.)

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Hsiung Feng I

Two forward-facing, outboard angled, launchers for Hsiung Feng I anti-ship missiles are behind the superstructure.

Specifications
Length: 3.9 m (12.8 ft)
Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)
Weight: 540 kg (1,190 lb)
Speed: Mach 0.9
Range: 19 n miles (36 km)
Warhead: 150 kg (330 lb)
Guidance: Semi-active radar and manual

SURFACE-TO-AIR MISSILES (SAM)

FIM-92 Stinger

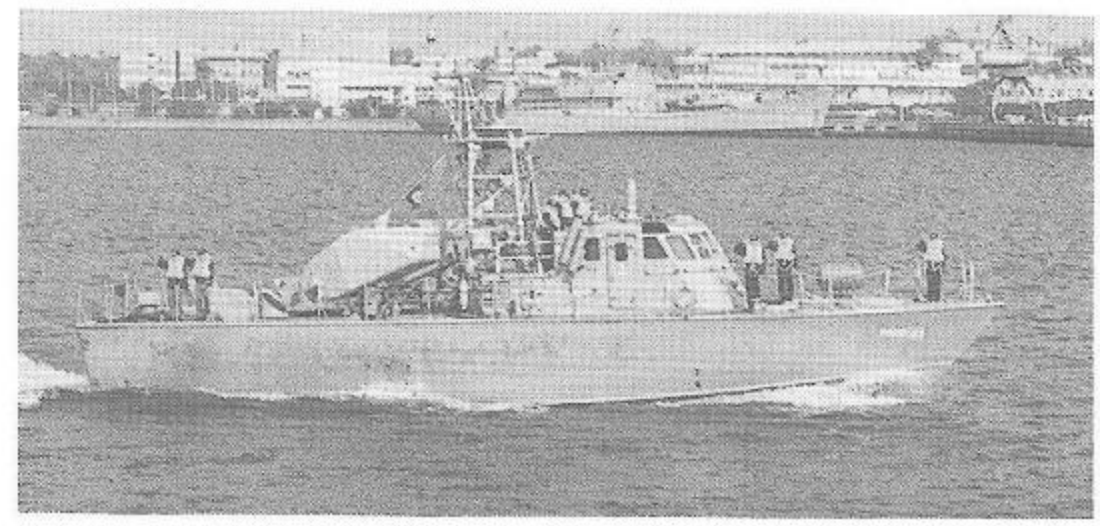
These vessels often carry a FIM-92 Stinger man-portable point defence missile launcher.

Specifications
Length: 1.52 m (4.99 ft)
Diameter: 70 cm (27.5 ft)
Wing span: n/k
Weight: 10.1 kg (22.3 lb)
Speed: Mach 2.2
Range: 2 n miles (3.8 km)
Warhead: 3 kg (6.6 lb)
Guidance: Infra-red passive homing

Manufacturer/Contractor
Hughes Missile Systems.
Raytheon Company's Missile Systems Division.

GUNS

There is a 20 mm Type 75 gun at the stern. No details are available on this weapon. Some also mount two 12.7 mm machine guns at the stern; type unknown.



FABG 41, a 'Hai Ou' class FAC-missile of the RoC Navy (L J Lamb)

Israeli 'Dvora' class FAC-gun from which the Taiwanese 'Hai Ou' class FAC-missile was developed

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

WD-2A ESM
The domestically produced WD-2A threat-warning receiver is carried to provide early warning of E/J-band threats.

ELECTRONIC COUNTERMEASURES (ECM)

AV-2
The decoy launcher carried in these vessels is the domestically produced AV-2 chaff rocket launcher. Two pairs of launchers are installed to create an 80 m² cloud using Rafael-designed rockets.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

These vessels have a combined surface-to-surface missile and gun weapon control system similar to that used in Israeli 'Sa'ar 3' and 'Sa'ar 4' classes but produced domestically.

ELECTRO-OPTIC SENSORS

Kollmorgen Mk 35
There is a Kollmorgen Mk 35 optical periscope for missile control.

RADARS

Type	LN66	R76C5
Maker	Canadian Marconi	Lockheed Martin
Role	Search	Weapon control
Frequency	I-band	I-band
Beam	2.5 × 22°	2.7°
Peak power	75 kW	250 kW
Gain	30 dB	32 dB
Pulsewidth	0.1, 1 µs	0.25, 0.5 µs
PRF	500, 2,000 pps	1,000-3,000 pps
Scan rate	22 rpm	n/k
Typical range	24 n miles (44.5 km)	21.5 n miles (40 km)

FABG 17 (Chien Chung)

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 12V 331 TC82 diesels; 1.92 MW (2,605 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

There has been close co-operation on weapons and technical matters between israel and Taiwan for some years. Two Israeli 'Dvora' class FACs were exported to Taiwan and are now the first two craft (FABF 5, FABG 6) in this class. The design was then deployed by the Sun Yat Sen Scientific Research Institute and built by the China Shipbuilding Corporation at the Tsoying Shipyard.

DESIGN

There are two versions; the first with pole mast whose missile launchers are nearer the stern and the second with a lattice mast whose missile launchers are further forward.

DEPLOYMENT

In addition to the armament mentioned above some carry two 12.7 mm machine guns.

In addition to patrol work they are used to provide high-speed targets in shallow waters.

JIN CHIANG

GENERAL SPECIFICATIONS

Operator: Taiwan, Republic of China
Type: FAC, Missile

Class: JIN CHIANG

Built: 1
Active: 1

Displacement:
full load: 580 t

Dimensions
Length: 61.4 m (201.4 ft)
Beam: 9.5 m (31.2 ft)
Draught: 2.9 m (9.5 ft)

Speed: 25 kts
Range: 4,150 n miles (7,685 km) at 20 kts

Complement: 50 (7 officers)

SHIPS

JIN CHIANG (603)
Builder Lien Ho, Kaohsiung, Taiwan

Launched 27 Jun 1994
Commissioned 1 Dec 1994

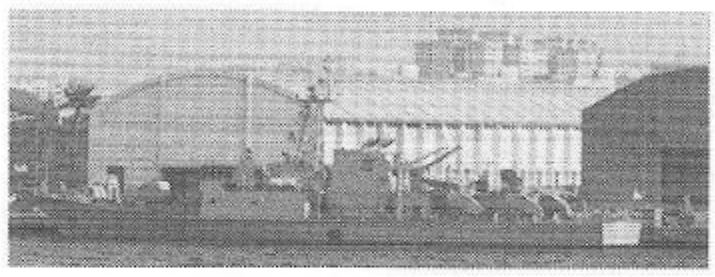
WEAPONS SYSTEMS

ANTI-SHIP MISSILES

Hsiung Feng I

Four launchers for the Hsiung Feng I anti-ship missile are installed aft of the superstructure.

Specification
Length: 3.9 m (12.8 ft)
Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)



Jin Chiang *(603), the prototype of a new class of FAC-M for the RoC Navy* (L J Lamb)

Weight: 540 kg (1,190 lb)
Speed: Mach 0.9
Range: 19 n miles (36 km)
Warhead: 150 kg (330 lb)
Guidance: Semi-active radar and manual

GUNS

OTOBREDA 40 mm L/70

An OTOBREDA-Bofors 40 mm L/70 is carried forward of the bridge while a Type 75 20 mm gun is installed in the superstructure.

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 300 rds/min
Range: 6.75 n miles (12.5 km)
Traverse: 360°
Elevation: n/k

Manufacturer/Contractor
OTOBREDA.

DEPTH CHARGES

There are two depth charge racks.

MINES

Two rails for the US Navy Mk 6 anchored mine.

COMMAND AND CONTROL SYSTEMS

Hughes H930 Mod 2

This class has a Hughes Naval and Marine Systems H930 Mod 2 command and weapon control system with mainframe architecture based upon the AN/UYK-19 mini-computer. The Mod 2 system, with five UYK-19 Model 1664 computers as well as a pair of display and control consoles, can control up to four guns as well as surface-to-surface missiles.

RADARS

Type	LN66	R76C5
Maker	Canadian Marconi	Lockheed Martin
Role	Search	Weapon control
Frequency	I-Band	I-Band
Beam	2.5 × 22°	2.7°
Peak power	75 kW	250 kW
Gain	30 dB	32 dB
Pulsewidth	0.1, 1 µs	0.25, 0.5 µs
PRF	500, 2,000 pps	1,000-3,000 pps
Scan rate	22 rpm	n/k
Typical range	24 n miles (44.5 km)	21.5 n miles (40 km)

SONAR

Simrad sonar

A Simrad sonar is installed for ASW operations but its identity has not been established.

ELECTRO-OPTIC SENSORS

Rafael Sea Eye

A Rafael Sea Eye electro-optical sensor is installed. No further details are available on this system.

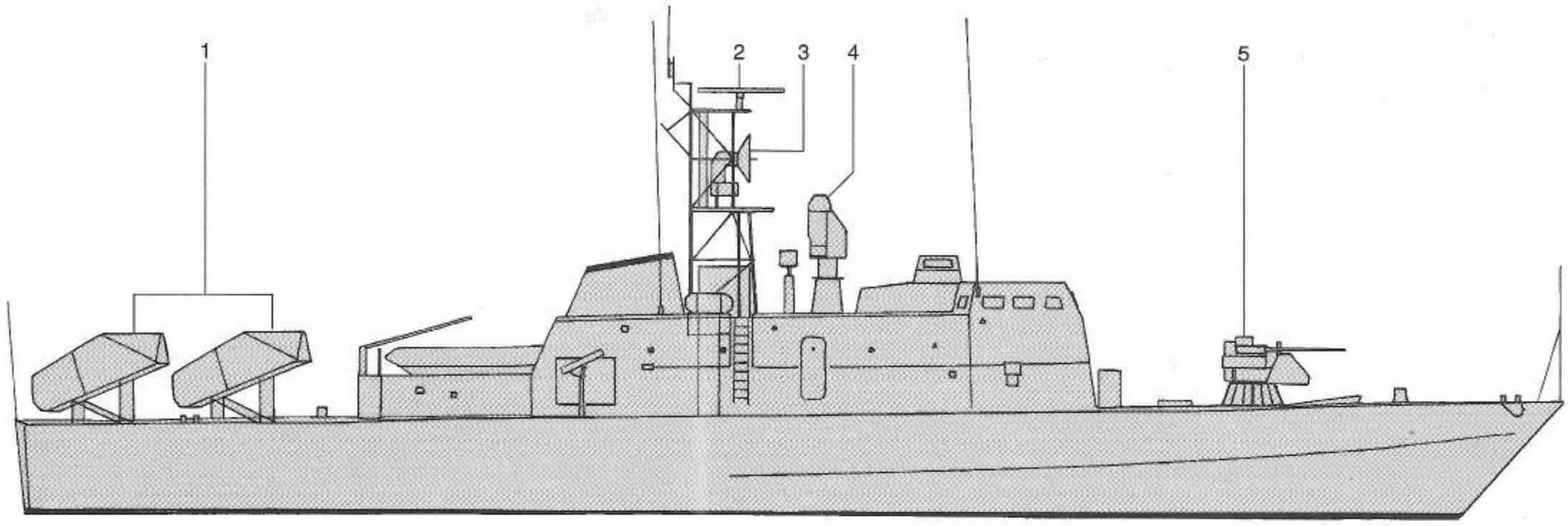
PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 20V 1163 TB93; 14.79 MW (20,128 hp)
Shafts: 2

FURTHER INFORMATION

Designed by the United Ship Design Center as the Kwang Hua Project III this new class resembles an enlarged 'Lung Chiang' (itself based upon PSMM Mk 5). *Jin Chiang* was laid down in August 1993, launched on 27 June 1994 and commissioned in December 1994. A similar design, modified as the result of sea trials, has been authorised with plans for 12 and options on another 12.

BROOKE MARINE 32.5 m (MADARAKA)



Brooke Maine 32.5m (Ian Sturton)
1 *IAI Gabriel II anti-ship missiles (four)* **2** *Racal Decca AC 1226 navigation radar* **3** *Alenia Orion RTN-10X fire-control radar* **4** *El-Op electro-optic director for Gabriel II system* **5** *Royal Ordance twin 30 mm GCM-AO2*

GENERAL SPECIFICATIONS

Operator: Kenya ('Madaraka')
Type: FAC, Missile

Class: BROOKE MARINE 32.5 m

Built: 3
Active: 3

Displacement:
standard: 120 t
full load: 145 t

Dimensions
Length: 32.6 m (107 ft)
Beam: 6.1 m (20 ft)
Draught: 1.7 m (5.6 ft)

Speed: 25.5 kts
Range: 2,500 n miles (4,630 km) at 12 kts

Complement: 21 (3 officers)

SHIPS

MADARAKA (P 3121)
Builder Brooke Marine, Lowestoft, UK
Launched 28 Jan 1975
Commissioned 16 Jun 1975

JAMHURI (P 3122)
Builder Brooke Marine, Lowestoft, UK
Launched 24 Mar 1975
Commissioned 16 Jun 1975

HARAMBEE (P 3123)
Builder Brooke Marine, Lowestoft, UK
Launched 2 May 1975
Commissioned 22 Aug 1975

The three 'Madaraka' class FACs in their original state in 1975, with two single Bofors 40 mm guns and no Gabriel missiles (Brooke Marine)

WEAPONS SYSTEMS

ANTI-SHIP MISSILES

Gabriel II

These vessels have two pairs of forward-facing, outboard angled, launchers for IAI Gabriel II anti-ship missiles on the afterdeck.

Specifications
Length: 3.42 m (11.2 ft)
Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)
Weight: 522 kg (1,151 lb)
Speed: Mach 0.7
Range: 19 n miles (36 km)
Warhead: 150 kg (330 lb)
Guidance: Semi-active radar and manual

Manufacturer/Contractor
Israel Aircraft Industries, Tel Aviv, Israel.

GUNS

Royal Ordnance GCM-AO2

A Royal Ordnance twin 30 mm GCM-AO2 is mounted forward of the bridge.

Specifications
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 650 rds/min/gun
Range: 1.5 n miles (3 km)

Mounting
Weight: 2.26 t
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
Royal Ordnance.

COMMAND AND CONTROL SYSTEMS

These vessels have an IAI fire-control system with a one-man display control and processing console which interfaces with the Gabriel surface-to-surface missiles and the main gun.

ELECTRO-OPTIC SENSORS

El-Op electro-optical director

An electro-optical director is carried by these vessels, as part of the Gabriel II system. It appears identical to similar devices aboard Israeli Sa'ar class FACs.

RADARS

Type	AC 1226	Orion
Maker	Racal-Decca	Alenia
Role	Search	Weapon control
Frequency	I-band	I-band
Beam	1.2°	n/k
Peak power	25 kW	200 kW
Gain	n/k	n/k
Pulsewidth	0.05, 0.25, 1.0 µs	1.5 µs
PRF	1,300 pps	450-550 pps
Scan rate	25 rpm	—
Typical range	20 n miles (37 km)	n/k

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Paxman Valenta 16CM
Power output: 4.96 MW (6,650 hp)
Shafts: 2

FURTHER INFORMATION

These steel-hulled ships were ordered as patrol boats from Brooke Marine, Lowestoft in 1973 and commissioned in 1975. In 1982 they were upgraded with Gabriel II missiles, the associated electro-optical director and the twin 30 mm gun, which replaced two 40 mm guns.

MAMBA (BROOKE MARINE) 37.5 m

GENERAL SPECIFICATIONS

Operator: Kenya ('Mamba')
Type: FAC, Missile

Class: BROOKE MARINE 37.5 m

Built: 1
Active: 1

Displacement:
standard: 125 t
full load: 160 t

Dimensions
Length: 37.5 m (123 ft)
Beam: 6.9 m (22.6 ft)
Draught: 1.6 m (5.2 ft)

Speed: 25 kts
Range: 3,300 n miles (6,110 km) at 13 kts

Complement: 25 (3 officers)

SHIPS

MAMBA (P 3100)
Builder Brooke Marine, Lowestoft, UK
Laid down 17 Feb 1972
Launched 6 Nov 1973
Commissioned 7 Feb 1974

WEAPONS SYSTEMS

ANTI-SHIP MISSILES

Gabriel II
This ship has two pairs of forward-facing, outboard angled, launchers for Gabriel II anti-ship missiles on the afterdeck.

Specifications
Length: 3.42 m (11.2 ft)
Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)
Weight: 522 kg (1,151 lb)
Speed: Mach 0.7
Range: 19 n miles (36 km)
Warhead: 150 kg (330 lb)
Guidance: Semi-active radar and manual

Manufacturer/Contractor
Israel Aircraft Industries, Tel Aviv, Israel.

GUNS

Royal Ordnance GCM-AO2
The Kenya ship has a Royal Ordnance GCM-AO2 twin 30 mm gun forward of the bridge.

Specifications
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 650 rds/min/gun
Range: 1.5 n miles (3 km)

Mounting
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
Royal Ordnance, UK.

COMMAND AND CONTROL SYSTEMS

These vessels have an IAI fire-control system with a one-man display control and processing console which interfaces with Gabriel surface-to-surface missiles and the main gun.

ELECTRO-OPTIC SENSORS

Mamba has an Israeli Kollmorgen 35 periscope.

RADARS

Type	AC 1226	Orion
Role	Search	Weapon control
Frequency	I-band	I-band
Beam	1.2°	n/k
Peak power	25 kW	200 kW
Gain	n/k	n/k

Type	AC 1226	Orion
Pulsewidth	0.05, 0.25, 1.0 µs	1.5 us
PRF	1,300 pps	450-550 pps
Scan rate	25 rpm	n/k
Typical range	20 n miles (37 km)	n/k
Maker	Racal-Decca	Alenia

PROPULSION

Specification
System: Diesel
Main machinery: 2 Paxman 16YJCM diesels; 2.98 MW (4,000 hp)
Shafts: 2

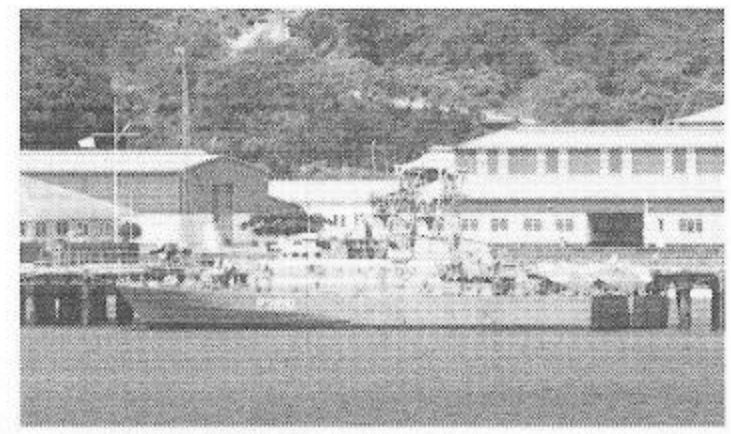
FURTHER INFORMATION

The steel-hulled Kenyan vessel was laid down as a patrol boat but upgraded in 1982 with the new weapons replacing two 40 mm guns.

Brooke Marine 37.5 m patrol boats or gun-armed versions are also in service with the following navies:

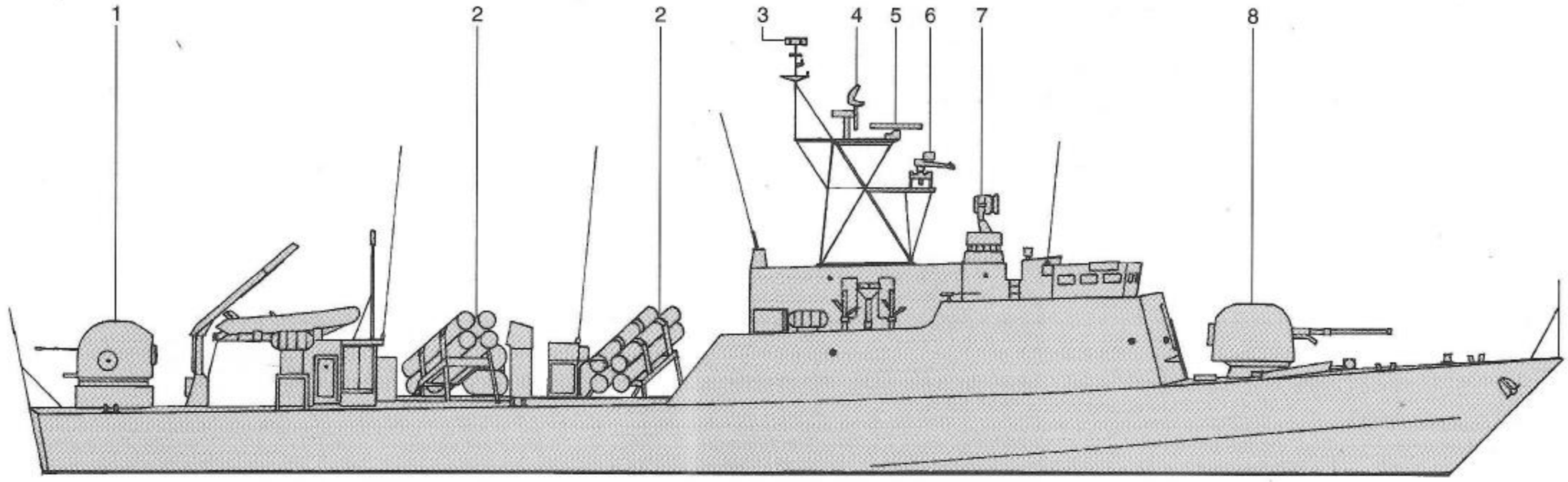
- Algeria. 'Kebir' class. Nine in service, plus three building.
- Barbados. 'Trident' class. One vessel.
- Oman. 'Al Waafi' class. Four delivered, but only two remain in service.

This vessel was modernised in 1982, when the Gabriel II missiles, new gunnery equipment and an optronic director were fitted. It then underwent a major refit between May 1989 and November 1990 at Vosper Thornycroft in the UK.



Mamba *(P 3100)*

NYAYO/DHOFAR (PROVINCE)



Al Bat'nah (Ian Sturton)
1 *OTOBREDA 76 mm (3 in)/62* **2** *Aerospatiale MM 38 Exocet anti-ship missiles (eight; six in Dhofar)* **3** *Racal Thorn Cutlass radar warning (ESM)* **4** *Siemens Plessey AWS-6 air search radar* **5** *Racal Decca TM 1226 navigation radar* **6** *Siemens Plessey AWS-4 surface search radar* **7** *CelsiusTech 9GR600 fire-control director* **8** *OTOBREDA 76 mm/62 Compact automatic gun*

GENERAL SPECIFICATIONS

Operator: 'Nyayo' class — Kenya, 'Dhofar' class — Oman
Type: FAC, Missile

Class: NYAYO/DHOFAR (PROVINCE)

Built: Kenya 2; Oman 4
Active: Kenya 2; Oman 4

Displacement:
standard: 310 t (Kenya); 311 t (Oman)
full load: 400 t (Kenya); 394 t (Oman)

Dimensions
Length: 56.7 m (186 ft)
Beam: 8.2 m (26.9 ft)
Draught: 2.4 m (7.9 ft)

Speed: 40 kts (Kenya); 38 kts (Oman)
Range: 2,000 n miles (3,700 km) at 18 kts

Complement: 40 (Kenya); 45 (5 officers) (Oman)

SHIPS

Kenya

NYAYO (P3126)

Builder	Vosper Thornycroft, Woolston, Hampshire, UK
Launched	20 Aug 1986
Commissioned	23 Jul 1987

UMOJA (P 3127)

Builder	Vosper Thornycroft, Woolston, Hampshire, UK
Launched	5 Mar 1987
Commissioned	16 Sep 1987

Oman

DHOFAR (B 10)

Builder	Vosper Thornycroft, Woolston, Hampshire, UK
Launched	14 Oct 1981
Commissioned	7 Aug 1982

AL SHARQIYAH (B 11)

Builder	Vosper Thornycroft, Woolston, Hampshire, UK
Launched	2 Dec 1982
Commissioned	5 Dec 1983

AL BAT'NAH (B 12)

Builder	Vosper Thornycroft, Woolston, Hampshire, UK
Launched	4 Nov 1982
Commissioned	18 Jan 1984

MUSSANDAM (B 14)

Builder	Vosper Thornycroft, Woolston, Hampshire, UK
Launched	19 Mar 1988
Commissioned	31 Mar 1989

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

These vessels have two sets of launchers facing forward and outboard on the main deck aft of the superstructure. The forward launchers face port while the after ones face starboard. The Kenyan vessels have two twin launchers for Otomat Mk 2 while Omani vessels have two quad launchers (two triple in *Dhofar*) for Aerospatiale MM 38 Exocet.

Otomat Mk 2

Specifications
Length: 4.46 m (14.62 ft)
Diameter: 46 cm (18 in)
Wing span: 1.36 m (4.46 ft)
Weight: 770 kg (1,698 lb) (with boosters)
Speed: Mach 0.9
Range: 35 n miles (65 km) (Longer ranges require helicopter support)
Warhead: 210 kg (465 lb)
Guidance: Inertial with active radar homing

Manufacturers/Contractors
Alenia Missile Systems.
Matra BAe Dynamics.

Exocet MM 38

Specifications
Length: 5.21 m (17.08 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 22.5 n miles (42 km)
Warhead: 165 kg (365 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, France.

GUNS

Both classes have an OTOBREDA 76/62 Compact forward of the bridge, but the secondary armament differs. Kenyan vessels have a Royal Ordnance twin 30 mm GCM-AO2 on the aft superstructure and two 20 mm Royal Ordnance A41 in the superstructure. Omani vessels have only an OTOBREDA twin 40 mm Compact on the stern.

OTOBREDA 76/62 Compact

Specifications
Gun
Calibre: 76 mm (3 in)
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 10/85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA.

OTOBREDA twin 40 mm L/70 Compact

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 600 rds/min
Range: 3.25 n miles (12.5 km)

Mounting
Traverse: 360°
Elevation: −13 to +85°

Manufacturer/Contractor
OTOBREDA.

Royal Ordnance GCM-AO2
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 650 rds/min/gun
Range: 1.5 n miles (3 km)

Mounting
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
Royal Ordnance, UK.

Royal Ordnance A41

Specifications
Gun
Calibre: 20 mm
Length of barrel: 80 calibres
Muzzle velocity: 850 m/s (2, 789 ft/s)
Rate of fire: 750/800 rds/min
Range: 1.3 n miles (2.4 km) and 2,000 m

Mounting
Traverse: 360°
Elevation: −10 to +50°

Manufacturer/Contractor
Royal Ordnance, UK.

Umoja *(P 3127). The Kenyan ships carry four Otomat Mk 2 missiles (not fitted in this picture). Note also the AWS 4 radar on the lower mast platform, Cygnus jammer (spherical radome) and Cutlass radar warner (masthead)* (Vosper Thornycroft)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal Thorn Cutlass ESM
All these vessels have the Racal-Thorn Cutlass ESM system which uses the same antenna as RDL and provides bearings, CW bearing and frequency measurement over the E/J-band with instantaneous frequency measurement. The system can incorporate a responsive noise jammer as well as providing spot or barrage noise. It may also be integrated with decoy launchers.

ELECTRONIC COUNTERMEASURES (ECM)

Racal Thorn Cygnus ECM
Kenyan ships have Racal Thorn Cygnus ECM system and ML Aviation Barricade decoy launchers. Cygnus is a narrowband tracking jammer covering the D/J bands and designed to operate with Cutlass for spot or barrage jamming. With one transmitter and two antennas it can jam two targets simultaneously, the 300 kW jammer being tuned by instantaneous frequency measurement.

Racal Thorn Scorpion
Omani ships have the Racal Thorn Scorpion wideband jammer which covers the E/J bands. The dual-beam antenna can call upon 50 kW of radiated power and the system can deal with between five and eight targets.

DECOYS

ML Aviation Barricade
All ships have the ML Aviation Barricade lightweight chaff launcher system which uses spin-stabilised 57 mm rockets. The launcher consists of frames which point in various directions at different angles of elevation. Barricade fires short-range rockets which create chaff clouds up to 60 m (197 ft) from the ship and long-range rockets whose clouds are deployed between 400 and 2,000 m (1,312 and 6,562 ft) from the ship. The short-range Pallisade rockets weigh 2.1 kg (4.6 lb) while the longer-ranged Stockade rockets (which are also available with infra-red payloads) weigh 1.77/1.88 kg (3.9 lb/4.1 lb).

Nyayo *(P 3126). The Kenyan ships have a similar profile to the Omani ships but can be instantly recognised by the spherical radome at the masthead for the Cygnus jammer* (H & L van Ginderen Collection)

Al Sharqiyah *(B 11) of the RNO. Sensors include: CelsiusTech 9GR 600 (on bridge roof); Plessey AWS-4 surface search radar (on lower mast platform); Racal-Decca 1226 navigation radar and Plessey AWS-6 air search radar (masthead platform) and Racal Thorn Cutlass ESM array (masthead)* (Vosper Thornycraft)

COMMAND AND CONTROL SYSTEMS

GEC-Marconi CAAIS 450

Kenyan ships only. This former Ferranti command and weapon control system is a federated architecture system based upon the FM1600E mini-computer and F100L microprocessors. There are two consoles for display and weapon control and the system can track up to 120 targets simultaneously.

Manufacturer/Contractor
GEC-Marconi, UK.

CelsiusTech 9LV200 Mk 2

Omani ships but not *Dhofar* The 9LV 200 Mk 2 is a radar-based weapon control system of mainframe architecture using the Philips P800 mini-computer for the control of one medium and one light calibre gun mounting as well as surface-to-surface missiles. There is a tactical display system and two gun control displays, for ASuW and AAW operations.

Manufacturer/Contractor
CelsiusTech, Sweden.

British Aerospace Systems and Equipment Sea Archer 1A Mod 0

Omani ships only. This is an electro-optical fire-control system of mainframe architecture with a single fire-control console. It can control one medium and one light calibre mounting simultaneously.

Manufacturer/Contractor
BAe, UK.

RADARS

'Nyayo' class (Kenya)

Type	AWS 4	ST 1802	AC 1226
Maker	Siemens Plessey	GEC-Marconi	Racal-Decca
Role	Search	Weapon control	Navigation
Band	E/F	I	I
Beam	1.9 × 30°	2.4°	1.2°
Peak power	n/k	50 kW	25 kW
Gain	n/k	37 dB	n/k
Pulsewidth	0.3, 1 µs	0.3, 0.67, 1.0 µs	0.05, 0.25, 1.0 µs
PRF	680, 1,360 pps	3,000 pps	1,300 pps
Scan rate	10, 20 rpm	n/k	25 rpm
Typical range	59 n miles (110 km)	21.5 n miles (40 km)	20 n miles (37 km)

'Dhofar' class (Oman)

Type	AWS 4	AWS 6	9GR600	TM 1226
Maker	Siemens Plessey	Siemens Plessey	CelsiusTech	Racal-Decca
Role	Search	Search	Weapon control	Navigation
Band	E/F	G/H	I	I
Beam	1.9 × 30°	1.5°	1.1 × 7°	1.2°
Peak power	n/k	49 kW	200 kW	25 kW
Gain	n/k	26/29 dB	35.5 dB	n/k
Pulsewidth	0.3, 1 µs	0.1, 4.3 µs	0.25, 1.0 µs	0.05, 0.25, 1.0 µs
PRF	680, 1,360 pps	n/k	1,000, 3,000 pps	1,300 pps
Scan rate	10, 20 rpm	30, 60 rpm	60 rpm	25 rpm
Typical range	59 n miles (110 km)	n/k	n/k	20 n miles (37 km)

ELECTRO-OPTIC SENSORS

MSI Defence Systems Optical Fire Director (OFD)

The OFD is part of the Sea Archer system and is either manually or remotely operated.

Specifications
Weight: 485 kg (1,069 lb)
Elevation: −20 to +70°
Sensors: Optical and thermal imager

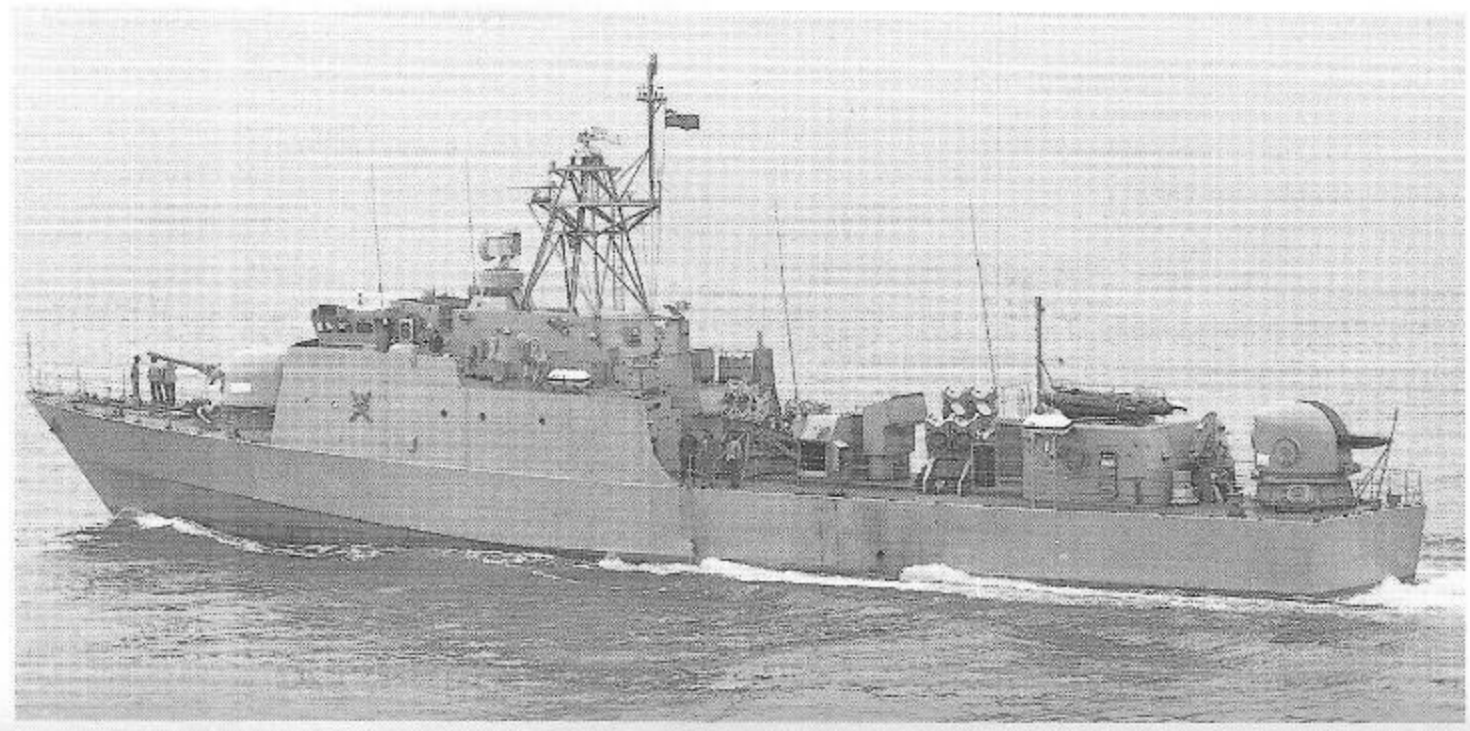
PROPULSION

Specifications
System: Diesel
Main machinery: 4 Paxman Valenta 18CM diesels; 12.2 MW (15,000 hp)
Shafts: 4

FURTHER INFORMATION

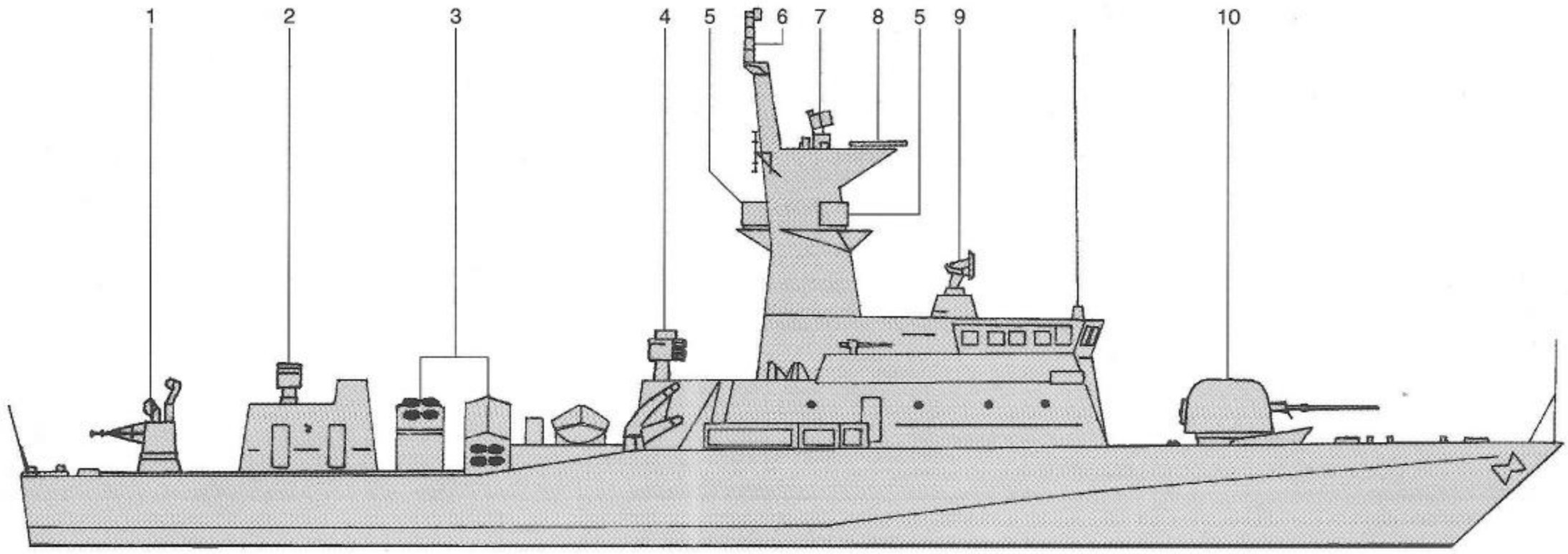
The first two Omani vessels (Dhofar) were ordered in 1980 from Vosper Thornycroft as modified versions of the 'Ramadan' class for Egypt; they were commissioned in 1982. *Al Sharqiyah* and *Al Bat'nah* were ordered from the same yard in 1981 with new command and sensor systems as well as larger offensive load. All have steel hulls with aluminium superstructure and carry 45 tonnes of fuel while the electricity generation system produces 420 kW. They have two 100 hp electric motors for manoeuvring. They were commissioned in 1983/1984 while the last ship was ordered in 1986 and commissioned in 1989. In addition to the weapon systems mentioned above they have two 12.7 mm machine guns.

The Kenyan vessels were ordered from Vosper Thornycroft in 1984 and commissioned in 1987.



Al Sharqiyah *(B 11)*
(H & L van Ginderen Collection)

BARZAN



Barzan (Ian Sturton)
1 *Signaal SGE-30 Goalkeeper 30 mm CIWS* **2** *CS Défense Dagaie chaff/IR launcher* **3** *Aerospatiale MM 40 Exocet anti-ship missiles (eight)* **4** *Matra Sadral six-tube Mistral SAM launcher* **5** *Dassault Salamandre (ARBB 33) jammer* **6** *Thomson-CSF DR 3000S ESM* **7** *Thomson-CSF MRR air/surface search radar* **8** *Kelvin Hughes 1007 navigation radar* **9** *Signaal STING fire-control radar* **10** *OTOBREDA 76 mm (3 in)/62 Super Rapid automatic gun*

GENERAL SPECIFICATIONS

Operator: Qatar
Type: FAC, Missile

Class: BARZAN

Built: 2
Active: 2
Building: 4

Displacement:
standard: 376 t
full load: 450 t

Dimensions
Length: 56.3 m (185.7 ft)
Beam: 9 m (29.5 ft)
Draught: 2.5 m (8.2 ft)

Speed: 35 kts
Range: 1,800 n miles (3,330 km) at 12 kts

Complement: 30 (8 officers)

SHIPS

BARZAN (Q 04)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down Feb 1994
Launched 1 Apr 1995
Commissioned Oct 1996

HWAR (Q 05)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down Aug 1994
Launched 15 Jul 1995
Commissioned Oct 1996

AL UDEID (Q 06)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down Mar 1995
Launched 21 Mar 1996
Commissioned Sep 1997

Adeebel (Q 07)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down Aug 1995
Launched Aug 1996
Commissioned Sep 1997

Plus two; no dates yet available

WEAPONS SYSTEMS

ANTI-SHIP MISSILES

Exocet MM 40 Block 2

The 'Barzan' class carries two quad launchers of Exocet MM 40 Block 2 anti-ship missiles in crossover configuration aft of the superstructures. The forward set face to port and the starboard set face starboard.

Specifications
Length: 5.80 m (19.02 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.13 m (3.7 ft)
Weight: 870 kg (1,918 lb)
Speed: Mach 0.9
Range: 40.5 n miles (75 km)
Warhead: 155 kg (340 lb)
Guidance: Inertial navigation and active radar homing

Manufacturer/Contractor
Aerospatiale Missiles, France.

SURFACE-TO-AIR MISSILES (SAM)

Mistral

A six-round Sadral launcher for the Matra Mistral point defence missile is installed amidships.

Barzan *(Q 04). Armament comprises: 76 mm gun (foredeck); Sadral Mistral SAM launcher (aft of mast); eight MM 40 Exocet (abaft Sadral); Goalkeeper CIWS* (Vosper Thornycroft)

Specifications
Length: 1.81 m (5.9 ft)
Diameter: 9.2 cm (3.6 in)
Wing span: 11.1 cm (4.4 in)
Weight: 18.4 kg (40.5 lb)
Speed: Mach 2.6
Range: 2.7 n miles (5 km)
Warhead: 2.95 kg (6.5 lb)
Guidance: Infra-red passive homing

Manufacturer/Contractor
Matra BAe Dynamics.

GUNS

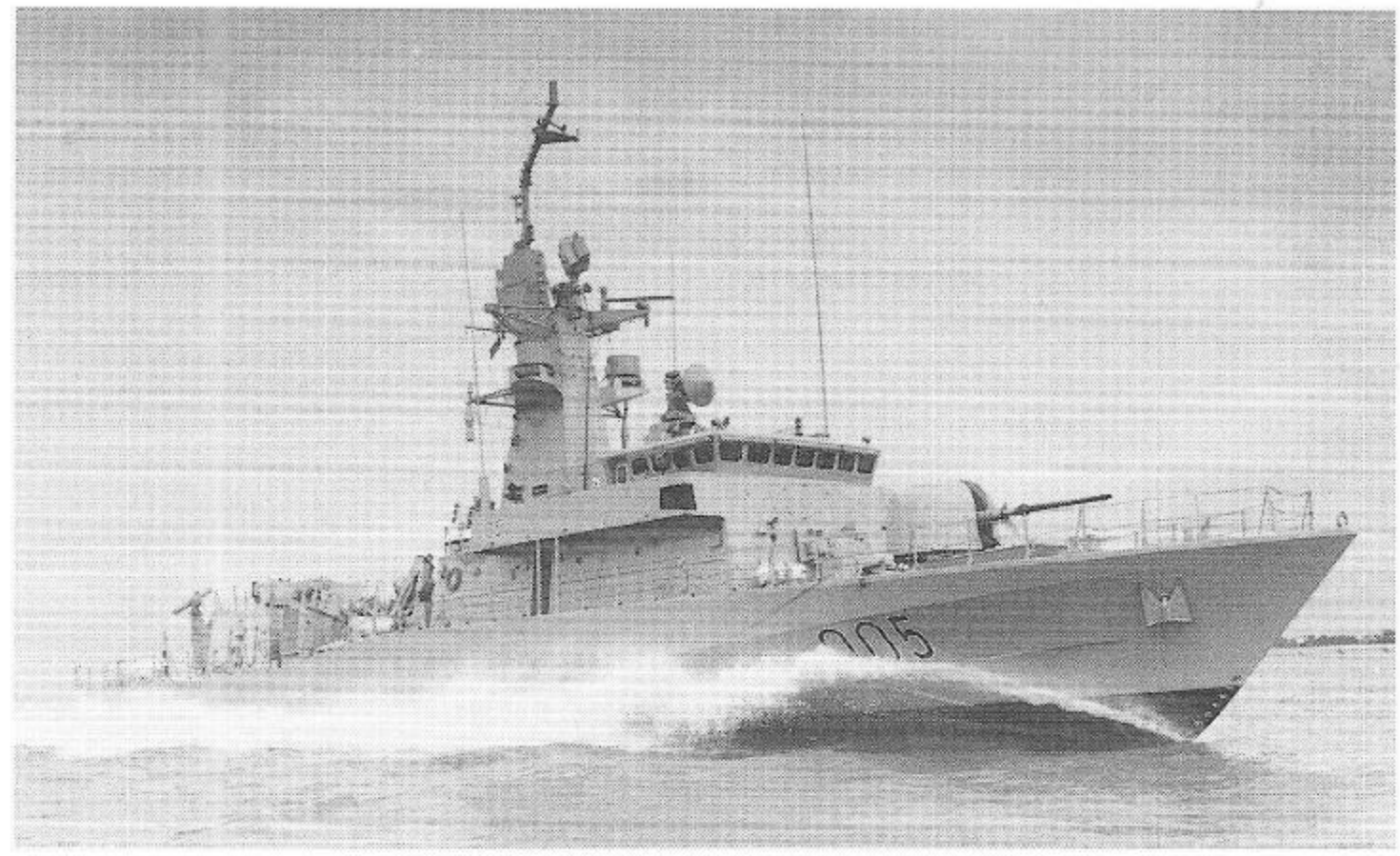
An OTOBREDA 76/62 Super Rapid is installed forward of the bridge while a Signaal Goalkeeper close in weapon system is at the stern.

OTOBREDA 76/62 Super Rapid

Specifications
Gun
Calibre: 76 mm (3 in)
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 120 rds/min
Range: 8.5 n miles (16 km)

Mounting
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.



Hwar *(Q 05) at speed. With a top speed of 35 knots and a heavy armament, the squadron of six of these FACs for the Qatar Emiri Navy will exert a substantial influence on naval operations in the Gulf* (Vosper Thornycroft)

Goalkeeper

Specifications
Gun
Calibre: 30 mm
Length of barrel: 78 calibres
Muzzle velocity: 1,020-1,150 m/s (3,346-3,773 ft/s)
Rate of fire: 4,200 rds/min
Range: 1.6 n miles (3 km)

Mounting
Traverse: 360°
Elevation: −25 to +85°

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

There is a Thomson-CSF DR 3000S ESM system with CS Défense Sidewind electronic warfare co-ordination software. The DR 3000S is a lightweight ESM system covering D/K-bands with higher sensitivity (due to a low-noise amplifier in the antenna) and an instantaneous direction-finding accuracy of 6°. There are six direction-finding antennas under one radome.

Manufacturer/Contractor
Thomson-CSF, Paris, France.

ELECTRONIC COUNTERMEASURES (ECM)

Dassault Salamandre

For ECM activity the ships have a Dassault Salamandre ECM system. The Salamandre has up to three phased array, travelling-wave tube, transmitters in cylindrical radomes on the mast.

Manufacturer/Contractor
Dassault, France.

DECOYS

Dagaie

Dagaie is a trainable mounting with 10 replaceable containers loaded with a mixture of 3/5 and 8/14 µm IR or I/J-band chaff projectiles produced by Etienne Lacroix Défense.

Manufacturer/Contractor
CS Défense, France.

COMMAND AND CONTROL SYSTEMS

Signaal TACTICOS

The 'Barzan' class has a Signaal Tacticos command and weapon control system. This is a distributed architecture system based upon SUN-1S processors with five MOC (Multifunction Operator Consoles) workstations linked by a dual-databus system. In addition to data from on-board sensors the system receives radar data from off-board platforms via a Signaal Link Y datalink.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

ELECTRO-OPTIC SENSORS

Signaal IRSCAN

A Signaal IRSCAN electro-optical tracker is installed and the STING has electro-optical elements. There are also TDS directors.

IRSCAN

Specifications
Weight: 75 kg (165 lb)
Elevation: n/k
Sensors: Thermal imager

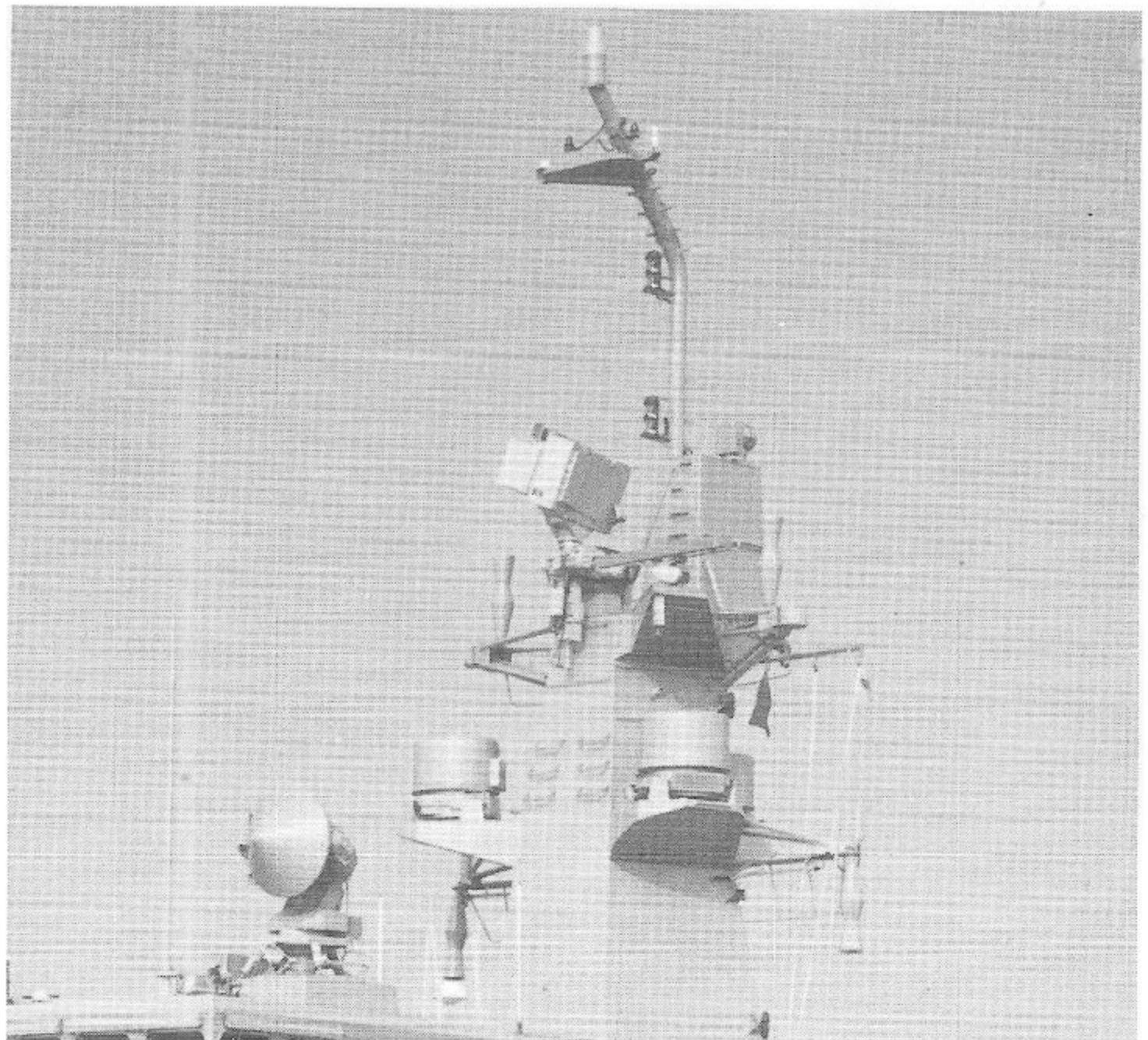
RADARS

Type	**MRR***	**1007**	**STING**
Maker	Thomson-CSF	Kelvin Hughes	Signaal
Role	Search	Navigation	Weapon control
Freqency	G/H-band	I-band	I/K-band
Beam	1.75 × 20°	1.0 × 18°/0.75 × 18°	0.4 × 1.6°
Peak power	n/k	25 kW	30, 220 kW
Gain	n/k	31, 33 dB	n/k
Pulsewidth	n/k	0.08, 0.3, 0.8 µs	n/k
PRF	n/k	400-800, 1,600 pps	n/k
Scan rate	10/30 rpm	26 rpm	n/k
Typical range			
surface	38 n miles (70 km)	n/k	n/k
altitude	13.5 n miles (25 km)	n/k	n/k

* MRR = MultiRole Radar

TDS

Specifications
Weight: 77 kg (170 lb)
Elevation: −15 to +85°
Sensors: Optical



The mainmast of a 'Barzan' class FAC. On the bridge roof is the Signaal STING fire director. Behind the STING are two of the three radomes of the Dassault Salamandre (ARBB-33) jamming system, while above the port jammer is the horizontal slotted waveguide of the Kelvin Hughes Type 1007 navigation radar. Above the 1007 is the Thomson-CSF MRR (MultiRole Radar) and at the head of the 'swan-neck' topmast is the Thomson-CSF DR 3000S radar intercept array

PROPULSION

Specifications
System: Diesel
Main machinery: 4 MTU 20V 538 TB93; 13.8 MW (18,740 hp)
Shafts: 4
Ships services: 3 Deutz 260 kW diesel generators; 1—135 kW emergency generators

FURTHER INFORMATION

PROGRAMME

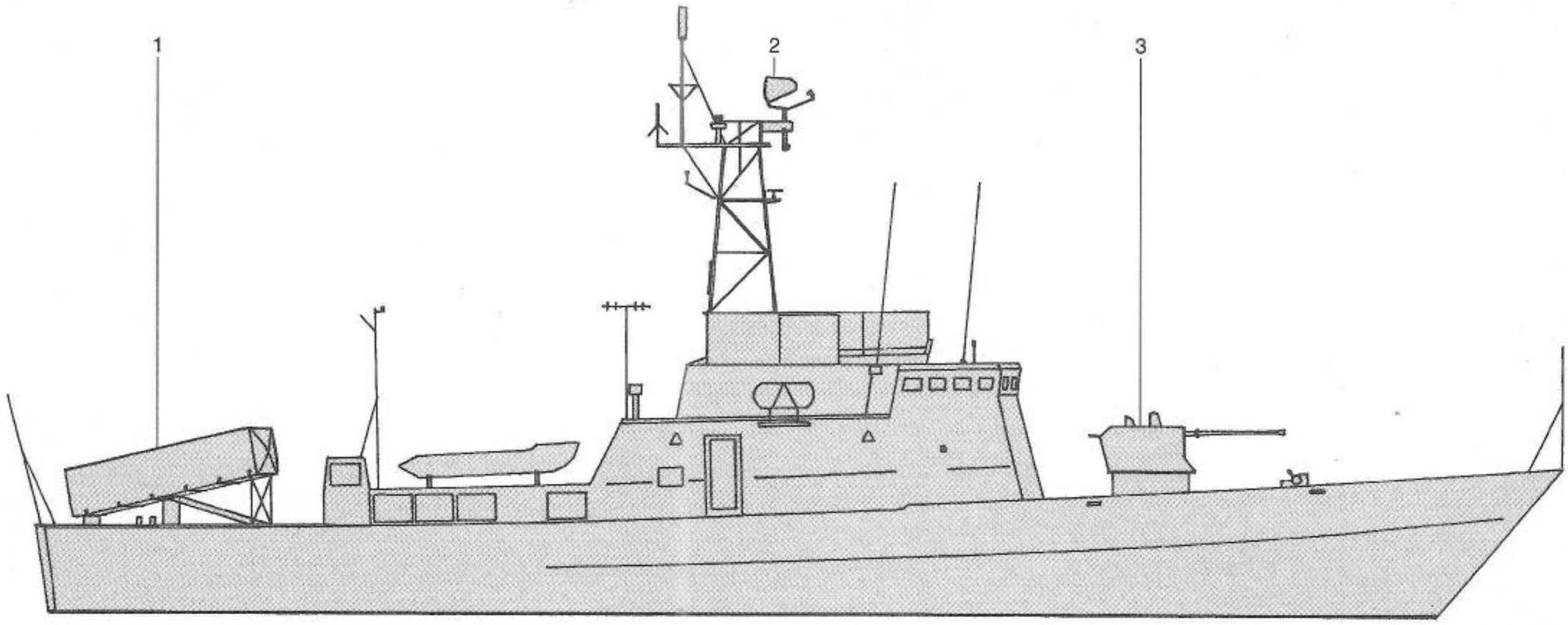
Four of these Vita-based designs were ordered in 1992 from Vosper Thornycroft and the first two commissioned in October 1996 with *Al Udeid* and *Adeebel* scheduled to be commissioned in 1997.

DESIGN

The main propulsion, electrical generation and auxiliary systems are operated from a one-man console while the bridge can also monitor all compartments for damage control purposes. The sideplating of the hull forward has a pronounced 'knuckle' to reduce spray. In addition to the weapons mentioned above these ships carry two 12.7 mm machine guns.

Barzan *(Q 04)* (Jane's/H M Steele)

VOSPER THORNYCROFT 37 m (121 ft)



Federación (Ian Sturton)
1 *OTOBREDA Otomat Teseo Mk 2 TG1* **2** *Alenia MM/SPQ-2D search/target designation radar* **3** *Bofors 40 mm/70 (open mount)*

GENERAL SPECIFICATIONS

Operator: Venezuela ('Constitución')
Type: FAC, Missile/FAC, Gun

Class: VOSPER THORNYCROFT 37 m (121 ft)

Built: 6
Active: 6

Displacement:
full load: 170 t

Dimensions
Length: 36.9 m (121 ft)
Beam: 7.1 m (23.3 ft)
Draught: 1.8 m (6 ft)

Speed: 31 kts
Range: 1,350 n miles (2,500 km) at 16 kts

Complement: 20 (4 officers)

SHIPS

FAC-Gun

CONSTITUCION (PC 11)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down Jan 1973
Launched 1 Jun 1973
Commissioned 16 Aug 1974

INDEPENDENCIA (PC 13)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down Feb 1973
Launched 24 Jul 1974
Commissioned 20 Sep 1974

PATRIA (PC 15)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down Mar 1973
Launched 27 Sep 1973
Commissioned 9 Jan 1975

FAC-Missile

FEDERACIÓN (PC 12)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down Aug 1973
Launched 26 Feb 1974
Commissioned 25 Mar 1975

LIBERTAD (PC 14)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down Sep 1973
Launched 5 Mar 1974
Commissioned 12 Jun 1975

VICTORIA (PC 16)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down Mar 1974
Launched 3 Sep 1974
Commissioned 22 Sep 1975

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Otomat Mk 2 TG1

Federación, Libertad, Victoria only. These three vessels have two launchers for Otomat Mk 2 TG1 anti-ship missiles at the stern.

Specifications
Length: 4.46 m (14.62 ft)
Diameter: 46 cm (18 in)
Wing span: 1.36 m (4.46 ft)
Weight: 770 kg (1,698 lb) (with boosters)
Speed: Mach 0.9
Range: 35 n miles (65 km) (Longer ranges require helicopter support)
Warhead: 210 kg (465 lb)
Guidance: Inertial with active radar homing

Manufacturers/Contractors
Alenia Missile Systems.
Matra BAe Dynamics.

Federación *(PC 12), also as built, with a Bofors 40 mm/70 in an open mount forward and two OTOBREDA Otomat Mk 2 launchers aft* (Vosper Thornycroft)

GUNS

OTOBREDA Single Compact 30 mm

Constitución, Independencia, Patria only. An OTOBREDA Single Compact 30 mm mounting is installed forward of the bridge.

Specifications

Gun
Calibre: 30 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,040-1,220 m/s (3,412-4,002 ft/s)
Rate of fire: 800 rds/min
Range: 1.6 n miles (3 km)

Mounting
Weight: 1.33 t
Traverse: 360°
Elevation: −13 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA 76 mm (3 in)/62 Compact

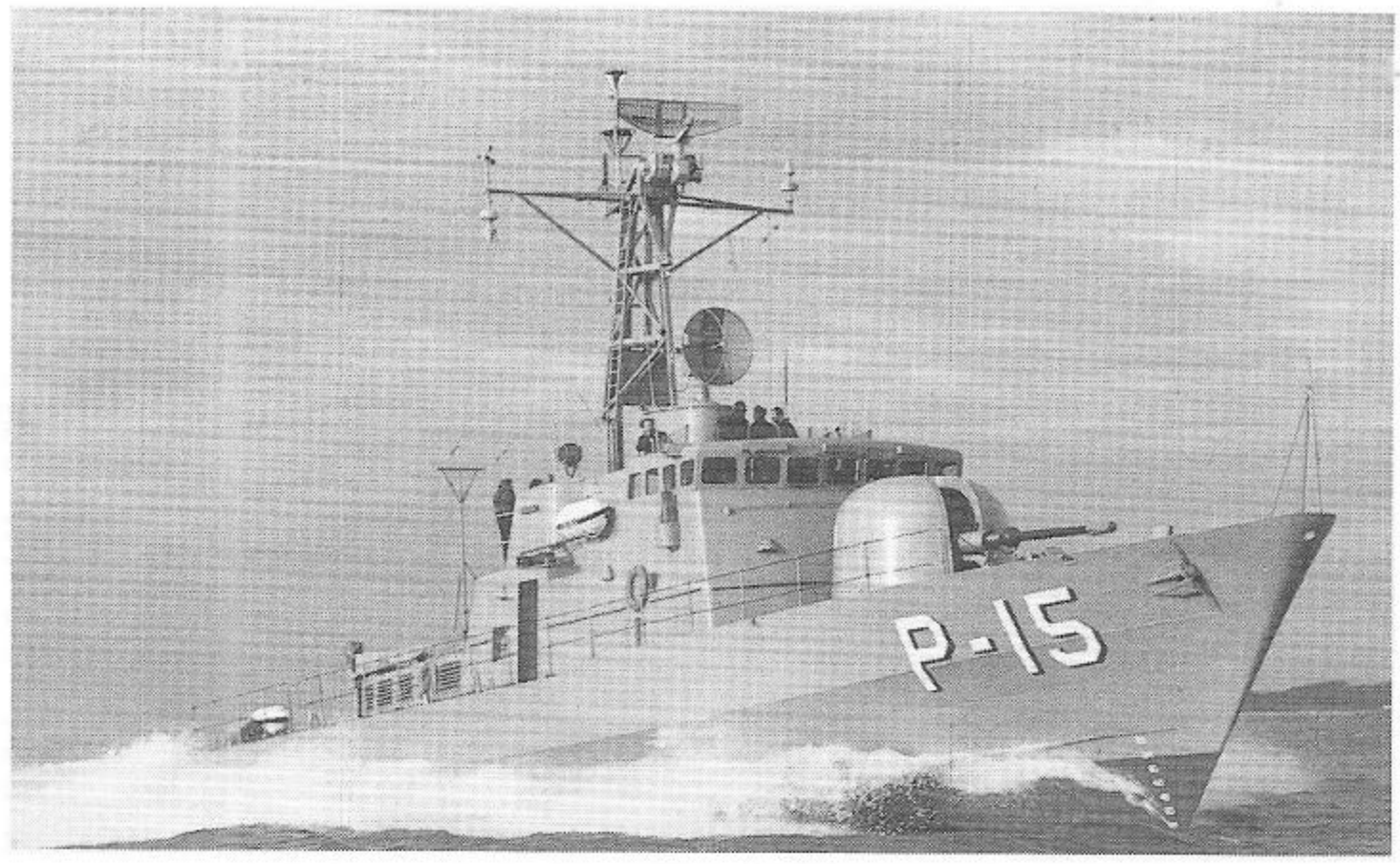
There are two gun mountings; an OTOBREDA 76/62 Compact forward of the bridge and an OTOBREDA twin 40 mm Compact at the stern.

Specifications

Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.



Patria *(PC 15) as built. This is the gun version with an OTOBREDA 76 mm/62 gun in 'A' position* (Vosper Thornycroft)

COMMAND AND CONTROL SYSTEMS

RADARS

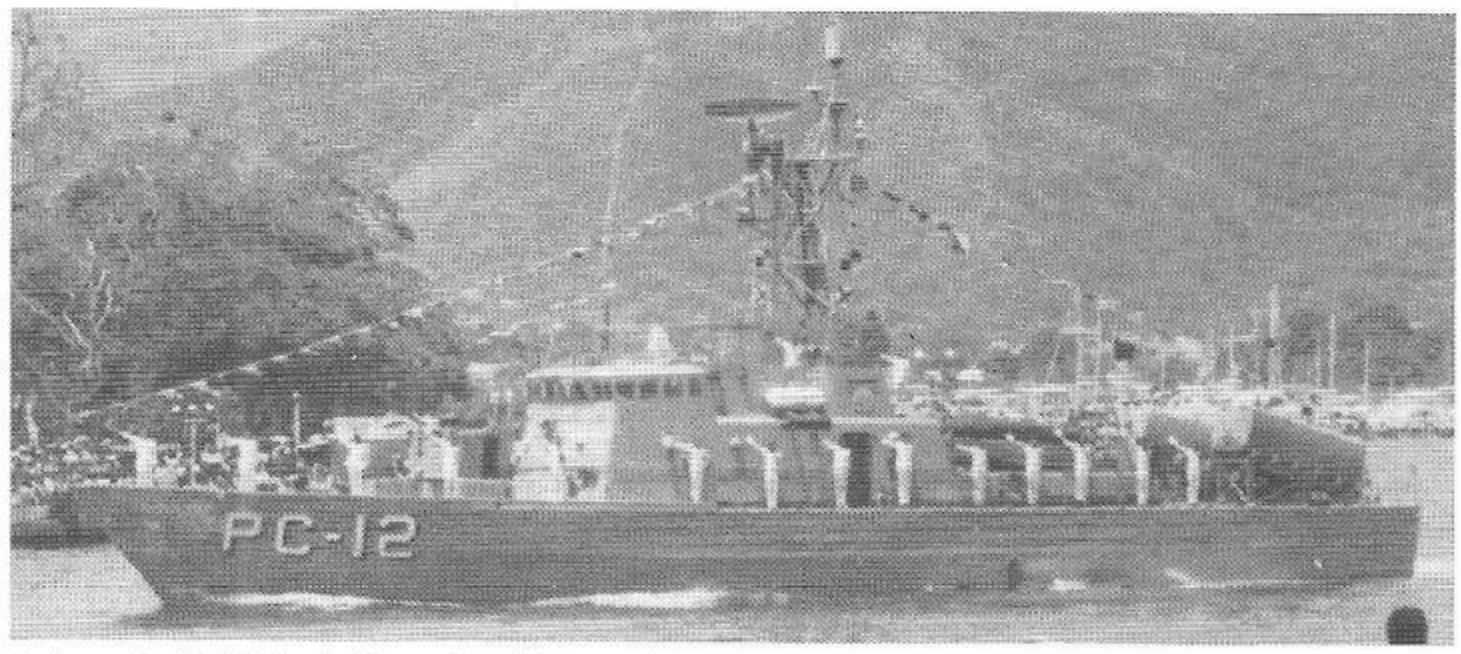
	MM/SPQ-2D	RTN-10X (Orion)
Role	Search/target designation	Fire control
Ships	FAC-Missile (PC-12, -14, -16)	FAC-Gun (PC-11, -13, -15)
Frequency	I-band	I-band
Beam	0.6°	n/k
Peak power	180 kW	200 kW
Pulsewidth	0.15, 1.5 µs	1.5 µs
PRF	450-550 pps	450-550 pps
Scan rate	15 rpm	—
Maker	SMA, Italy	Alenia, Italy

ELECTRO-OPTIC SENSORS

Alenia Medusa

Specifications
Weight: n/k
Elevation: −40 to +85°
Sensors: TV camera, thermal imager, laser rangefinder

Manufacturer/Contractor
Alenia, Italy.



Federación *(PC 12)* missile version (Venezuelan Navy)

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU MD 16V 538 TB90 diesels; 4.4 MW (6,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

Ordered from Vosper Thornycroft in 1972 for the coastguard, these vessels were transferred to the navy in 1983. All six have the same hull, but three were completed as missile ships and three as gun ships.

These were the first ships to be built by Vosper Thornycroft to metric (as opposed to Imperial) standards.

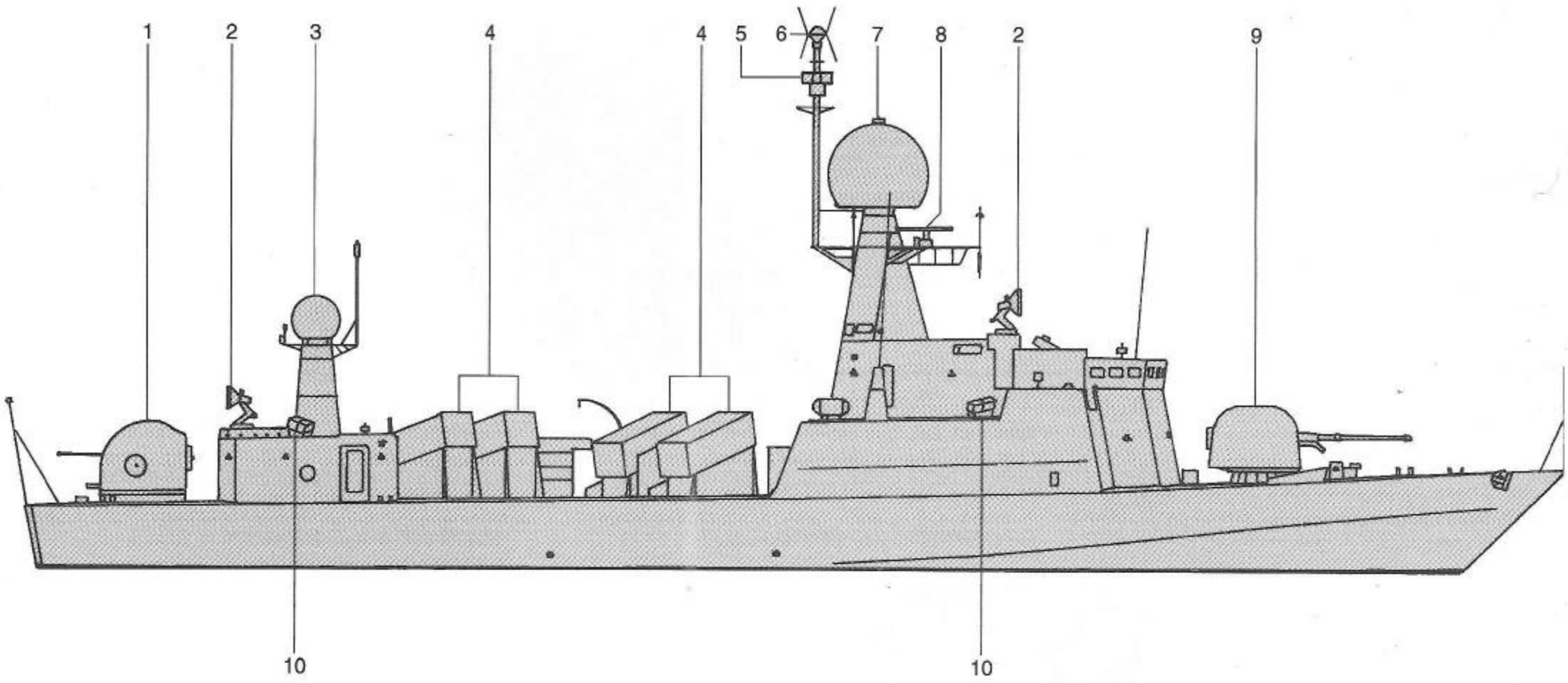
The order was obtained at the last minute from a Scandinavian yard at a time when the Venezuelan Navy had already purchased the weapons systems from various Italian companies.

DESIGN

They have steel hulls, subdivided into seven watertight compartments with aluminium bulkheads, and aluminium superstructure. Electrical power is from two GM 6-71 (M) diesels and two Delco-Remy three phase, 60 Hz, 450 V (125 kW) generators.

Plans were made to replace the Otomat missiles with Harpoon in the FAC-missiles and to be added to the FAC-Guns but these plans were cancelled for financial reasons. However, in 1989 the OTOBREDA Bofors 40 mm L/70 was replaced by the 30 mm mounting. These vessels have Vosper Thornycroft roll dampers.

VOSPER THORNYCROFT 52 m (RAMADAN)



Ramadan (Ian Sturton)
1 *OTOBREDA twin 40 mm/70 automatic cannon* **2** *GEC-Marconi ST802 fire-control radar* **3** *Cygnus jammer* **4** *OTOBREDA Otomat Mk 2 anti-ship missiles (total four)* **5** *Racal Decca Cutlass ESM* **6** *DASA Telegon HF/DF* **7** *GEC-Marconi S1810 surveillance radar* **8** *GEC-Marconi S810 navigation radar* **9** *OTOBREDA 76 mm/62 Compact automatic gun* **10** *Racal-Thorn Protean chaff/IR launchers*

GENERAL SPECIFICATIONS

Operator: Egypt ('Ramadan')
Type: FAC, Missile

Class: VOSPER THORNYCROFT 52 m (RAMADAN)

Built: 6
Active: 6

Displacement:
full load: 307 t

Dimensions
Length: 52 m (170.6 ft)
Beam: 7.6 m (25 ft)
Draught: 2.3 m (7.5 ft)

Speed: 40 kts
Range: 1,600 n miles (2,960 km) at 18 kts

Complement: 30 (4 officers)

SHIPS

RAMADAN (670)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down 22 Sep 1978
Launched 6 Sep 1979
Commissioned 20 Jul 1981

KHYBER (672)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down 23 Feb 1979
Launched 31 Jan 1980
Commissioned 15 Sep 1981

EL KADESSAYA (674)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down 24 Apr 1979
Launched 19 Feb 1980
Commissioned 6 Apr 1982

EL YARMOUK (676)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down 15 May 1979
Launched 12 Jun 1980
Commissioned 18 May 1982

BADR (678)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down 29 Sep 1979
Launched 17 Jun 1981
Commissioned 17 Jun 1982

Ramadan *(670) in 1991* (Vosper Thornycroft)

HETTEIN (680)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Laid down 29 Feb 1980
Launched 25 Nov 1980
Commissioned 28 Oct 1982

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

Otomat Mk 1

There are four launchers for Otomat Mk 1 anti-ship missiles between the superstructures, the forward two are trained to port and the after two are trained to starboard, with all angled towards the bow.

Specifications

Length: 4.66 m (15.28 ft)
Diameter: 46 cm (18 in)
Wing span: 1.36 m (4.46 ft)
Weight: 770 kg (1,698 lb) (with boosters)
Speed: Mach 0.9
Range: 35 n miles (65 km) (Longer ranges require helicopter support)
Warhead: 210 kg (465 lb)
Guidance: Inertial with active radar homing

Manufacturers/Contractors

Alenia Missile Systems.
Matra BAe Dynamics.

SURFACE-TO-AIR MISSILES (SAM)

Man-portable SA-N-5 'Grail' missiles are carried by these vessels.

Specifications

Length: 1.45 m (3.2 ft)
Diameter: 7 cm (2.75 in)
Wing span: n/k
Weight: 9.97 kg (22 lb)
Speed: Mach 1.7
Range: 2.6 n miles (5.5 km)
Warhead: 1.1 kg (2.4 lb)
Guidance: Infra-red passive homing

Manufacturer/Contractor

Fakel, Moscow, Russia.

GUNS

There are two gun mountings; an OTOBREDA 76/62 Compact forward of the bridge and an OTOBREDA twin 40 mm Compact at the stern.

OTOBREDA 76/62 Compact

Specifications

Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

OTOBREDA twin 40 mm L/70 Compact

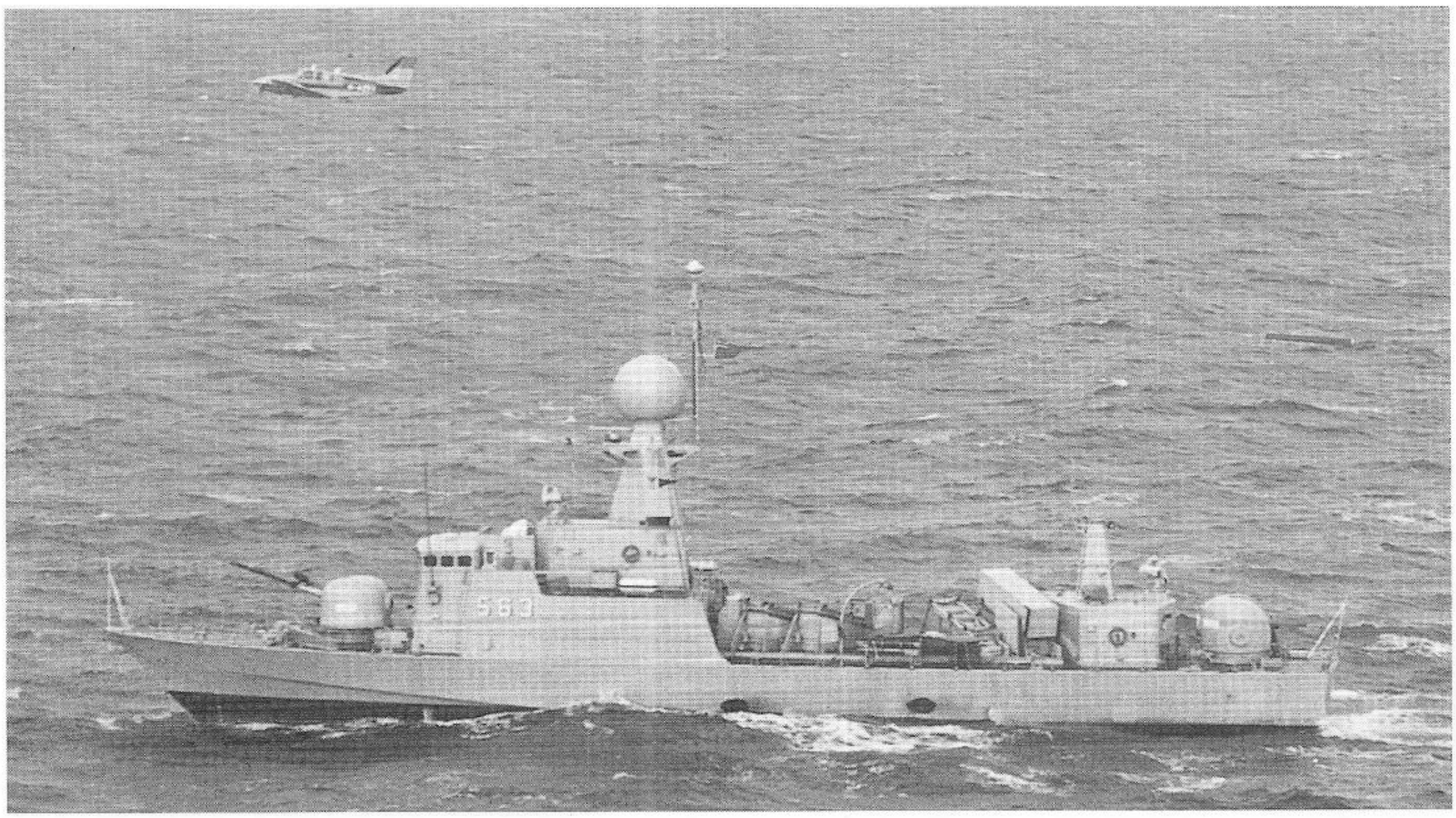
Specifications

Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 600 rds/min
Range: 3.25 n miles (12.5 km)

Mounting
Traverse: 360°
Elevation: −13 to +85°

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.



A 'Ramadan' class FAC; one of six built for the Egyptian Navy by Vosper Thornycroft. In this picture only one Otomat launcher/container is fitted and the Cygnus jammer has not been installed (Vosper Thornycroft)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-Thorn Cutlass

Cutlass uses the same antenna as RDL and provides bearings, CW bearing and frequency measurement over the E/J-band with instantaneous frequency measurement.

Manufacturer/Contractor

Racal-Thorn, UK.

ELECTRONIC COUNTERMEASURES (ECM)

Racal-Thorn Cygnus

Cygnus is a narrowband tracking jammer covering the D/J-bands and designed to operate with Cutlass for spot or barrage jamming. With one transmitter and two antennas it can jam two targets simultaneously, the 300 kW jammer being tuned by instantaneous frequency measurement.

Manufacturer/Contractor

Racal-Thorn, UK.

Racal-Thorn Protean decoy launcher

Protean consists of two fixed launchers. Each has four magazines with 36 × 40 mm chaff or infra-red payload grenades. The former fire at intervals of 0.1 second per magazine and within 1 second create a 1,000 m^2 decoy cloud while the infra-red ones cover both the 3-5 µm and 8-14 µm bands.

Manufacturer/Contractor

Racal-Thorn, UK.

COMMAND AND CONTROL SYSTEM

GEC-Marconi CAAIS

These ships have the GEC-Marconi CAAIS 450 tactical data handling system and two British Aerospace Systems and Equipment Sapphire weapon control systems. CAAIS is a former Ferranti system with a federated architecture system based upon the FM1600E mini-computer and F100L microprocessors. There is a two-man tactical picture compilation console and the system can track up to 120 targets simultaneously. Sapphire is a radar and electro-optical weapon control system for guns based upon the Sea Archer 1 predictor. The system is operated from a single console.

Manufacturer/Contractor

GEC-Marconi, UK.

RADARS

Type	S820	S810	ST802
Maker	GEC-Marconi	GEC-Marconi	GEC-Marconi
Role	Search	Search	Weapon control
Frequency	I-band	I-band	I-band
Beam	3 × 30°	2.2 × 25°	2.4°
Peak power	180 kW	180 kW	150 kW
Gain	n/k	29.5 dB	36.5 dB
Pulsewidth	0.6, 1.2 µs	0.33, 0.67 µs	0.33, 0.67 µs
PRF	750, 1,500 pps	1,500 pps	3,000 pps
Scan rate	24 rpm	24 rpm	20 rpm
Typical range	13.5 n miles (25 km)	13.5 n miles (25 km)	21.5 n miles (40 km)

PROPULSION

Specifications

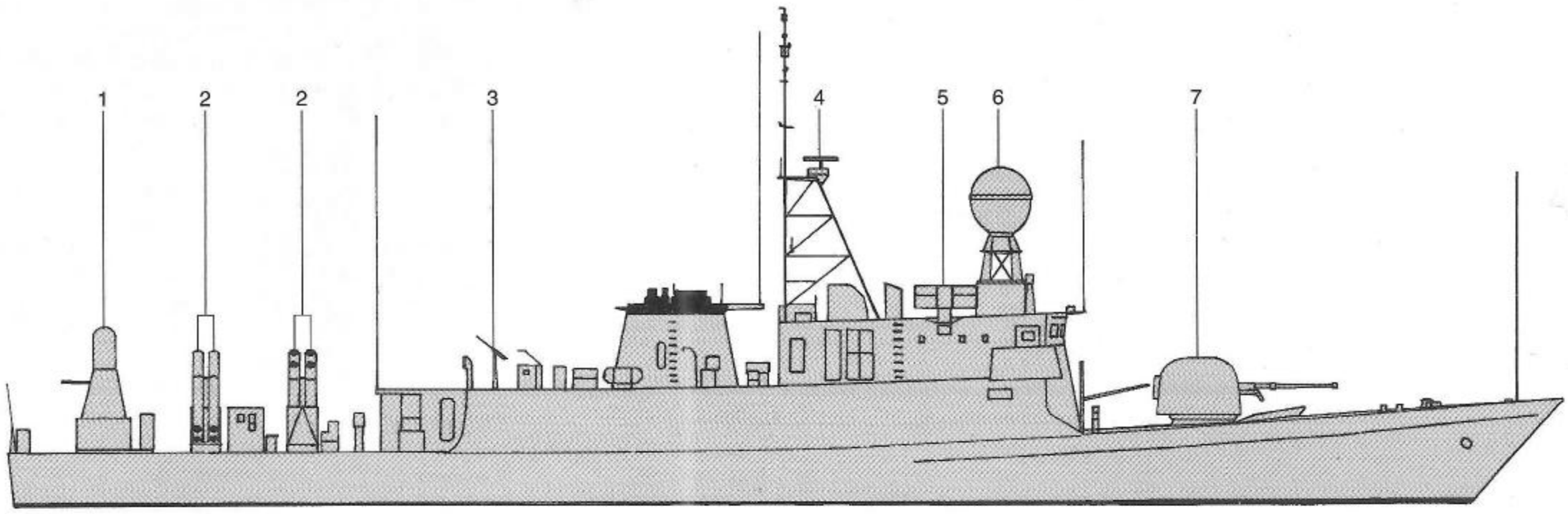
System: Diesel
Main machinery: 4 MTU 20V 538 TB91; 11.29 MW (15,360 hp)
Shafts: 4 (three-bladed propellers)

FURTHER INFORMATION

These ships were ordered from Vosper Thornycroft in 1977, laid down from 1978 onwards and commissioned in 1981/1982 using the Vosper Thornycroft 52 m design which was based upon that of the Royal Navy's 'Tenacity' class fast patrol boats. They have steel hulls but, to save weight, extensive use was made of aluminium in the decks, main bulkheads and superstructure. They carry 43 tonnes of fuel oil, while their electricity generator systems produce 420 kW. There are plans to replace the existing Otomat launchers with lightweight ones which will double the payload. New electronic warfare equipment was installed between 1995 and 1996.

Ramadan *(670) on trials, wearing temporary pennant number. Sensor fit includes; two ST802 fire-control directors (one on bridge roof, one on deckhouse roof, aft) S820 air/surface search (atop foremast) and S810 navigation radar (ahead of S820). All are by GEC-Marconi. EW equipment includes DASA Telegon 4 HF/DF (foremast head), Racal Decca Cutlass (below Telegon 4) and Cygnus jammer (small radome atop mainmast)* (Vosper Thornycroft)

AL SIDDIQ



Al Siddiq (Ian Sturton)
1 *Hughes Mk 15 20 mm seven-barrel CIWS* **2** *McDonnell Douglas Harpoon anti-ship missiles (four)* **3** *Oerlikon 20 mm cannon* **4** *Cardion AN/SPS-55 surface search radar* **5** *AN/SLQ-32(V)1 ESM* **6** *Lockheed Martin Mk 92 fire-control radar* **7** *United Defense Mk 75 76 mm/62 automatic gun*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Saudi Arabia
Type: FAC, Missile

Class: AL SIDDIQ

Built: 9
Active: 9

Displacement:
standard: 425 t
full load: 478 t

Dimensions
Length: 58.1 m (190.5 ft)
Beam: 8.1 m (26.5 ft)
Draught: 2 m (6.6 ft)

Speed: 38 kts (gas turbine), 25 kts (diesel)
Range: 2,900 n miles (5,370 km) at 14 kts

Complement: 38 (5 officers)

SHIPS

AL SIDDIQ (511)
Builder Peterson Brothers, Sturgeon Bay, Wisconsin, USA
Laid down 30 Sep 1979
Launched 22 Sep 1979
Commissioned 15 Dec 1980

AL FAROUQ (513)
Builder Peterson Brothers, Sturgeon Bay, Wisconsin, USA
Laid down 12 Mar 1979
Launched 17 May 1980
Commissioned 22 Jun 1981

ABDUL AZIZ (515)
Builder Peterson Brothers, Sturgeon Bay, Wisconsin, USA
Laid down 19 Oct 1979
Launched 23 Aug 1980
Commissioned 3 Sep 1981

FAISAL (517)
Builder Peterson Brothers, Sturgeon Bay, Wisconsin, USA
Laid down 4 Mar 1980
Launched 15 Nov 1980
Commissioned 23 Nov 1981

KAHLID (519)
Builder Peterson Brothers, Sturgeon Bay, Wisconsin, USA
Laid down 27 Jun 1980
Launched 23 Mar 1981
Commissioned 11 Jan 1982

AMYR (521)
Builder Peterson Brothers, Sturgeon Bay, Wisconsin, USA
Laid down 21 Oct 1980
Launched 13 Jun 1981
Commissioned 21 Jun 1982

TARIQ (523)
Builder Peterson Brothers, Sturgeon Bay, Wisconsin, USA
Laid down 10 Feb 1981
Launched 23 Sep 1981
Commissioned 11 Aug 1982

OQBAH (525)
Builder Peterson Brothers, Sturgeon Bay, Wisconsin, USA
Laid down 8 May 1981
Launched 12 Dec 1981
Commissioned 18 Oct 1982

ABU OBAIDAH (527)
Builder Peterson Brothers, Sturgeon Bay, Wisconsin, USA
Laid down 4 Sep 1981
Launched 3 Apr 1982
Commissioned 6 Dec 1982

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

McDonnell Douglas Harpoon 1C

There are two twin launchers for McDonnell Douglas Harpoon 1C anti-ship missiles in crossover configuration on the afterdeck. The forward pair face starboard and the after pair face port.

Specifications
Length: 4.63 m (15.18 ft) (with booster)
Diameter: 34 cm (13.38 in)
Wing span: 83 cm (32.67 in)
Weight: 681.9 kg (1,503 lb) (with booster)
Speed: Mach 0.85
Range: 67 n miles (124 km)
Warhead: 221.6 kg (500 lb)
Guidance: Inertial navigation and active radar

Tariq *(523)* (H & L van Ginderen Collection)

Al Siddiq *(511), first of nine missile-armed FACs for the Royal Saudi Navy. Armament is heavy for the hull size and includes a 76 mm gun, Vulcan Phalanx CIWS and four Harpoon missiles* (Guy Toremans)

Manufacturer/Contractor
McDonnell Douglas Missile Systems Company, USA.

GUNS

United Defense Mk 75 76 mm/62

A United Defense Mk 75 76 mm gun is mounted forward of the bridge and a Hughes Phalanx close in weapon system at the stern. Amidships there are two US Navy Mk 2 or Mk 4 20 mm Oerlikon mountings.

Mk 75

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
United Defense, USA.

Hughes Mk 15 CIWS Phalanx

Specifications
Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km)

Mounting
Traverse: 310°
Elevation: −25 to +85°

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA.

US Navy Mk 20 mm Oerlikon Mk 2/4

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Rate of fire: 450 rds/min
Range: 0.8 n miles (1.5 km)

Mounting
Traverse: 360°
Elevation: −15 to +90°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

E-Systems AN/SLQ-32(V)1

These vessels use the E-Systems' AN/SLQ-32(V)1 ESM system which is designed to detect missile seekers in the H, I and J-bands. There are two antenna assemblies with two direction-finding receiver arrays each covering 90° supported by a semi-omni-antenna covering 180°.

ELECTRONIC COUNTERMEASURES (ECM)

Loral Hycor Mk 36 SRBOC

The ships have a Lockheed Martin Hycor Mk 36 SRBOC Mod 1 (Super Rapid Bloom Offboard Countermeasures) decoy system with two Mk 137 launchers each with six barrels. These are 160 × 43 × 86 cm (63 × 17 × 39 in) mortar systems which fire a variety of 130 mm chaff and infra-red munitions from cartridges weighing 3.8/22.7 kg (8.4/50 lb) which create chaff clouds up to 2.5 n miles (4.5 km) from the ship.

Manufacturer/Contractor
Loral Hycor, USA.

COMMAND AND CONTROL SYTEMS

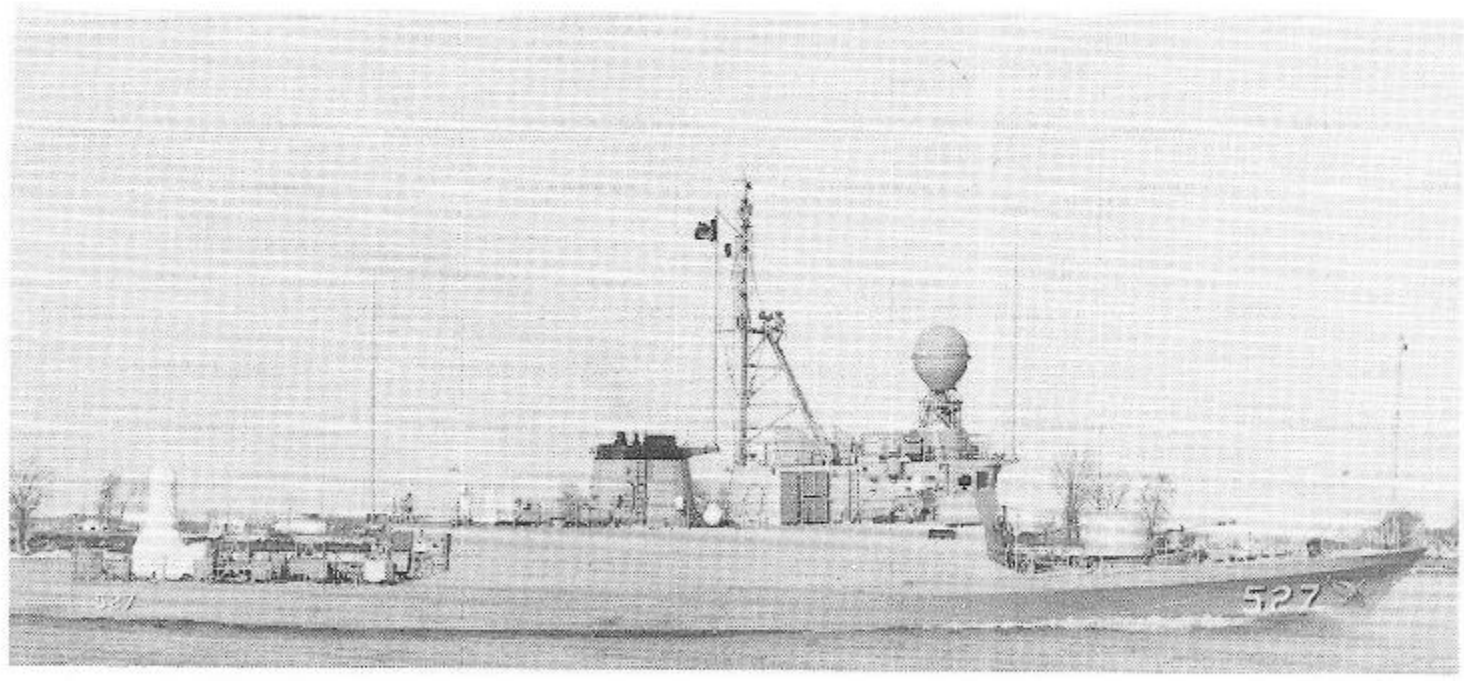
Lockheed Martin Mk 92 Mod 5

A Lockheed Martin Mk 92 Mod 5 radar-based weapon control system has a mainframe architecture based upon the AN/UYK-7 mini-computer with two display and control consoles as well as a supervisory console. It can operate against two targets simultaneously using one gun or a surface-to-surface missile.

Manufacturer/Contractor
Lockheed Martin, USA.

RADARS

Type	AN/SPS-55	Mk 92
Maker	Cardion	Lockheed Martin
Role	Search	Weapon control
Frequency	I-band	I-band
Beam	1.5 × 20°	1.5 × 7° 2.4°
Peak power	130 kW	200 kW
Gain	31 dB	33.5 dB
Pulsewidth	0.12, 1.0 µs	0.22, 0.45 µs
PRF	750, 2,250 pps	1,800, 3,600 pps
Scan rate	16 rpm	60 rpm
Typical range	n/k	16 n miles (30 km)



Abu Obaidah *(527). The prominent 'egg' on the bridge roof houses the Lockheed Martin Mk 92 fire-control radar, a licence-produced version of the Signaal system* (H & L van Ginderen Collection)

PROPULSION

Specifications
System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 MTU 12V 652 TB91 diesels; 2.55 MW (3,470 hp); 1 General Electric LM-2500 gas turbine; 17.2 MW (23,000 hp)
Shafts: 2 with controllable pitch propellers

FURTHER INFORMATION

PROGRAMME

Ordered on 16 February 1972 from the Peterson yard, these vessels were commissioned between 1980 and 1982. They were scheduled for modernisation from the early 1990s but this was postponed for financial reasons in the wake of the Gulf War. In adddition to the armament mentioned above they are also equipped with two 81mm mortars and two Mk 19 40 mm grenade launchers.

DESIGN

They are generally similar in design to the larger 'Badr' class, with an identical propulsion system and alsmost the same weapons systems, except for half the number of Harpoon missiles.

ASHEVILLE

OVERVIEW

The 'Asheville' class has its origins in the mid-1960s, when the emphasis in United States military planning was on small wars, infiltration and 'special forces'. There was also a perceived requirement for small, very fast vessels to play a part in US operations against Cuba. As the design was being prepared gas turbines were coming into use in naval warships and it was decided to give the 'Asheville' class a CODOG propulsion system, with a single General Electric LM-1500 gas turbine and two Cummins diesels.

A total of 17 'Asheville' class vessels was built by Tacoma Boatbuilding and Peterson Brothers and they were employed by the US Navy in a variety of roles. They saw service in the Vietnam War, where they were particularly valued in riverine operations, and they also simulated attacking Soviet missile boats in US and NATO exercises. Some were also employed in trailing Soviet ships in the Mediterranean, for which they were armed with a naval version of the Standard air-to-ground anti-radiation missile (ARM).

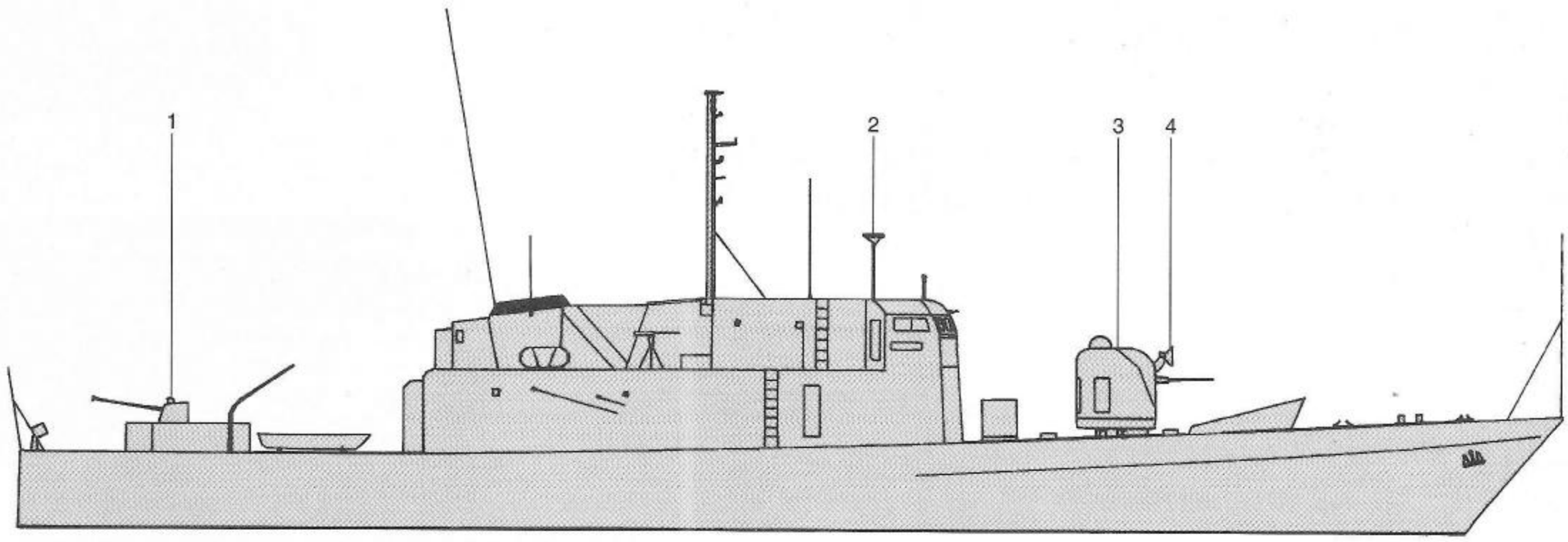
Their careers in the US Navy were short. Having been commissioned between 1967 and 1970, the first transfers took place in 1973. They were then either transferred or stricken until the last two, which had been retained to train Saudi Arabian crews, were transferred to Colombia in 1983 to combat drug smuggling.

The Asheville class suffered from a bad reputation for a variety of reasons. First, they suffered from propeller cavitation at high speeds and never reached their design maximum, although this might have been overcome by new propellers. Secondly, they were uncomfortable in a seaway. Thirdly, they were mechanically unreliable and have caused problems to some of the foreign navies who received them after their US Navy service was completed.

TABLE I. ASHEVILLE CLASS

Name	Pennant number	Builder	Completed	US Navy Fate	Current Status	Remarks
Asheville	PG 84	Tacoma	6 Aug 1966	Stricken 1976	—	
Gallop	PG 85	Tacoma	22 Oct 1966	Taiwan 1981	Stricken	
Antelope	PG 86	Tacoma	4 Nov 1967	US Environmental Protection Agency. 1977	—	**A.** Had Mk 87 fire-control system **B.** Armed with Standard ARM
Ready	PG 87	Tacoma	6 Jan 1968	Stricken. 1977	—	**A.** Had Mk 87 fire-control system **B.** Armed with Standard ARM
Crockett	PG 88	Tacoma	24 Jun 1967	US Environmental protection Agency. 1977	—	
Marathon	PG 89	Tacoma	11 May 1968	Stricken. 1976	—	
Canon	PG 90	Tacoma	26 Jul 1968	Taiwan. 1981	Stricken	
Tacoma	PG 92	Tacoma	14 Jul 1969	Colombia. 1981	In service with coast guard	
Welch	PG 93	Peterson	8 Sep 1969	Colombia. 1981	In service with coast guard	
Chehalis	PG 94	Tacoma	11 Aug 1969	US Naval Ship R and D Center. 1975	—	
Defiance	PG 95	Peterson	24 Sep 1969	Turkey. 1973	Sank. 1985	
Benicia	PG 96	Tacoma	25 Apr 1970	South Korea. 1971	In service as Pae Ku 51	Used for US Navy Standard ARM trials
Surprise	PG 97	Peterson	17 Oct 1969	Turkey. 1973	In service. *Bora* (P 339)	
Grand Rapids	PG 98	Tacoma	Aug 1970	US Naval Ship R and D Center. 1978	—	Armed with Standard ARM
Beacon	PG 99	Peterson	21 Nov 1969	Greece. 1990	In service. *Ormi* (P 230)	
Douglas	PG 100	Tacoma	Nov 1970	US Naval Ship R and D Center. 1979	—	Armed with Standard ARM
Green Bay	PG 101	Peterson	5 Dec 1969	Greece. 1990	In service *Tolmi* (P 229)	

ASHEVILLE



Asheville (Ian Sturton)
1 *US Navy Mk 3 Bofors 40 mm/60 (open mount)* **2** *Raytheon 1645 surface search/navigation* **3** *US Navy Mk 34 76 mm (3 in)/50 gun (enclosed mount)* **4** *AN/SPG-50 fire-control radar (part of Mk 63 GFCS)*

GENERAL SPECIFICATIONS

Country of origin: USA
Operators: Colombia, Greece, South Korea, Turkey
Type: FAC, Missile

Class: ASHEVILLE

Built: 17
Active: Colombia — 2; Greece — 2; South Korea — 1; Turkey — 1

Displacement:
standard: 225 t
full load: 245 t

Dimensions
Length: 50.1 m (164.5 ft)
Beam: 7.3 m (23.8 ft)
Draught: 2.9 m (9.5 ft)

Speed: 40 kts (gas turbine), 16 kts (diesel)
Range: 1,700 n miles (3,150 km) at 16 kts (diesels); 325 n miles (600 km) at 37 kts

Complement: 24 (3 officers)

SHIPS

Colombia

ALBUQUERQUE (PM 111)

Builder	Peterson, Sturgeon Bay, Wisconsin, USA
Commissioned (US Navy)	8 Sep 1969
Transferred on lease (Colombia)	16 May 1983
Purchased	Aug 1989
Transferred to coastguard	1992

QUITA SUENO (PM 112)

Builder	Tacoma Boatbuilding, Tacoma, USA
Commissioned (US Navy)	14 Jul 1969
Transferred on lease (Colombia)	16 May 1983
Purchased	Aug 1989
Transferred to coastguard	1992

Greece

TOLMI (P 229)

Builder	Peterson, Sturgeon Bay, Wisconsin, USA
Commissioned (US Navy)	5 Dec 1969 (*Green Bay* (PG 101))
Transferred (Greece)	1990
Recommissioned	18 Jun 1991

ORMI (P230)

Builder	Peterson, Sturgeon Bay, Wisconsin, USA
Commissioned (US Navy)	21 Nov 1969 *(Beacon* (PG 99))
Transferred (Greece)	1990
Recommissioned	18 Jun 1991

Korea, South

PAE KU 51 (PGM 581)

Builder	Tacoma Boatbuilding, Tacoma, Washington, USA.
Commissioned (US Navy)	25 Apr 1970 *(Benicia* (PG 96))
Transferred on loan (S Korea)	15 Oct 1971
Purchased	May 1993

Turkey

BORA (P 339)

Builder	Peterson Sturgeon Bay, Wisconsin, USA
Commissioned (US Navy)	17 Oct 1969 (*Surprise* (PG 97))
Transferred on loan (Turkey)	28 Feb 1973
Purchased	Jun 1987

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

These ships have two missile launchers. Greek vessels use SS 12M while Korean ones use Standard Anti-Radiation Missiles.

Aerospatiale SS 12M

Length: 1.86 m (6.1 ft)
Diameter: 21 cm (8.26 in)
Wing span: 65 cm (25.6 in)
Weight: 76 kg (167.5 lb)
Speed: Mach 0.6
Range: 3 n miles (5.5 km)
Warhead: 28.38 kg (62.5 lb)
Guidance: Wire command to line of sight

Manufacturer/Contractor

Aerospatiale Missiles.

RGM-66D Standard ARM

The Standard ARM was developed for use by aircraft (AGM-78) as an air-to-ground anti-radar missile. The RoK Navy uses the Standard ARM in several types of ship, the only known naval application of this variant of the widely used Standard SAM. (See 'Further Information').

Specifications

Length: 4.48 m (14.7 ft)
Diameter: 34 cm (13.4 in)
Wing span: 91.5 cm (36 in)
Weight: 617 kg (1,358 lb)
Speed: Mach 2.5
Range: 70 n miles (130 km)
Warhead: 100 kg (222 lb) blast fragmentation
Guidance: Inertial navigation with emitter homing

Manufacturer/Contractor
Standard Missile Company, USA.

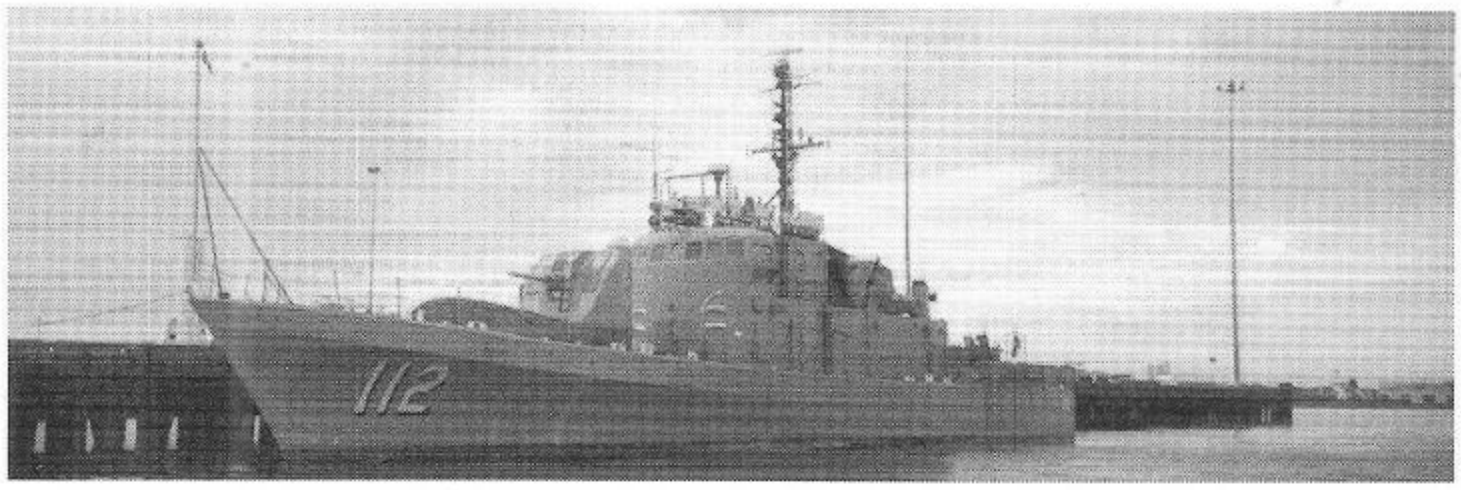
GUNS

One United Defense Mk 34 76 mm is forward of the bridge and one Navy Mk 3 Bofors 40 mm L/60 mounting is at the stern.

United Defense Mk 34 76 mm/62

Specifications
Gun
Calibre: 76.2 mm
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,700 ft/s)
Rate of fire: 50 rds/min
Range: 7 n miles (13 km)

Mounting
Traverse: 355°
Elevation: −15 to +85°



Quita Sueno *(PM 112), a former US Navy 'Asheville' class patrol combatant is now used by the Colombian coastguard on anti-smuggling duties* (Paul Campbell)

Manufacturer/Contractor
United Defense, USA.

US Navy Mk 3 Bofors 40 mm L/60

Specifications
Gun
Calibre: 40 mm
Length of barrel: 56 calibres
Muzzle velocity: 881 m/s (2,890 ft/s)
Rate of fire: 60 rds/min
Range: 5.5 n miles (10 km)

Mounting
Traverse: 360°
Elevation: −6 to +90°

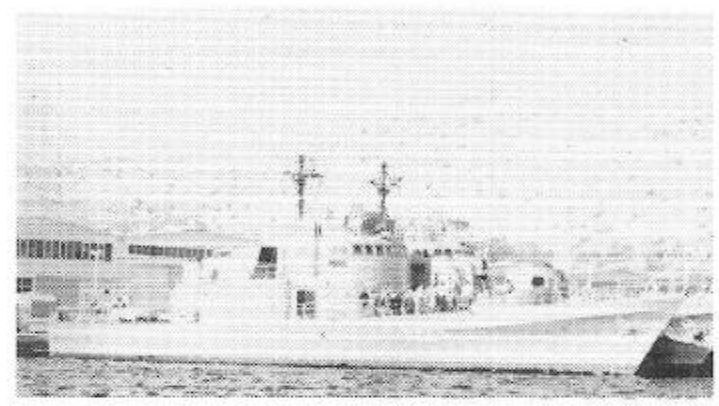
COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

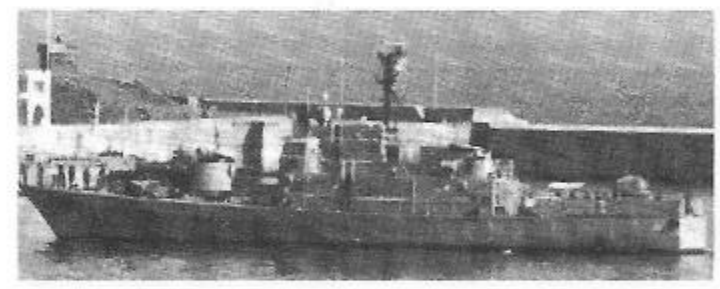
Mk 63 Gun Fire Control System (GFCS)
A Mk 63 radar-based weapon control system is used for the 76 mm gun. The SPG-50 radar is augmented by a manned Mk 29 optical sight. This is essentially a Second World War system.

RADARS

Type	1645	AN/SPG-50
Maker	Raytheon	Western Electric
Role	Search	Weapon control
Frequency	I-band	I-band
Beam	4 × 25°	2.5°
Peak power	4 kW	50 kW
Gain	n/k	36 dB
Pulsewidth	0.08, 0.5, 0.25 µs	0.3 µs
PRF	750, 1,500 2,250 pps	1,800 pps
Scan rate	24 rpm	n/k
Typical range	32 n miles (59 km)	29 n miles (55 km)



Tolmi *(P 229) one of two ex-'Asheville' class boats of the US Navy transferred to Greece in 1991. The last to be released, they had been retained to train Saudi Arabian crews. The gas turbine was removed before transfer and top speed is now 16 knots* (Hellenic Navy)



Pae Ku 51 *is the only surviving 'Asheville' class boat still to be armed with the Standard ARM*

PROPULSION

Colombia, Greece

Specifications
System: Diesel
Main machinery: 2 Cummins VT12-875M diesels; 1.08 MW (1,450 hp)
Shafts: 2 (with controllable pitch propellers)

South Korea, Turkey

Specifications
System: Combined diesel and gas turbine (CODOG)
Main machinery: 2 Cummins VT12-875M diesels; 1.08 MW (1,450 hp); 1 General Electric LM 1500 gas turbine; 9.92 MW (13,300 hp)
Shafts: 2 (with controllable pitch propellers)

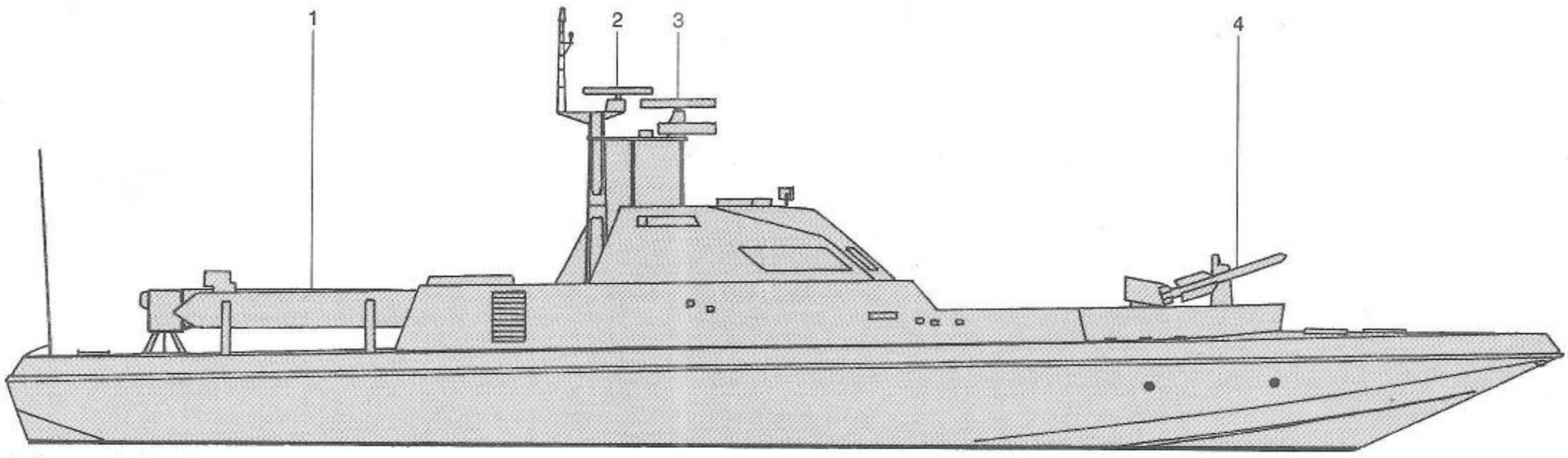
FURTHER INFORMATION

The 'Asheville' class was built by Peterson Shipbuilding and Tacoma Boatbuilding as CODOG Motor Gun Boats and were commissioned in the US Navy between 1966 and 1969. They were transferred or leased to foreign navies from 1971 to 1983, many of them removing the gas turbines.

The South Korean vessel was acquired in 1971 (with its gas turbine) and received missiles in 1975. Greece acquired its two vessels in 1989 (without the gas turbine) and equipped them with missiles upon arrival in 1990.

In addition to the missiles and guns the ships have four 12.7 mm machine guns.

'ISLA CORONADO' CLASS



Isla Coronado (Ian Sturton)
1 *Rigid-hull inflatable boat (RHIB)* **2** *Raytheon AN/SPS-69(V) navigation radar* **3** *Thomson-CSF Agrion weapon control radar* **4** *Twin-arm launcher for Aerospatiale MM 15 anti-ship missile*

GENERAL SPECIFICATIONS

Operator: Mexico
Type: FAC, Missile

Class: ISLA CORONADO

Built: 4
Active: 4

Displacement:
full load: 52 t

Dimensions
Length: 25 m (82 ft)
Beam: 5.5 m (17.9 ft)
Draught: 1.2 m (4 ft)

Speed: 50 kts
Range: 1,200 n miles (2,220 km) at 30 kts

Complement: 9 (3 officers)

SHIPS

ISLA CORONADO (P 51)
Builder Trinity-Equitable Shipyard, New Orleans, Louisiana, USA
Commissioned 1 Sep 1993

ISLA LOBOS (P 52)
Builder Trinity-Equitable Shipyard, New Orleans, Louisiana, USA
Commissioned 1 Nov 1993

ISLA GUADALUPE (P 53)
Builder Trinity-Equitable Shipyard, New Orleans, Louisiana, USA
Commissioned 1 Feb 1994

ISLA COZUMEL (P 54)
Builder Trinity-Equitable Shipyard, New Orleans, Louisiana, USA
Commissioned 1 Apr 1994

WEAPONS SYSTEMS

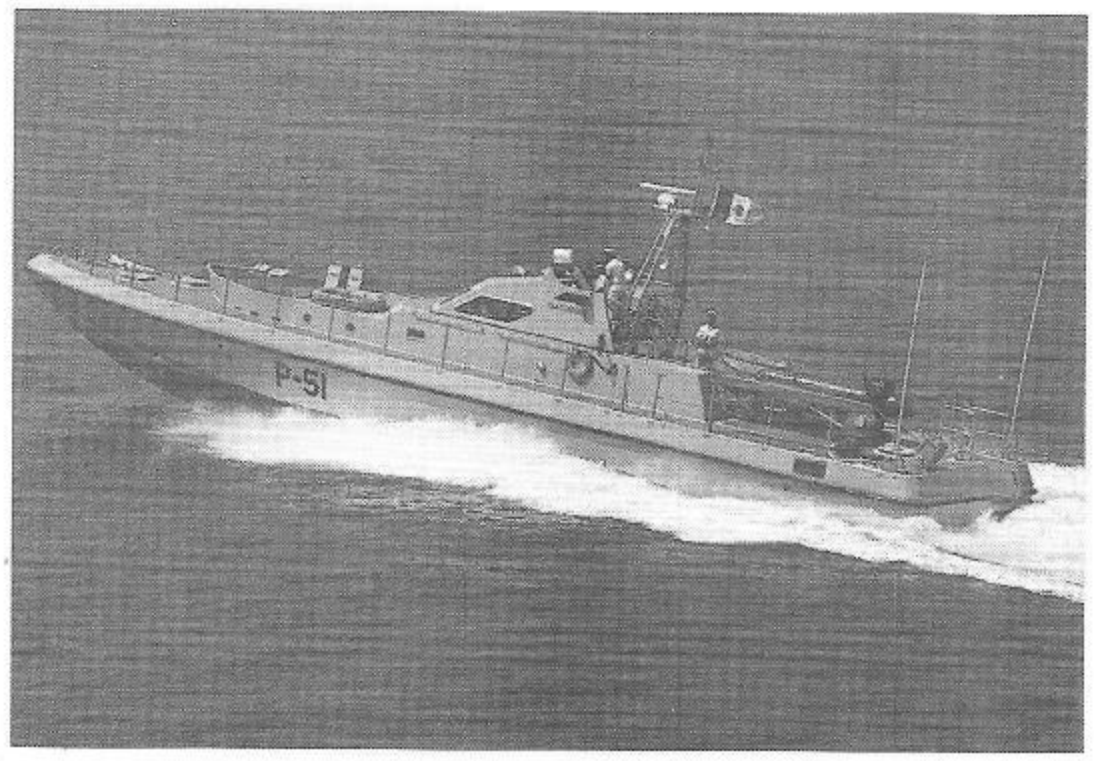
SURFACE-TO-SURFACE MISSILES (SSM)

Aerospatiale MM 15 short-range anti-ship missile

The Mexican Navy is one of the first users of the MM 15 (MM = *Mer-Mer)* system, which is designed to provide small ships with a capability between that of a gun and a long-range missile. The warhead is derived from that used in AS 12M and features a delayed impact fuze. The sensor is the Thomson-CSF Agrion 15 search and fire-control radar, an 8-10 GHz (I/J-band) system with a roll-stablised, disc-like main antenna for panoramic search and tracking, and a second antenna to gather the missile. Agrion produces a very narrow beam which can be used for 360° panoramic sweep or for sector sweep, and may be used in surveillance, surface search and over-the-horizon (OTH) targeting modes.

On detecting the target, the operator switches to automatic tracking, selects the missile and operates the firing button to launch the missile. Given the parameters of the radar altimeter's performance, the missile climbs after launch to a height of no more than 50 m (164 ft). A second missile may be fired against the same target almost immediately afterwards, although against targets at the periphery of the radar's range an interval of 1 minute must elapse. The missile is gathered by the auxiliary antenna and brought into the main radar beam. The target and the missile are tracked simultaneously and automatically with the missile's radar responder providing a highly amplified echo which assists tracking by reducing the effects of sea clutter and ECM activity.

Using differential tracking of both missile and target, the ship's fire-control system computes the necessary



Isla Coronado *(P 51)* (Mexican Navy)

Isla Cozumel *(P 54). Note the revised launcher for two MM 15 anti-ship missiles*

azimuth guidance commands which are automatically transmitted to the missile in coded form through the radar transmission. The commands are decoded in the missile and translated into steering commands. The radar altimeter keeps the missile at a height of up to 15 m (50 ft) above the sea until the terminal phase, 300 m (980 ft) from the target, when it approaches at a height of about 2 m (6.6 ft).

Specifications
Length: 2.3 m (7.55 ft)
Diameter: 18.5 cm (7.3 in)
Wing span: 56.4 cm (22.2 in)
Launch weight: 103 kg (227 lb)
Maximum range: 8.2 n miles (15 km)
Speed: Mach 0.9
Guidance: Radar command

Manufacturer/Contractor
Aerospatiale Missiles, Paris, France.

COMMAND AND CONTROL SYSTEMS

RADARS

Type	AN/SPS-69	Agrion
Maker	Raytheon	Thomson-CSF
Role	Search	Weapon control
Frequency	I-band	J-band
Beam	4 × 25°	n/k
Peak power	4 kW	108 kW
Gain	n/k	n/k
Pulsewidth	0.08, 0.25 µs	0.25, 1.5 µs
PRF	750, 1,500, 2,250 pps	300, 600, 1,200 pps
Scan rate	n/k	12, 24 rpm
Typical range	24 n miles (44 km)	30 n miles (55 km)

Aerospatiale MM 15 short-range anti-ship missile

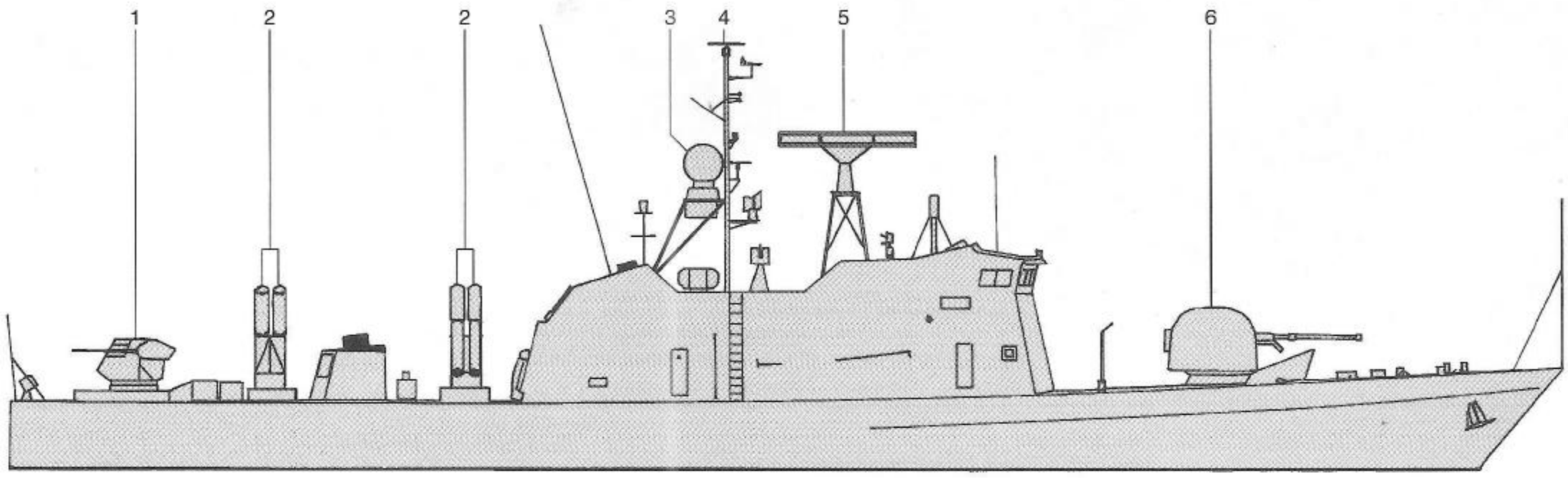
PROPULSION

Specifications
System: Diesel
Main machinery: 3 Detroit Diesel; 12.9 MW (16,200 hp)
Shafts: None, three Arneson surface drives

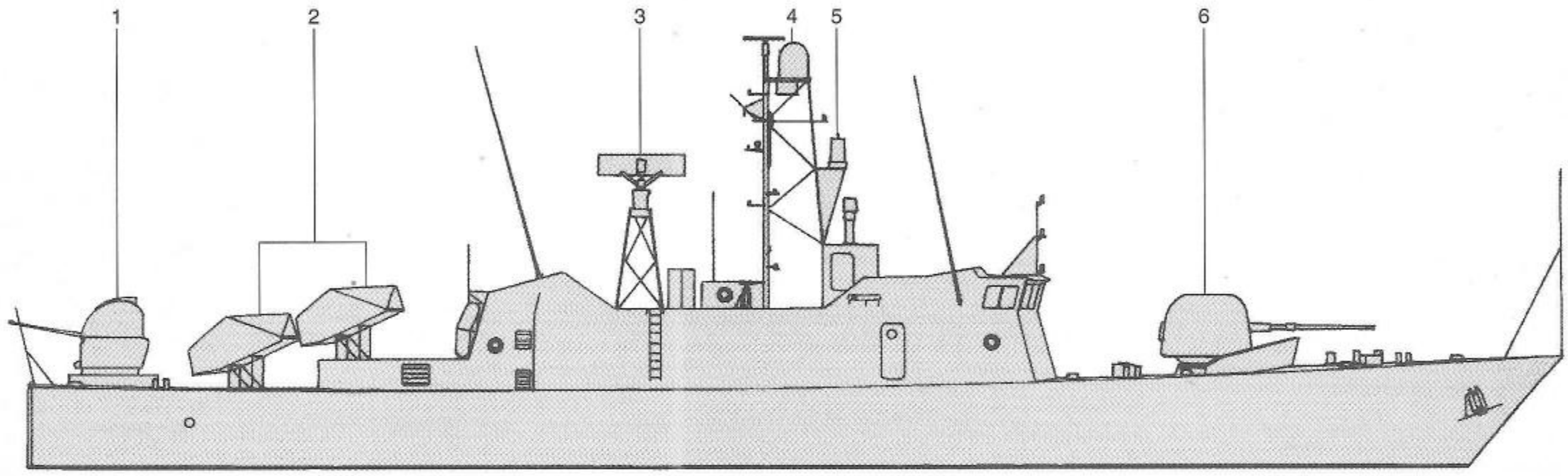
FURTHER INFORMATION

This Extra Fast Patrol Boat (XFPB) design of fibre-reinforced plastic and Kevlar was built by the Trinity Group's Halter Marine Equitable Shipyard, New Orleans, and commissioned in 1993 and 1994. In addition to missiles they carry a 12.7 mm and two 7.62 mm machine guns. The US Navy uses similar vessels for Special Operations as the 'Pegasus' class.

DAGGER/PAE KU/LUNG CHIANG (PSMM MK 5)



'Pae Ku' class (South Korea) (Ian Sturton)
1 *Esco twin 30 mm automatic cannon* **2** *McDonnell Douglas Harpoon anti-ship missile (four)* **3** *Westinghouse W-120 fire-control radar* **4** *Marconi Canada HC 75 surface search radar* **5** *AN/SPS-58 air search radar* **6** *OTOBREDA 76 mm (3 in)/62 automatic gun*



Lung Chiang *(Taiwan)* (Ian Sturton)
1 *Esco twin 30 mm* **2** *Hsiung Feng I anti-ship missiles* **3** *Alenia RAN-11 L/X air/surface search radar* **4** *RCA HR-76 fire-control radar* **5** *WD-2 radar intercept* **6** *OTOBREDA 76 mm (3 in)/62 Compact*

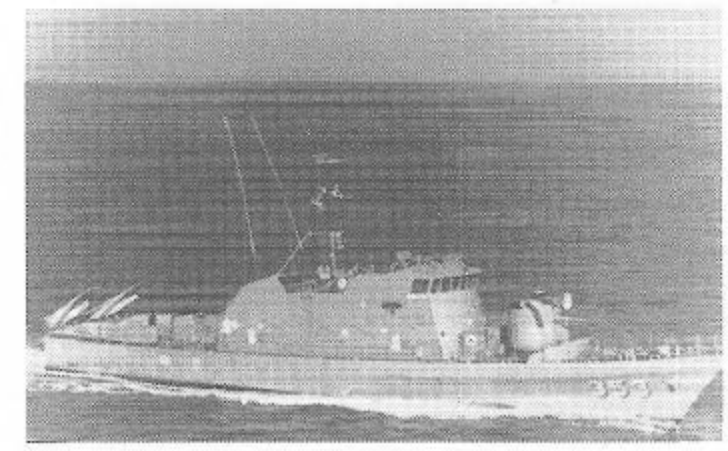
GENERAL SPECIFICATIONS

Country of origin: USA
Operators: Indonesia ('Dagger'); South Korea ('Pae Ku'); Taiwan ('Lung Chiang')
Class: PSMM MK 5
Type: FAC, Missile

TABLE I: PARTICULARS

	Indonesia	South Korea	Taiwan
	'Dagger' class	**'Pae Ku' class**	**'Lung Chiang' class**
Built	4	8	2
Active	4	8	2
Displacement			
standard			218 t
full load	268 t	275 t	275 t
Dimensions			
length	50.2 m (164.7 ft)	53.7 m (176.2 ft)	50.2 m (164.7 ft)
beam	7.3 m (23.9 ft)	7.3 m (23.9 ft)	7.3 m (23.9 ft)
draught	2.3 m (7.5 ft)	2.9 m (9.5 ft)	2.9 m (9.5 ft)
Speed			
gas turbine	41 kts	41 kts	35 kts
diesels	17 kts	17 kts	20 kts
Range	2,000 n miles (3,700 km) at 17 kts	2,400 n miles (4,445 km) at 18 kts	2,700 n miles (5,000 km) at 12 kts on one diesel; 1,900 n miles (3,520 km) at 20 kts; 700 n miles (1,300 km) at 29 kts
Complement	43 (7 officers)	32 (5 officers)	41 (5 officers)

Pae Ku 58 *(PGM 588) with OTOBREDA 76 mm gun, four Harpoon anti-ship missile launchers and an Esco twin 30 mm cannon* (G Jacobs)



Pae Ku 53 *(PGM 583) with US Navy 76 mm (3 in)/50 Mk 34 gun and standard ARM missiles* (G Jacobs)

SHIPS

'Dagger' class (Indonesia)

MANDAU (621)
Builder Korea Tacoma, Masan, South Korea
Commissioned 20 Jul 1979

RENCONG (622)
Builder Korea Tacoma, Masan, South Korea
Commissioned 20 Jul 1979

BADIK (623)
Builder Korea Tacoma, Masan, South Korea
Commissioned Feb 1980

KERIS (624)
Builder Korea Tacoma, Masan, South Korea
Commissioned Feb 1980

'Pae Ku' class (South Korea)

PAE KU 52 (PGM 582)
Builder Tacoma Boatbuilding, Tacoma, Washington, USA
Commissioned 14 Mar 1975

PAE KU 53 (PGM 583)
Builder Tacoma Boatbuilding, Tacoma, Washington, USA
Commissioned 14 Mar 1975

PAE KU 55 (PGM 585)
Builder Tacoma Boatbuilding, Tacoma, Washington, USA
Commissioned 1 Feb 1976

PAE KU 56 (PGM 586)
Builder Korea Tacoma, Masan, South Korea
Commissioned 1 Feb 1976

PAE KU 57 (PGM 587)
Builder Korea Tacoma, Masan, South Korea
Commissioned 1977

PAE KU 58 (PGM 588)
Builder Korea Tacoma, Masan, South Korea
Commissioned 1977

PAE KU 56 (PGM 589)
Builder Korea Tacoma, Masan, South Korea
Commissioned 1977

PAE KU 61 (PGM 591)
Builder Korea Tacoma, Masan, South Korea
Commissioned 1977

'Lung Chiang' class (Taiwan)

LUNG CHIANG (601)
Builder Tacoma Boatbuilding, Tacoma, Washington, USA
Commissioned 15 May 1978

SUI CHIANG (602)
Builder China Shipbuilding, Kaoshsiung, Taiwan
Commissioned 1982

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SSM)

'Dagger' class (Indonesia)
Indonesian ships may embark up to four launchers for Aerospatiale Exocet MM 38 anti-ship missiles on the afterdeck with the forward two facing to starboard and the after two facing to port.

'Pae Ku' class (South Korea)
Korean ships have two forward-facing launchers with Standard Anti-Radiation Missiles (Pae Ku 52, Pae Ku 53, Pae Ku 55) on the stern or two twin launchers for the McDonnell Douglas Harpoon 1C are carried in cross-over configuration aft of the superstructure with the forward set facing to port and the after ones facing starboard.

'Lung Chiang' class (Taiwan)
Taiwanese vessels have two pairs of forward-facing launchers for Hsiung Feng I, two at the rear of the superstructure and two immediately aft of it.

Harpoon 1C (Korea)

Specifications
Length: 4.63 m (15.18 ft) (with booster)
Diameter: 34 cm (13.38 in)
Wing span: 83 cm (32.67 in)
Weight: 681.9 kg (1,503.6 lb) (with booster)
Speed: Mach 0.85
Range: 67 n miles (124 km)
Warhead: 221.6 kg (500 lb)
Guidance: Inertial navigation and active radar

Manufacturer/Contractor
McDonnell Douglas Missile Systems Company.

RGM-66D Standard ARM (Korea)

Specifications
Length: 4.48 m (14.7 ft)
Diameter: 34 cm (13.4 in)
Wing span: 91.5 cm (36 in)
Weight: 617 kg (1,358 lb)
Speed: Mach 2.5
Guidance: Inertial navigation with emitter homing

Manufacturer/Contractor
Standard Missile Company, USA.

Exocet MM 38 (Indonesia)

Specifications
Length: 5.21 m (17.08 ft)
Diameter: 35 cm (13.77 in)
Wing span: 1.00 m (3.28 ft)
Weight: 735 kg (1,620 lb)
Speed: Mach 0.9
Range: 22.5 n miles (42 km)
Warhead: 165 kg (365 lb)
Guidance: Inertial navigation and active radar homing

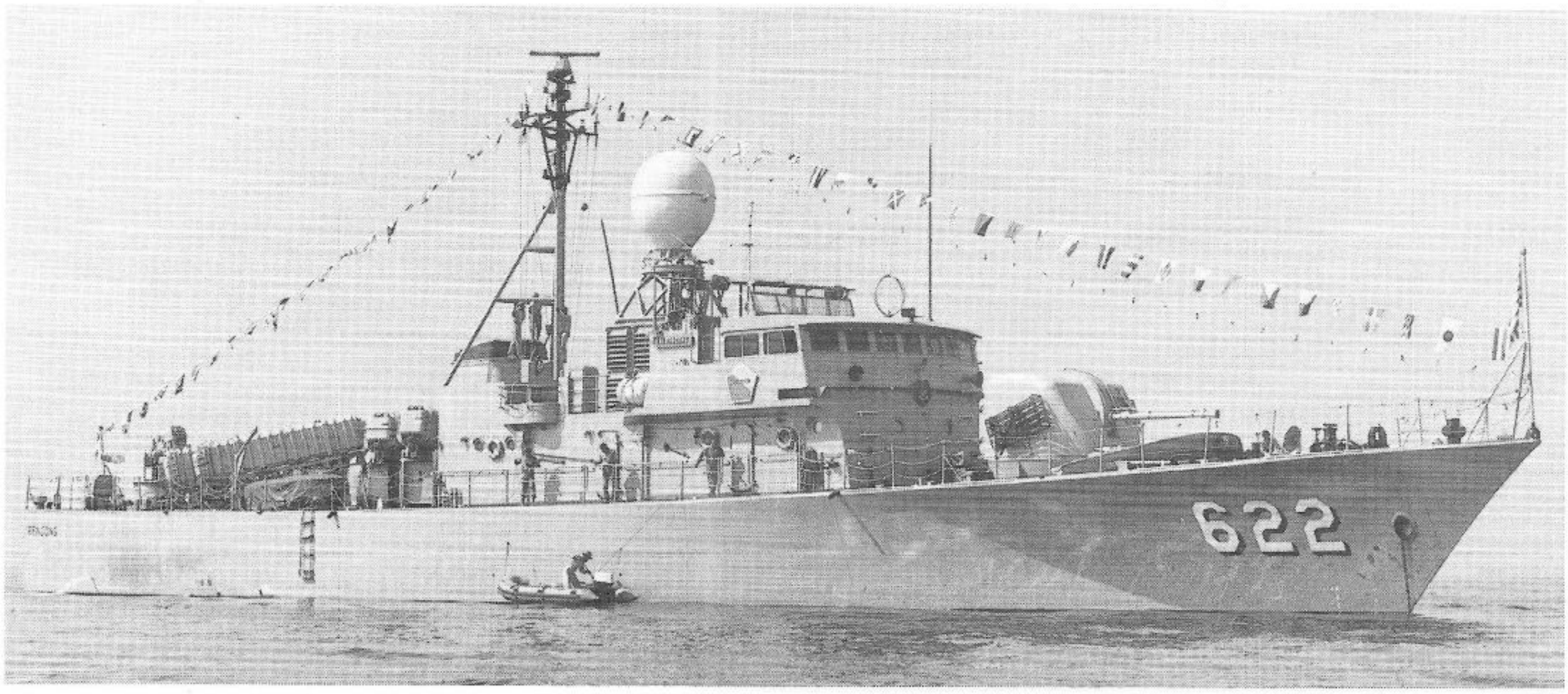
Manufacturer/Contractor
Aerospatiale Missiles, France.

Hsiung Feng I (Taiwan)

Specifications
Length: 3.9 m (12.8 ft)
Diameter: 34 cm (13.4 in)
Wing span: 1.35 m (4.4 ft)
Weight: 540 kg (1,190 lb)
Speed: Mach 0.9
Range: 19 n miles (36 km)
Warhead: 150 kg (330 lb)
Guidance: Semi-active radar and manual

GUNS

'Pae Ku' class (South Korea), 'Lung Chiang' class (Taiwan)



Rencong *(622) of the Indonesian Navy. Weapons include Bofors 57 mm Mk 1 on foredeck (with flare launchers on turret sides), four MM 38 Exocet anti-ship missiles and a Bofors 40 mm/70 at the stern in a gun mount* (John Mortimer)

The Korean ships have either a United Defense Mk 34 (Pae Ku 52, Pae Ku 53, Pae Ku 55) or an OTOBREDA 76/62 Compact forward of the bridge and an Esco (formerly Emerlec) 30 twin 30 mm gun at the stern, this latter armament also being carried by Taiwanese vessels.

'Dagger' class (Indonesia)
The Indonesian ships carry a Bofors SAK 57 Mk 1 gun forward and a Bofors SAK 40 L/70-520 at the stern.

United Defense Mk 34 76 mm/50

Specifications
Gun
Calibre: 76.2 mm
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,700 ft/s)
Rate of fire: 50 rds/min
Range: 7 n miles (13 km)

Mounting
Traverse: 355°
Elevation: −15 to +85°

Manufacturer/Contractor
United Defense.

OTOBREDA 76 mm/62 Compact

Specifications
Gun
Calibre: 76 mm
Length of barrel: 62 calibres
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 85 rds/min
Range: 8.5 n miles (16 km)

Mounting
Traverse: 360°
Elevation: −15 to +85°

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Bofors SAK 57 Mk 1

Specifications
Gun
Calibre: 57 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,020 m/s (3,346 ft/s)
Rate of fire: 200 rds/min
Range: 9 n miles (17 km)

Mounting
Traverse: 360°
Elevation: −10 to +75°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Bofors SAK 40 L/70-520

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Rate of fire: 300 rds/min
Range: 6.75 n miles (12.5 km)

Mounting
Traverse: 360°
Elevation: −9 to +85°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Esco 30

Specifications
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 600 rds/min/barrel
Range: 3.25 n miles (6 km)

Mounting
Weight: 3.88 t
Traverse: 360°
Elevation: −15 to +80°

Manufacturer/Contractor
Esco, USA.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

'Pae Ku' class (South Korea), 'Dagger' class (Indonesia)
ESM systems are installed in all Korean vessels and the 'Dagger' class ships *Badik* and *Keris*, but they have not been identified.

WD-2
'Lung Chiang' class (Taiwan) only. The domestically produced WD-2A threat-warning receiver is carried to provide early warning of E/J-band threats.

DECOYS

Lockheed Martin Hycor Mk 33 RBOC
'Pae Ku' class (South Korea) only. The Mk 33 RBOC (Rapid Bloom Offboard Countermeasures) decoy launcher system has four launchers each with six mortar barrels at different angles of elevation. These are 112 and 203 mm tubes firing a variety of chaff and infrared cartridges weighing between 4.1 and 18.2 kg (9.0 and 40 lb) which can deploy munitions up to 2 n miles (4 km) from the ship.

AV2
'Lung Chiang' class (Taiwan) only. Taiwanese vessels have four domestically produced AV2 decoy launchers. Each launcher has two tubes firing Rafael-designed chaff rockets which produce an 80 m² cloud.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Mk 63 Gun Fire Control System (GFCS)
Pae Ku 52, Pae Ku 53, Pae Ku 55 (South Korea). The Mk 63 radar-based weapon control system is used for the 76 mm gun and the SPG-50 radar is augmented by a manned Mk 29 optical sight.

Hughes H-930 weapon control system
Pae Ku 56, -57, -58, -59, -61 (South Korea); Sui Chiang (Taiwan). The H-930 is a command and weapon control system with mainframe architecture based upon the AN/UYK-19 mini-computer. The Mod 0 system, with UYK-19 Model 1602 computer, has radar display and weapon control consoles and can control two guns as well as a surface-to-surface missile system. The Mod 2 system, with five UYK-19 Model 1664 computers as well as a pair of display and control consoles, can control up to four guns as well as missiles.

Signaal WM28
'Dagger' class (Indonesia). Indonesian ships have a Signaal WM28 radar-based weapon control system with a mainframe architecture based upon the SMR mini-computer as well as a two-man display and control console. It can operate against two targets simultaneously using two guns or surface-to-surface missiles.

Alenia NA 10
Lung Chiang (Taiwan). *Lung Chiang* has an Alenia NA 10 radar-based weapon control system. This has an autonomous one-man control and display console with a mini-computer and it can control up to three guns and a surface-to-surface missile.

RADARS

'Pae Ku' class (Korea)

Type	AN/SPS-58	HR76C	AN/SPG-50	W-120
Maker	Westinghouse	Lockheed Martin	Western Electric	Westinghouse
Role	Air search	Surface search	Weapon control	Weapon control
Frequency	D-band	I-band	I-band	I-band
Beam	12°	2.7°	2.5°	n/k
Peak power	12 kW	250 kW	50 kW	165 kW
Gain	26 dB	32 dB	36 dB	34.5 dB
Pulsewidth	5 µs	0.25, 0.5 1 µs	0.3 µs	0.4, 2 µs
PRF	2,290, 3,050 pps	1,000-3,000 pps	1,800 pps	500, 1,000 pps
Scan rate	15 rpm	n/k	n/k	n/k
Typical range	125 n miles (230 km)	21.5 n miles (40 km)	29 n miles (55 km)	30 n miles (55.5 km)

'Dagger' class (Indonesia)

Type	1226	WM28
Maker	Racal-Decca	Signaal
Role	Surface search	Weapon control
Frequency	I-band	I-band
Beam	1.2°	1.5 × 7° 2.4°
Peak power	25 kW	200 kW
Gain	n/k	33.5 dB
Pulsewidth	0.05, 0.25, 1.0 µs	0.22, 0.45 µs
PRF	1,300 pps	1,800, 3,600 pps
Scan rate	25 rpm	60 rpm
Typical range	20 n miles (37 km)	16 n miles (30 km)

'Lung Chiang' class (Taiwan)

Type	RAN 11	AN/SPS-58	HR76C
Maker	Alenia	Westinghouse	Lockheed Martin
Role	Search	Navigation	Weapon control
Frequency	D/I-band	D-band	I-band
Beam	6.6 × 16° (D) 1.1 × 6 (I)	12°	2.7°
Peak power	180 kW	12 kW	250 kW
Gain	22/35 dB	26 dB	32 dB
Pulsewidth	0.15, 1.5, 20 µs	5 µs	0.25, 0.5, 1 µs
PRF	450-500 pps	2,290, 3,050 pps	1,000-3,000 pps
Scan rate	15, 30 rpm	15 rpm	n/k
Typical range	20 n miles (37 km)	125 n miles (230 km)	21.5 n miles (40 km)

Note
Lung Chiang does not have HR76C

PROPULSION

'Dagger' class (Indonesia)

Specifications
System: Combined diesel or gas turbine (CODOG)
Main machinery: 2 MTU 12V 331 TC81; 1.65 MW (2,240 hp); 1 GE LM 2500; 17.16 MW
Shafts: 2 with controllable pitch propellors

'Pae Ku' class (South Korea)

Specifications
System: Gas turbine (COGAG)
Main machinery: 6 Avco Lycoming TF 35; 12.53 MW (16,800 hp)
Shafts: 2

'Lung Chiang' class (Taiwan)

Specifications
System: Combined diesel and gas turbine (CODAG)
Main machinery: 3 Detroit Diesel 12V-149TI; 2.04 MW (2,736 hp); 3 Avco Lycoming TF-40A gas turbines; 8.95 MW (12,000 hp)
Shafts: 3 with controllable pitch propellers

FURTHER INFORMATION

PROGRAMME

The Patrol Ship, Multi-Mission, 5 (PSMM 5) design was prepared by Tacoma Boatbuilding and was based upon the Asheville design. Three (*Pae Ku* 52, *Pae Ku* 53, *Pae Ku* 55) were built for Korea by Tacoma and commissioned between 1975 and 1976. The remainder were built by Korea Tacoma Marine and commissioned in 1977 and 1978.

The Indonesian vessels were ordered from Korea Tacoma, Masan in 1975 and commissioned between 1979 and 1980. They are smaller derivatives of the PSMM Mk 5. The Taiwanese vessels are similar, *Lung Chiang* being built by Tacoma and *Sui Chiang* by China Shipbuilding (due to the HR 76 she has a large lattice mast). It was planned to build six of this class with Harpoon missiles but Washington's refusal to sell the missiles, poor sea-keeping qualities (despite the provision of roll dampers) and fires due to overheating of the gas turbine gearboxes led to the abandonment of this plan.

Patrol versions of the PSMM 5 are used by Thailand.

DESIGN

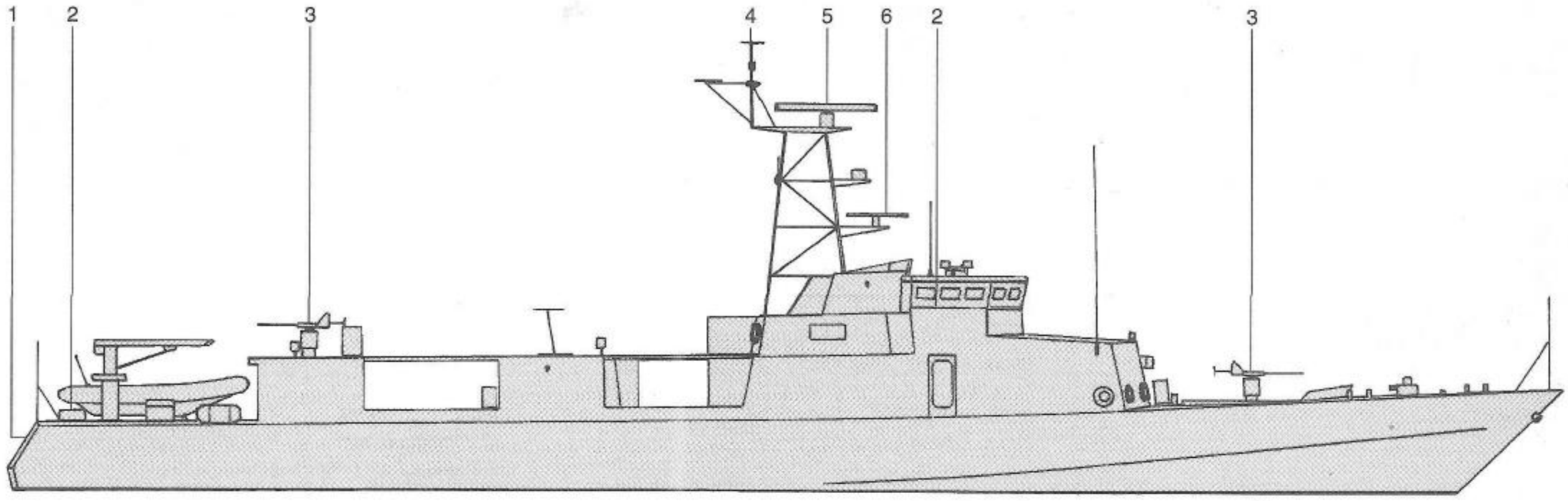
The design is based on that of the 'Asheville' class, with the Indonesian and Taiwanese boats being the same size as the original, while those for Korea were slightly longer. The hull is constructed of aluminium and while the superstructure of the Indonesian boats resembles the original Asheville, that of the Korean and Taiwanese boats is quite different.

The propulsion arrangements differ significantly, with the Korean boats having no less than six gas tubines, of which between one and three per shaft can be connected, with a variety of power settings. The Indonesian boats have a CODOG system with one gas turbine and two diesels, while the Taiwanese boats have CODOG with three gas turbines and three diesels.

They carry 65 tonnes of fuel and their electricity generation systems produce 400 kW.

All carry, in addition to the armament mentioned above, two 12.7 mm machine guns.

CYCLONE CLASS



Cyclone (Ian Sturton)
1 *Platform for launching/recovering SEALs* **2** *Weapon mounts (either 12.7 mm machine guns, or 7.62 mm MGs, or 40 mm grenade launcher) (four total)* **3** *Sea Snake Mk 38 Mod 0 25 mm automatic cannon* **4** *AN/APR-39(V)1 radar warning* **5** *Sperry RASCAR surface search radar* **6** *Raytheon AN/SPS-64(V)9 navigation radar*

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: USA
Type: Coastal patrol craft (PC)

Class: CYCLONE

Built: 13
Active: 13

Displacement:
full load: 328 t

Dimensions
Length: 52 m (170.6 ft)
Beam: 7.6 m (24.9 ft)
Draught: 2.2 m (7.2 ft)

Speed: 35 kts
Range: 2,500 n miles at 12 kts

Complement: 28 (4 officers) plus 8 marines or SEALs

SHIPS

CYCLONE (PC 1)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned 7 Aug 1993

TEMPEST (PC 2)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned 21 Aug 1993

HURRICANE (PC 3)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned 15 Oct 1993

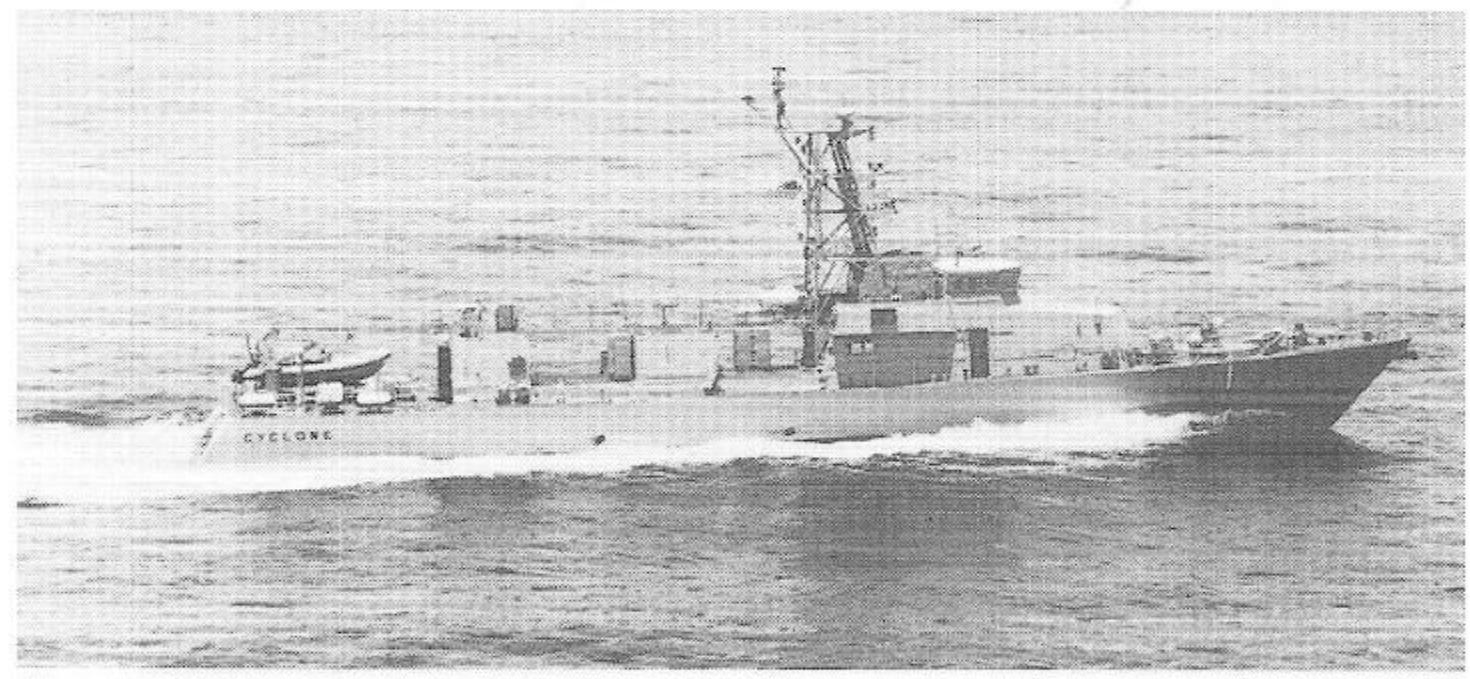
MONSOON (PC 4)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned 22 Jan 1994

TYPHOON (PC 5)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned 12 Feb 1994

SIROCCO (PC 6)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned 11 Jun 1994

SQUALL (PC 7)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned 4 Jul 1994

ZEPHYR (PC 8)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned 15 Oct 1994



First of class, Cyclone *(PC 1) at speed* (Vosper Thornycroft)

CHINOOK (PC 9)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned 28 Jan 1995

FIREBOLT (PC 10)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned 31 Mar 1995

WHIRLWIND (PC 11)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned Jun 1995

THUNDERBOLT (PC 12)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned Aug 1995

SHAMAR (PC 13)
Builder Bollinger, Lockport, Louisiana, USA
Commissioned Nov 1995

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES (SAM)

FIM-92C STINGER-RMP

'Cyclone' class vessels carry a Stinger launcher, with six missiles. The system consists of the M46A2 launcher, the sighting system, M41 missile in its launcher-container, and the battery coolant unit (BCU). The rocket motor's first stage drives the missile out of the launch tube and the aerodynamic surfaces deploy; then, after 1.6 seconds and with the missile 6 to 7 m (19.7 to 23 ft) clear of the launcher, the sustainer ignites, the warhead is armed, and the seeker starts to operate.

Stinger-RMP (FIM-92C) uses a rosette-pattern image scanning technique with IR and UV (Ultra-Violet) detectors, and has two microprocessors integrated into the signal processor. The IR data is processed to determine the relative angle between the missile and the target and an intercept point is then predicted using a proportional navigation guidance technique.

On receiving the alert, the operator shoulders the system, acquires the target through the optical sight and operates the IFF interrogator which responds with an audio signal in 0.7 seconds. First pressure on the trigger energises the cooling unit and, when the missile seeker has acquired the target, an audio signal tells the

operator to depress the trigger fully and the missile is launched. The total time elapsed between initiation of the firing sequence and motor ignition is 1.7 seconds. The weapon can be assembled for another engagement in 15 seconds.

Specifications
FIM-92C
Length: 1.52 m (5.0 ft)
Diameter: 70 cm (27.5 in)
Weight: 10.1 kg (22 lb)
Speed: Mach 2.2
Range: 8,000 m (26,246 ft)
Altitude: 3,500-3,800 m (11,483-12,467 ft)
Guidance: IR/UV passive homing

Manufacturers/Contractors
Hughes Missile Systems.
Raytheon Company, Missile Systems Division (second source).

GUNS

25 mm Mk 38 Mod 0 automatic cannon (Sea Snake)
There are two Mk 38 Mod 0 25 mm cannon (Sea Snake) on Mk 88 mountings: one is on the foredeck, the other on a raised platform, aft. This weapon is designed to engage surface and shore targets in low- and mid-intensity operational environments at ranges up to 1.33 n miles (2.5 km), and consists of a single barrel, externally powered weapon incorporating a rotating bolt mechanism driven by a chain. The barrel recoils separately from the receiver, reducing the available travel as the bolt also has to move, the travelling distance being 12.7 mm. The Mark 38 can fire single shots or 175 rds/min and features twin shoulder braces and an optical Aimpoint sight. The peak recoil force is 4,536 kg (10,000 lb) in the naval version but with a McDonnell Douglas muzzle brake modification and recoil damper this can be reduced to 2,721.5 kg (6,000 lb). The barrel life is in excess of 13,000 rounds while the demonstrated reliability of the weapon is 22,000 rounds between stoppages.

Specifications
Calibre: 25 mm
Length of barrel: 81 calibres
Muzzle velocity: 1,100 m/s (3,609 ft/s)
Traverse: 300°
Elevation: −20 to +55°
Weight: 596.5 kg (1,315 lb) (loaded)
Crew: 1 (often supported by a spotter)
Range: 1.33 n miles (2.47 km)
Rate of fire: 175 rds/min (max)
Ammunition: 184 g HEI-T

Interchangeable mountings
There are four weapons positions which are designed to accommodate either 12.7 mm machine guns, 7.62 mm machine guns, or Mk 19 40 mm grenade launchers. These positions are located, two on the port bridge wing; one on the starboard bridge wing; and one on the stern, on the starboard side.

Mk 26 Mod 17 12.7 mm machine guns
Two Mk 26 Mod 17 machine guns are carried. This is a selective fire, short recoil, automatic weapon with a 1,143 mm (45 in) long barrel. Muzzle energy is 1,867 mkp and the weapon uses 110-round belts.

Specifications
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)
Gun weight: 38.1 kg (84 lb)

M60 7.62 mm MGs
Two M60 machine guns are carried. These are the standard weapons used throughout the US armed forces.

Specifications
Weight: 10.51 kg (23 lb)
Muzzle velocity: 855 m/s (2,805 ft/s)
Rate of fire: 550 rds/min (cyclical); 200 rds/min (practical)

Mk 19 40 mm grenade launchers in Mk 64 mountings
Two grenade launchers are carried.

Specifications
Grenade Launcher Mk 19
Ammunition: M-406/M-463 High Explosive, M-407 Target Practice and M-430 High Explosive Dual Purpose (HEDP)
Fuzes: Impact detonating fuzes
Performance: M-430 penetrates 50 mm of rolled homogeneous armour at 2.2 km. In anti-personnel role will kill or seriously injure everyone within a 15 m (49 ft) radius of detonation
Muzzle velocity: 241 m/s (791 ft/s) (nominal)
Range: 2.21 km
Rate of fire: 475 rds/min (practical 325-375 rds/min)
Weight: 227 kg (500 lb)

Mark 64
Weight (unloaded): 422 kg (930 lb) (521 kg (1,148 lb) with shield)
Elevation: −15 to +65°
Traverse: 180°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

E-Systems AN/APR-39(V)1 radar warning
The AN/APR-39 radar warning receiver (RWR) was initially designed for use in helicopters and light aircraft, but has been adapted for use in FACs. It covers the F to I frequency bands and gives both visual and audio warnings of hostile radar transmissions.

DECOYS

Mk 52 chaff launchers
There are two Mk 52 six-tube chaff launchers.

COMMAND AND CONTROL SYSTEMS

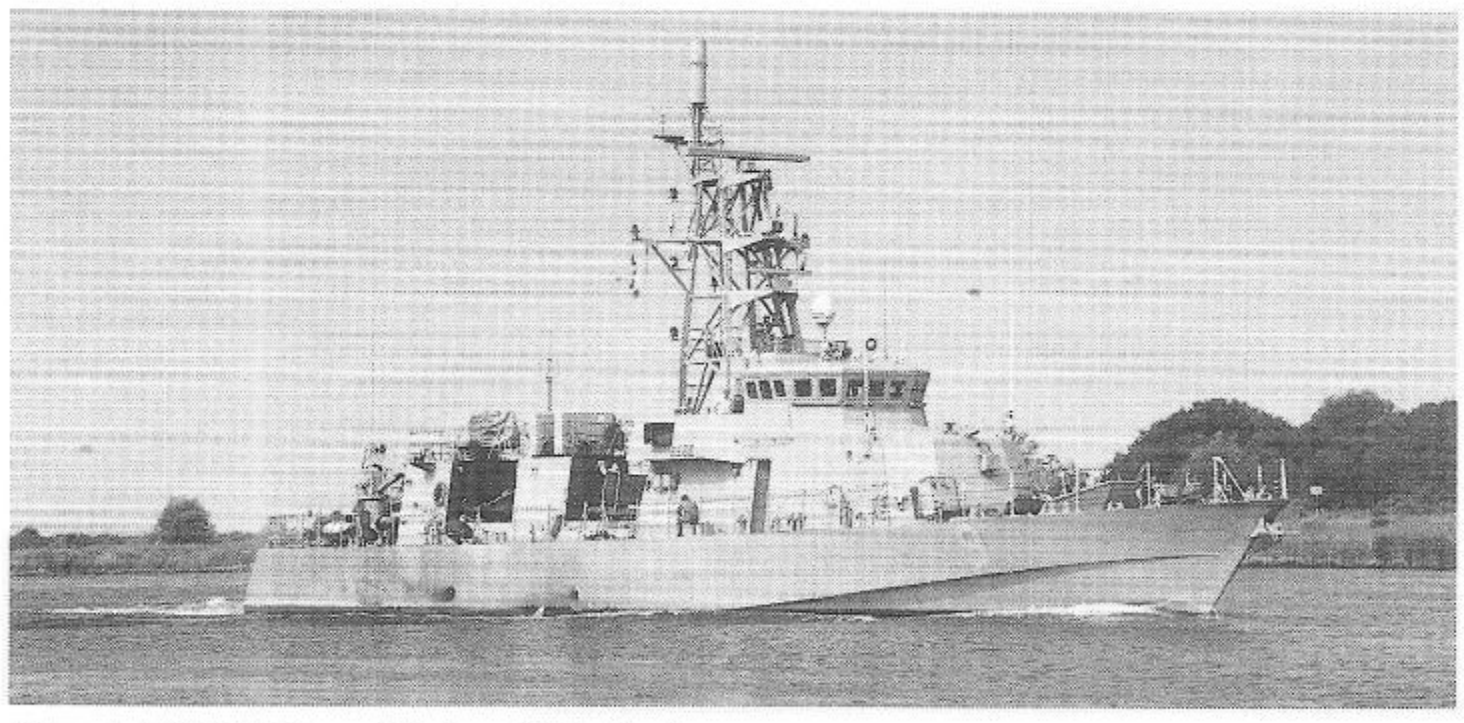
WEAPONS CONTROL

GEC-Marconi/McLennan VISTAR IM 405 electro-optic surveillance system
The VISTAR surveillance system is used at night and in poor visibility and consists of a servo-controlled sensor tracker head with second-generation image intensifier and a thermal imager, together with a display system. The tracker head features two-axis gyrostabilisation and may be slaved to a search radar and has a glass fibre hood for environmental protection. The McLennan Marine image intensifier amplifies light up to 80,000 times and is coupled by a fibre optic link to a VISTAR camera. The GEC-Marconi thermal imager operates in the 8-12 µm waveband and uses cadmium mercury telluride detectors.

Specifications
Maximum range: up to 8 n miles
Effective range: 2-8 n miles
Sensor head
- **weight:** 50 kg (110 lb)
- **height:** 42 cm (16.5 in)
- **width:** 63 cm (24.8 in)
- **length:** 60 cm (23.6 in)

Slew rate: 30°/s
Azimuth coverage: 340°
Elevation coverage: ±30°
Field of view
- **image intensifier:** 16 × 12°
- **thermal imager:** 9.6 × 5.6° (×2); 4.0 × 2.3° (×5)

Manufacturers/Contractors
GEC-Marconi Radar and Control, UK.
McLennan Marine Ltd, USA.



Chinook *(PC 9)* (H & L van Ginderen Collection)

RADAR

Sperry RASCAR
The Sperry RASCAR is an E/F/I/J band surface search radar.

Raytheon AN/SPS-64(V)9

Specifications
Role: Navigation
Frequency: I-band
Beam: 1.9 × 22°
Peak power: 20 kW
Gain: 20 dB
Pulsewidth: 0.06/0.5/1.0 µs
PRF: 3,600/1,800/900 pps
Scan rate: 33 rpm

Manufacturer/Contractor
Raytheon.

SONAR

Wesmar sonar
The 'Cyclone' class is fitted with a Wesmar hull-mounted, active, high-frequency, side-scanning sonar.

PROPULSION

Specifications
System: Diesel
Main machinery: 4 Paxman Valenta 16RP200CM diesels, 10 MW (13,400 hp) sustained
Shafts: 4

FURTHER INFORMATION

PROGRAMME

The US Navy had been seeking for some time to find a new craft to replace some elderly patrol boats, whose prime mission was to transport SEAL teams. Sixteen vessels were planned, but the first contract for eight was awarded in August 1990 followed by a second for five more in July 1991, and the last three will not now be ordered. The vessels are being built by Bollinger Shipyard, at Lockwood, Louisiana, a shipyard which had previously built 49 'Island' class patrol boats for the US Coast Guard to a modified Vosper Thornycroft design.

DESIGN

The design is based on the Vosper Thornycroft 'Ramadan' class, which was built for the Egyptian, Kenyan and Omani navies, but was modified to meet the US Navy's operational requirements. These modifications included a lighter armament than other versions of the 'Ramadan' class, 25.4 mm (1 in) Kevlar armour on the superstructure, shoulder-launched Stinger SAM, a slow speed loiter capability, and a swimmer platform in the transom.

They are fitted with the Vosper roll damping system.

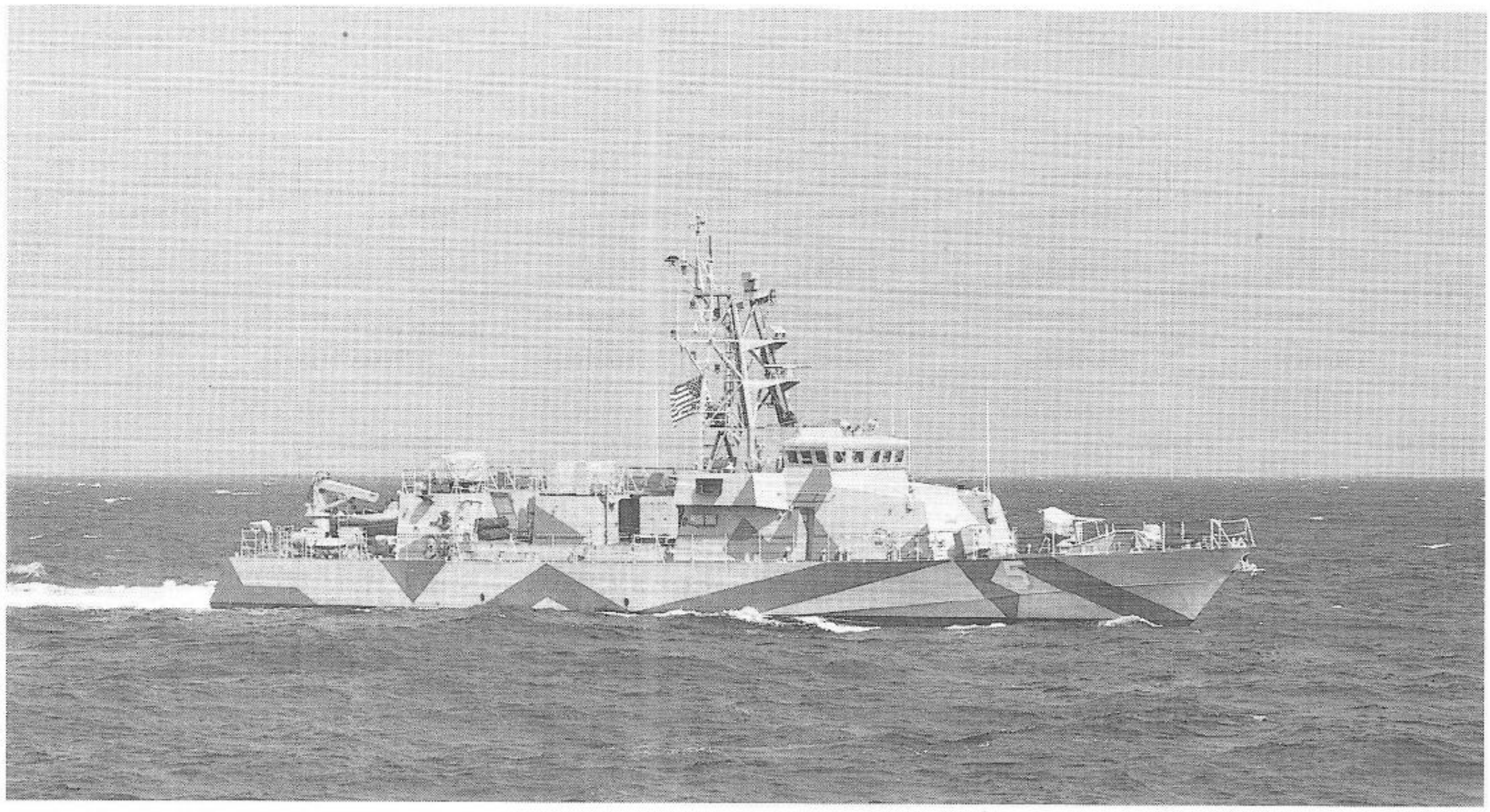
OPERATIONAL

The vessels are based at Norfolk, Virginia and San Diego, California, and operate in pairs supported by a 12-man maintenance team in two trucks ashore.

They carry up to eight SEALs, plus two SEAL raiding craft and one RIB. Swimmers are launched and recovered from a platform in the transom, which has a door providing direct access into the hull.

THE FUTURE

A stabilised weapons platform system is being developed for Stinger or Hellfire and a combat system is being developed to integrate the navigation, ship control and weapons control systems.



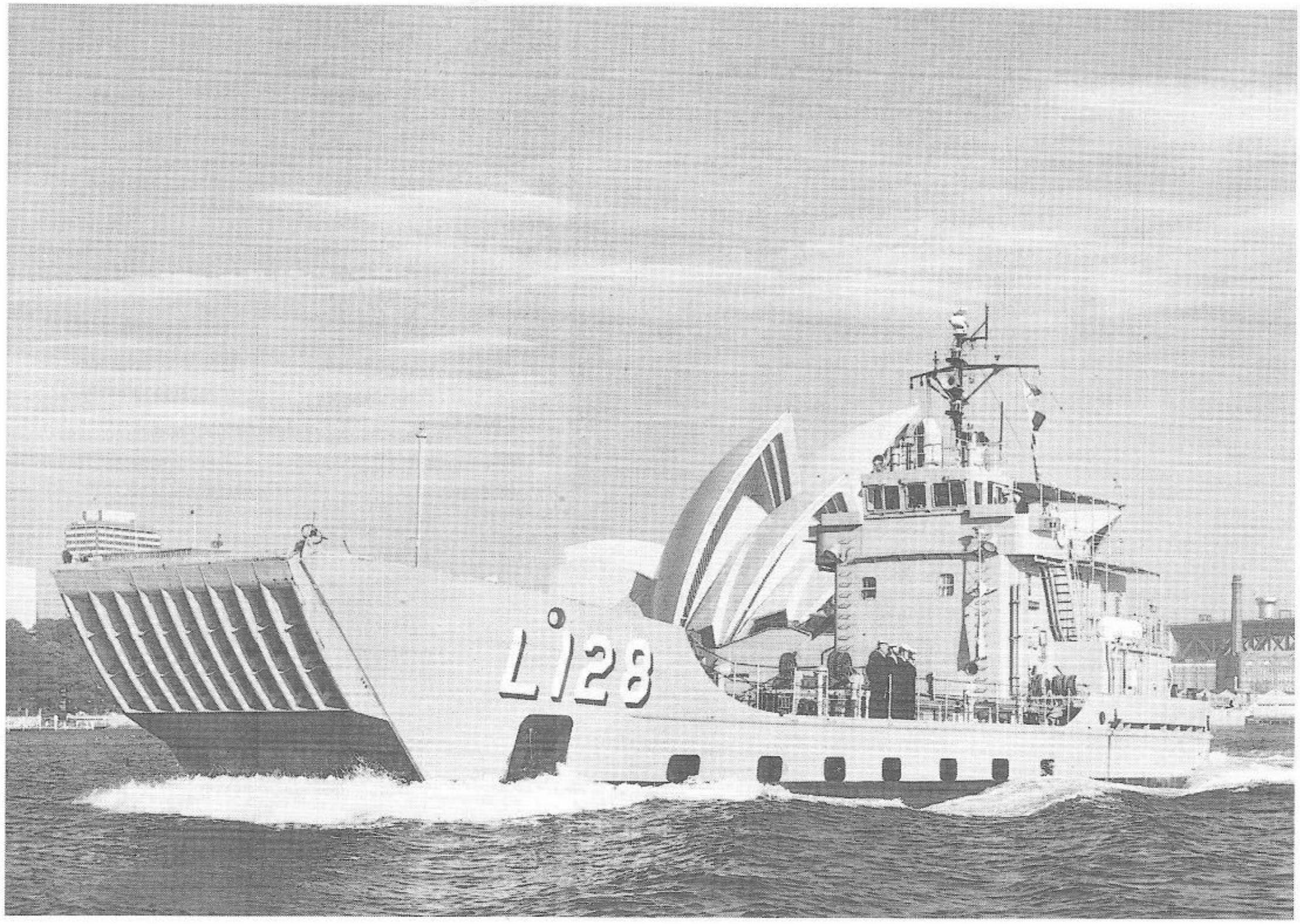
Typhoon *(PC 5) in the latest disruptive camouflage scheme* (H & L van Ginderen Collection)

Cyclone *(PC 1). Note the platform on the stern which enables SEALs and divers to enter and leave the water* (Bollinger)

The 'Cyclone' class was developed from the US Coast Guards' 'Island' class which were also built by Bollinger, Lockport, Louisiana to a Vosper Thornycroft design (Vosper Thornycroft)

AMPHIBIOUS WARFARE SHIPS

BALIKPAPAN



Labuan *(L 128). The design is typical of most landing craft, with a flat, horizontally hinged bow ramp; a long, rectangular tank deck, and superstructure and machinery aft* (DoD/PR, Australia)

GENERAL SPECIFICATIONS

Operator: Australia

Class: HEAVY LANDING CRAFT

Built: 8
Transferred to PNG: 2
Active: 6

Displacement:
standard: 314 t
full load: 511 t

Dimensions
Length: 44.5 m (146 ft)
Beam: 10.1 m (33 ft)
Draught: 2 m (6.5 ft)

Speed: 10 kts
Range: 3,000 n miles at 10 kts

Complement: 13 including two officers

SHIPS

BALIKPAPAN (L 126)

Builder	Walkers Ltd, Maryborough, Queensland, Australia
Laid down	May 1971
Launched	15 Aug 1971
Commissioned (Army)	8 Dec 1971
Transferred (RAN)	27 Sep 1974

BRUNEI (L 127)

Builder	Walkers Ltd, Maryborough, Queensland, Australia
Laid down	Jul 1971
Launched	15 Oct 1971
Commissioned (RAN)	5 Jan 1973

LABUAN (L 128)

Builder	Walkers Ltd, Maryborough, Queensland, Australia
Laid down	Oct 1971
Launched	29 Dec 1971
Commissioned (RAN)	9 Mar 1973

TARAKAN (L 129)

Builder	Walkers Ltd, Maryborough, Queensland, Australia
Laid down	Dec 1971
Launched	16 Mar 1972
Commissioned (RAN)	15 Jun 1973

WEWAK (L 130)

Builder	Walkers Ltd, Maryborough, Queensland, Australia
Laid down	Mar 1972
Launched	18 May 1972
Commissioned (RAN)	10 Aug 1973

BETANO (L 133)

Builder	Walkers Ltd, Maryborough, Queensland, Australia
Laid down	Sep 1972
Launched	5 Dec 1972
Commissioned (RAN)	8 Feb 1974

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Three medium battle tanks (MBT) or equivalent
- 150 tonnes cargo

AMPHIBIOUS FACILITIES

- Horizontally hinged flat bow ramp
- Kedge anchor

WEAPONS SYSTEMS

GUNS

Two 7.62 mm machine guns

The 7.62 mm machine gun normally carried by Australian vessels is the M60 with the heavy barrel option. The M60 is a gas-operated weapon with a 560 mm barrel and the majority of these weapons are fitted into simple single-pintle mountings, although some are installed on ring mountings attached to the ship's rail. Twin mountings are also found.

Specifications
(M60 7.62 mm machine gun)
Calibre: 7.62 mm
Length of barrel: 73.5 calibres
Gun weight: 10.51 kg (23.17 lb)
Muzzle velocity: 855 m/s (2,805 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 200 rds/min
Effective range: 0.97 n miles (1.8 km)

COMMAND AND CONTROL SYSTEMS

RADAR

Racal Decca RM 916

One Type 916 navigation radar is carried. This is one of the Transar series of radars from UK manufacturer Racal-Decca and is also used on the Australian heavy lift ship Tobruk. The radar features PPI Plan Position Indicator displays, and operates in the I-band.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors 6-71 diesels; 260 kW (348 hp) sustained.
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These small landing ships (or heavy landing craft) were originally designed and built for the Australian Army to carry three of the (then) new Leopard main battle tanks. Only the first of the series, *Balikpapan* (L 126), ever saw army service, however, and was transferred to the Royal Australian Navy (RAN) in September 1974 and commissioned on 27 September 1974, by which time the other seven were in naval service. Two of the class of eight were transferred almost immediately to the Papua New Guinea Defence Force, where they are officially classed as auxiliaries.

DESIGN

These are built to the traditional tank-landing craft (LCT) design, with a flat bow ramp providing direct access to a long tank deck. All machinery and superstructure are aft. There is a large kedge anchor.

DEPLOYMENT

Brunei (L 127) and *Betano* (L 133) act as diving tenders at Cairns. *Labuan* (L 128) is operational at Cairns and *Balikpapan* (L 126) at Darwin. *Wewak* (L 130) is laid up at Cairns. *Tarakan* (L 129) operates from Cairns in a survey ship role and for general duties, All are available for amphibious duties. The two other craft in the class were transferred to Papua New Guinea and are listed below.

Balikpapan *(L 126) is one of six heavy landing craft operated by the RAN, although most are involved in other duties when not on amphibious operations* (John Mortimer)

SALAMAUA (BALIKPAPAN)

GENERAL SPECIFICATIONS

Country of Origin: Australia
Operator: Papua New Guinea

Class: BALIKPAPAN

Acquired: 2
Active: 2

Displacement:
standard: 314 t
full load: 511 t

Dimensions
Length: 44.5 m (146 ft)
Beam: 10.1 m (33 ft)
Draught: 2 m (6.5 ft)

Speed: 10 kts
Range: 3,000 n miles at 10 kts

Complement: 15 including two officers

SHIPS

SALAMAUA (31)
Builder Walkers Ltd, Maryborough, Queensland, Australia
Commissioned (RAN) 19 Oct 1973 (L 131)
Transferred (PNG Defence Force) Nov 1974

BUNA (32)
Builder Walkers Ltd, Maryborough, Queensland, Australia
Commissioned (RAN) 7 Dec 1973 (L 132)
Transferred (PNG Defence Force) Nov 1974

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Three medium battle tanks or equivalent
- 150 tonnes cargo

AMPHIBIOUS FACILITIES

- Horizontally hinged flat bow ramp

WEAPONS SYSTEMS

GUNS

M2HB 12.7 mm machine guns
The M2HB is a selective short recoil automatic operation weapon with a 1,143 mm (45 in) long barrel and eight right-hand grooves turning once every 381 mm (15 in). Muzzle energy is 1,867 mkp and the weapon uses 110-round belts.

Specifications
(M2HB)
Calibre: 12.7 mm (0.5 in)
Length of barrel: 90 calibres
Gun weight: 38.1 kg (84.0 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

RADARS

Racal Decca RM 916
The Type 916 navigation radar is one of the Transar series of radars from UK manufacturer Racal-Decca and is used on the Australian craft of this class. The radar features PPI Plan Position Indicator displays and operates in the I-band.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors 6-71 diesels, 260 kW (348 hp) sustained.
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These two ships are operated by the Papua New Guinea Defence Force Maritime Element, which is the equivalent of a navy. The vessels are officially classed as auxiliaries.

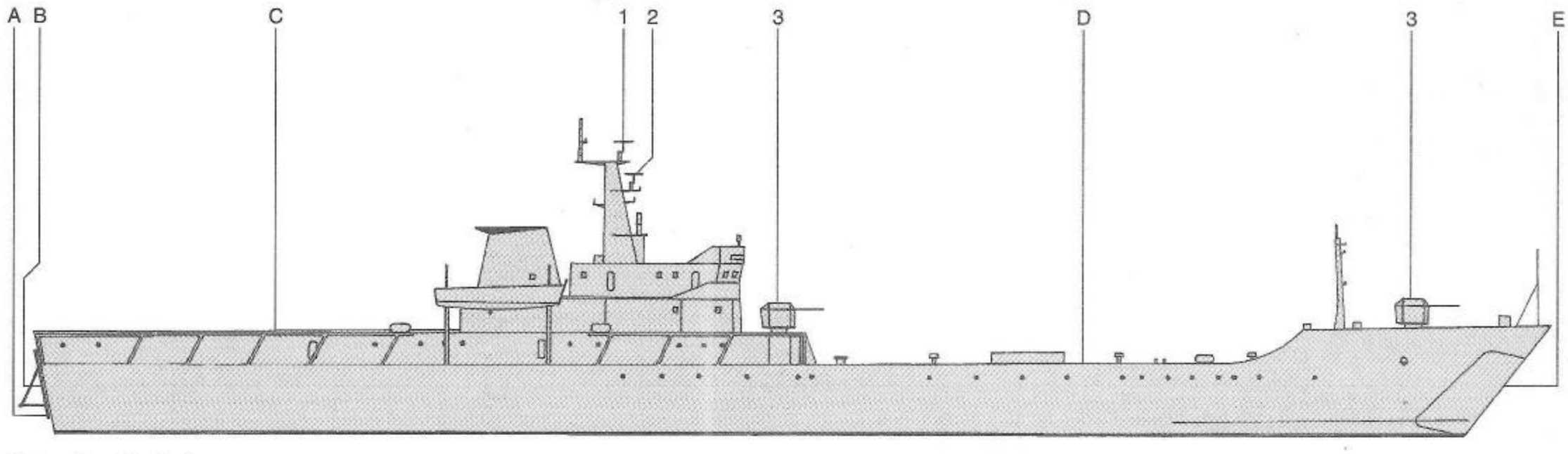
MODERNISATION

Both were given extensive refits in 1985/86.

DEPLOYMENT

They are based at Port Moresby.

YUTING



Yuting (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Stern door* **C** *Flight deck* **D** *Tank deck* **E** *Bow doors with internal ramp*

General 1 *Surface search radar* **2** *Navigation radar* **3** *Chinese 37 mm/63 twin cannon (three mounts)*

GENERAL SPECIFICATIONS

Operator: China

Class: YUTING (LST)

Built: 3
Active: 3
Building: 2

Displacement:
standard: 3,770 t
full load: 4,800 t

Dimensions
Length: 130 m (426.5 ft)
Beam: 16 m (52.5 ft)
Draught: 3.2 m (10.5 ft)

Speed: 17 kts
Range: 3,000 n miles at 14 kts

Complement: 120

SHIPS

YUTING 991
YUTING 934
YUTING 935

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 200 troops
- 10 medium battle tanks
- Cargo: 500 tonnes

SHIP-SHORE LIFT

- Two LCVPs are carried on the foredeck

AVIATION FACILITIES

Specifications
Flight deck: There is a large flight deck measuring approximately 28 × 16 m (93 × 53 ft)
Hangar: There does not appear to be a hangar, but it can be assumed that there are refuelling and rearming facilities.
Helicopters: No helicopters have been seen aboard these ships, so far, but the flight deck would be capable of operating up to and including Zhi-8 (Super Frelon)

WEAPONS SYSTEMS

GUNS

Chinese 37 mm/63 cannon
There are six China 37 mm/63 guns in three twin mountings. A Russian-derived weapon manufactured in China, the 37 mm/63, has become a standard light air defence gun in a variety of ships. In the twin mounting, the barrels are enclosed in separate water jackets with exposed spring recuperators. In addition to the Russian-originated mounting, the Chinese introduced the Type 76 turret mounting in the 1980s and use it for this gun as well as for the 57 mm.

Specifications
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 886 m/s (2,907 ft/s)
Traverse: 360° at 17°/s (25°/s in Type 76)
Elevation: −10 to 85° at 13°/s
Crew: 3
Range:
anti-surface: 2.2 n mile (4 km)
anti-air: 3,000 m (9,842 ft)
Ammunition: 0.732 kg (1.6 lb)

COMMAND AND CONTROL SYSTEMS

RADARS

Unidentified radars
Two radars are carried, presumably working in the I-band. These have not yet been identified. It is assessed that one will be used for surface search, the other for navigation.

PROPULSION

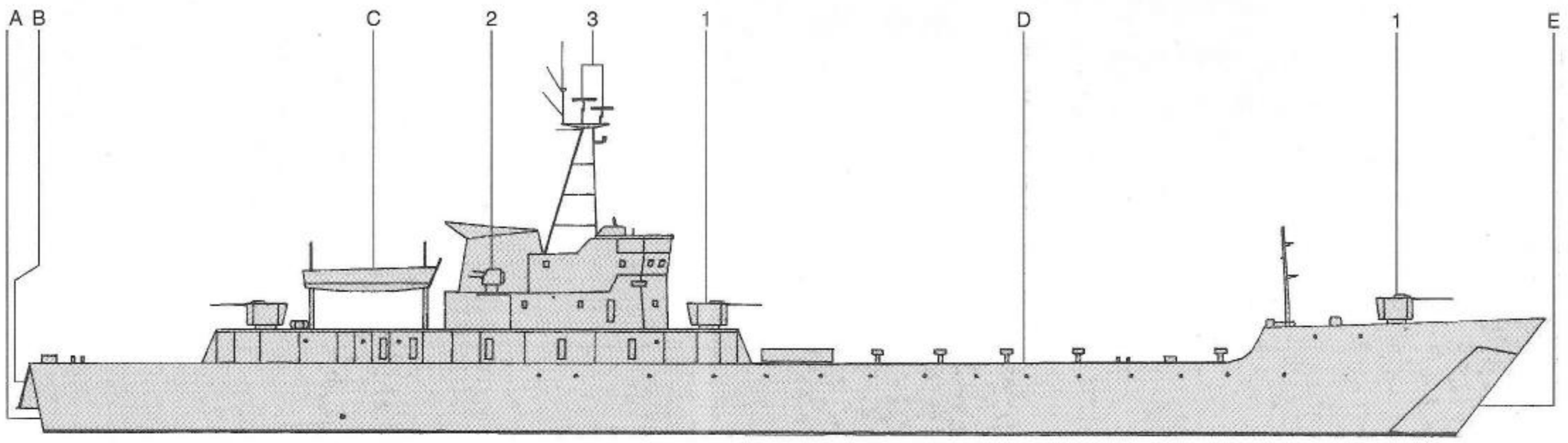
Specifications
System: Diesel
Main machinery: 2 (unknown type)
Shafts: 2

FURTHER INFORMATION

This appears to be a marginally larger version of the 'Yukan' class, providing helicopter facilities and a large helicopter deck. The first example of the class was seen fitting out at Shanghai in 1992. The quoted gun armament seems light by Chinese standards and may be augmented. Two more ships of this class are reported to be in build.

The 'Yuting' class LSTs appear to be some 10 m (32.8 ft) longer than the 'Yukan' class, but otherwise the two types are generally similar
(Henry Dodds)

YUKAN



'Yukan' class
Amphibious A *Stern ramp* **B** *Kedge anchor* **C** LCVP (two) **D** *Covered tank deck* **E** *Clamshell doors*

General 1 *Twin Chinese 57 mm/50 mounts (total four mounts)* **2** *Twin Chinese 25 mm cannon* **3** *Chinese Type 573 navigation radar (two)*

GENERAL SPECIFICATIONS

Operator: China

Class: YUKAN TYPE 072 (LST)

Built: 7
Active: 7

Displacement:
standard: 3,159 t
full load: 4,236 t

Dimensions
Length: 120 m (393.6 ft)
Beam: 15.3 m (50 ft)
Draught: 2.9 m (9.5 ft)

Speed: 18 kts
Range: 3,000 n miles at 14 kts

Complement: 109

SHIPS

YUKAN 927, YUKAN 928, YUKAN 929, YUKAN 930, YUKAN 931, YUKAN 932, YUKAN 933

AMPHIBIOUS CHARACTERISTICS

MILITARY LIFT

- 200 troops
- 10 tanks
- Cargo
- Total lift = 508 tonnes

SHIP-SHORE LIFT

- 2 LCVP are mounted abreast the stack.

AMPHIBIOUS FACILITIES

- Two clamshell bow doors with internal ramp; maximum load 51 tonnes.
- There is a comparatively small stern ramp; capacity 20.3 tonnes.

WEAPONS SYSTEMS

GUNS

Chinese 57 mm/66 cannon

Armament appears to be either two or four twin 57 mm mountings. The Chinese 57 mm guns are derived from the Russian ZIF-31B, which was manufactured in China as the Type 66. The gun is an air-cooled conventional weapon with a 4.39 m (14.4 ft) barrel. The twin-barrel mounting weighs 14.5 tonnes and is 3 m (9.84 ft) high, 3.6 m (11.8 ft) long (excluding barrels) and 3.6 m (11.4 ft) wide.

Specifications
Calibre: 57 mm
Length of barrel: 77 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Traverse: 360° at 30°/s
Elevation: −10 to 85° at 25°/s
Crew: 5
Range:
anti-surface: 4.52 n miles (8.4 km)
anti-air: 4,500 m (14,764 ft) (max)
Ammunition: 2.81 kg (6.19 lb)

37 mm 163 cannon

Four 37 mm (two twin). The 37 mm gun is another Russian-derived weapon manufactured in China and has become a standard light air defence gun in a variety of ships. It is a 62.8 calibre gun with a 2.32 m (7.6 ft) long barrel. In the twin mounting, the barrels are enclosed in separate water jackets with exposed spring recuperators.

Specifications
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 886 m/s (2,907 ft/s)
Traverse: 360° at 17°/s
Elevation: −10 to 85° at 13°/s
Crew: 3
Range:
anti-surface: 2.2 n mile (4 km)
anti-air: 3,000 m (9,842 ft)
Ammunition: 0.732 kg (26 oz)

25 mm/60 machine guns in Type 61 mount

Standard fit is four 25 mm/60 machine guns in two twin mountings, but some of class have a further two twin mountings amidships above the tank deck. The Chinese manufacture the gun, (which is of Russian origin) and developed their own mounting, the Type 61, which is used by the navies of 10 countries. There are two guns installed one above the other in separate cradles and turned on their sides so that they can be fed from the side. The guns have 1.5 m (4.92 ft) long air-cooled barrels. The ammunition is either in five-round clips or 65-round belts. There are two on-mount operators and five loader-carriers.

Specifications
Calibre: 25 mm
Length of barrel: 60 calibres
Elevation: −10 to 85°
Traverse speed (manual): 25°/s
Traverse speed (hydraulic): 70°/s
Elevation speed (manual): 15°/s
Elevation speed (hydraulic): 40°/s
Rates of fire: 450 rds/min/barrel
Projectile: 0.28 kg (0.61 lb) HEI-T
Range: anti-surface: 1.5 n mile (2.75 km)

COMMAND AND CONTROL SYSTEMS

RADARS

Type 753
Two Chinese Type 753 navigation radars; I-band

IFF
May have High Pole A IFF fitted.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Type 12E 390 diesels; 10.6 MW (14,400 hp (m)) sustained.
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The first of class was completed in 1980 and the seventh and (apparently) last in 1995. The type is now superseded by the 'Yuting' class, which has a helicopter deck, which this class lacks.

DESIGN

These are large LSTs with a respectable capacity. It is a conventional LST design, with vertically hinged clamshell doors, although the superstructure is rather extensive.

DEPLOYMENT

These ships are currently the PLAN's most capable amphibious warfare ships and several have been observed around the disputed Spratly Islands.

'Yukan' class LST 930. The 'Yukan' class represents the first attempt by the PLAN to design a successor to the numerous ex-US Navy LSTs. The design appears very sound and incorporates a stern door to give a ro-ro capability (Paul Beaver)

'Yukan' class LST 927 shows its beaching ability. The guns to the forecastle are twin 57 mm/50

YUDENG

GENERAL SPECIFICATIONS

Operator: China

Class: YUDENG

Built: 1 (see 'Further Information')
Active: 1

Displacement:
full load: 1,850 t

Dimensions
Length: 87 m (285.4 ft)
Beam: 13 m (42.7 ft)
Draught: 3.8 m (12.5 ft)

Speed: 14 kts

Complement: 35

SHIP

YUDENG 990

Launched	1990
Commissioned	1994

WEAPON SYSTEMS

GUNS

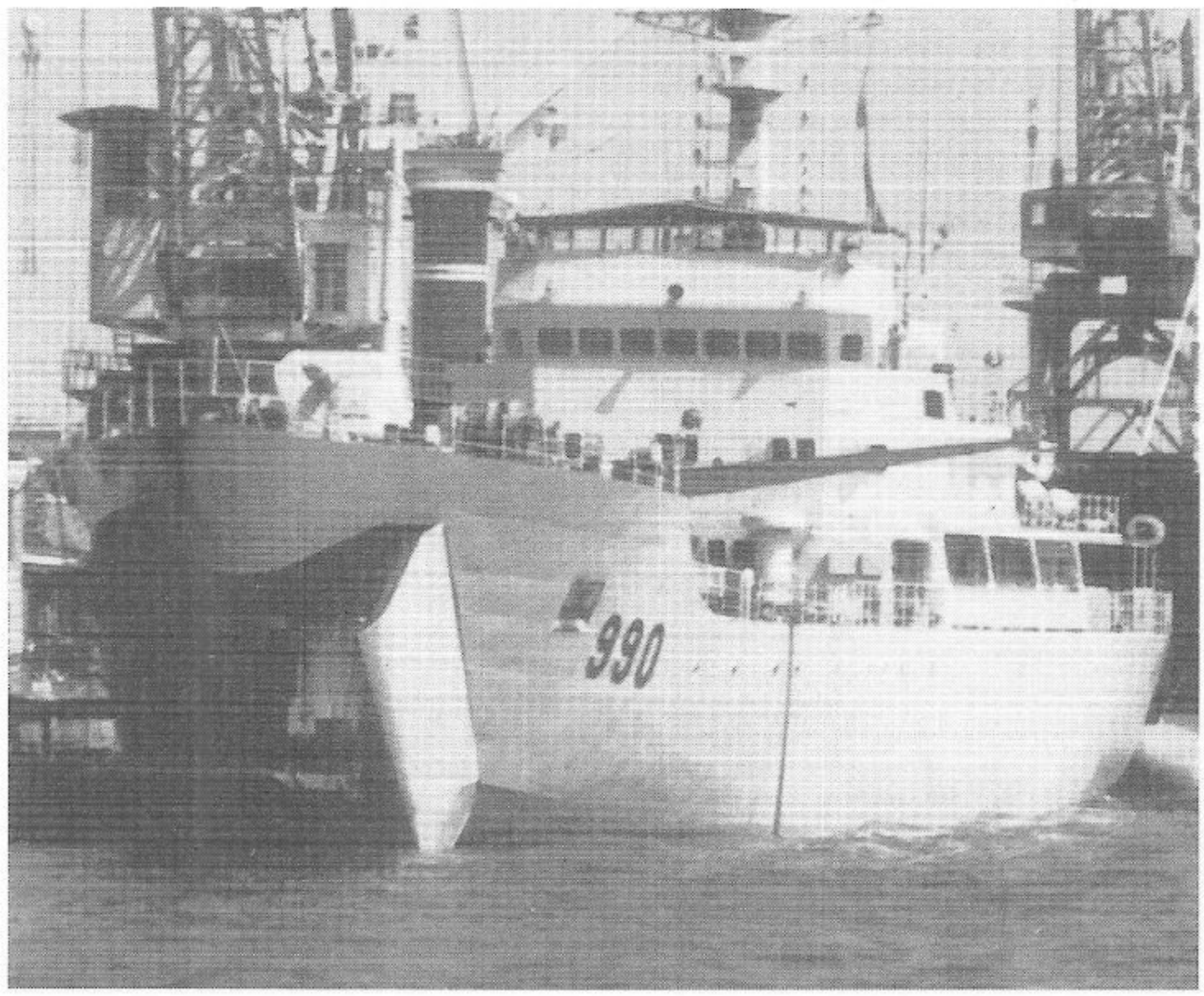
An unidentified gun, possibly 57 mm, is mounted on the forecastle.

PROPULSION

Specifications
System: Diesel
Main machinery: 2
Shafts: 2

FURTHER INFORMATION

One ship, Yudeng (990) has been observed and photographed at a port in China. A possible second ship in the class, No 994, has not been confirmed.



Yudeng *(990). This is the only known Western picture of this ship, which appears to be somewhat smaller than the 'Yukan' class . Note the bow doors and the shrouded gun on the forecastle* (Paul Beaver)

YULIANG

GENERAL SPECIFICATIONS

Operator: China
Type: 079

Class: YULIANG

Built: 31
Active: 31

Displacement:
full load: 1,117 t

Dimensions
Length: 63 m (206.7 ft)
Beam: 10 m (32.8 ft)
Draught: 2.4 m (7.9 ft)

Speed: 14 kts

Complement: 60

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Personnel
- Three main battle tanks
- Cargo = 150 tonnes (estimate)

AMPHIBIOUS FACILITIES

- There is a rectangular, flat, bottom-hinged, bow ramp.
- There is a kedge anchor at the stern.

WEAPONS SYSTEMS

GUNS

25 mm/60 machine guns in Type 61 mount

Standard fit is four 25 mm/60 machine guns in two twin mountings, located either side of the tank deck and about one-third of its length from the bows. The Chinese manufacture the gun, (which is of Russian origin) and developed their own mounting, the Type 61, which is used by the navies of 10 countries. There are two guns installed one above the other in separate cradles and turned on their sides so that they can be fed from the side. The guns have 1.5 m (4.92 ft) long air-cooled barrels. The ammunition is either in five-round clips or 65-round belts. There are two on-mount operators and five loader-carriers.

Specifications
Calibre: 25 mm
Length of barrel: 60 calibres
Elevation: −10 to 85°
Traverse speed (manual): 25°/s
Traverse speed (hydraulic): 70°/s
Elevation speed (manual): 15°/s
Elevation speed (hydraulic): 40°/s
Rates of fire: 450 rds/min/barrel
Projectile: 0.28 kg (0.61 lb) HEI-T
Range: anti-surface: 1.5 n mile (2.75 km)

BM-21 multiple rocket launcher

Two BM-21 multiple rocket launchers. Navalised BM-21 mountings were used first on the Russian Navy's 'Alligator' class LSTs and have since been sold to the former East Germany as well as to China. Naval BM-21s are used during the run-in to the beach and consist of two 20-tube clusters on either side of an electrically operated pedestal which holds training and elevation gears. They are reloaded automatically from a below-deck magazine. The mounting can traverse 360° and elevate from 0 to +55° . The standard missile for these weapons is the M-21-OF spin- and fin-stabilised rocket which comes in 3.226 m (10.6 ft) and 2.87 m (7.5 ft) lengths and can carry high-explosive fragmentation, smoke, incendiary or chemical warheads.

Specifications
Rocket M-21-OF (9M22U)
Diameter: 122 mm (4.8 in)
Length: 3.226 m (10.6 ft)
Weight: 77.5 kg (170.8 lb)
Range: 500-20,380 m (1,640-66,846 ft)
Warhead weight: 19.3-19.4 kg (42.5-42.7 lb)
Max velocity: 690 m/s (2,863 ft/s)

Rocket M-21-OF (9M22M)
Diameter: 122 mm (4.8 in)
Length: 2.87 m (9.4 ft)
Weight: 66 kg (145.5 lb)
Range: 500-20,000 m (1,640-6,560 ft)
Warhead weight: 18.4 kg (40.5 lb)
Max velocity: 700 m/s (2,296 ft/s)

COMMAND AND CONTROL SYSTEMS

RADARS

Fin Curve

The navigation radar is Fin Curve, an I-band equipment.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 diesel engines
Shafts: 2

FURTHER INFORMATION

PROGRAMME

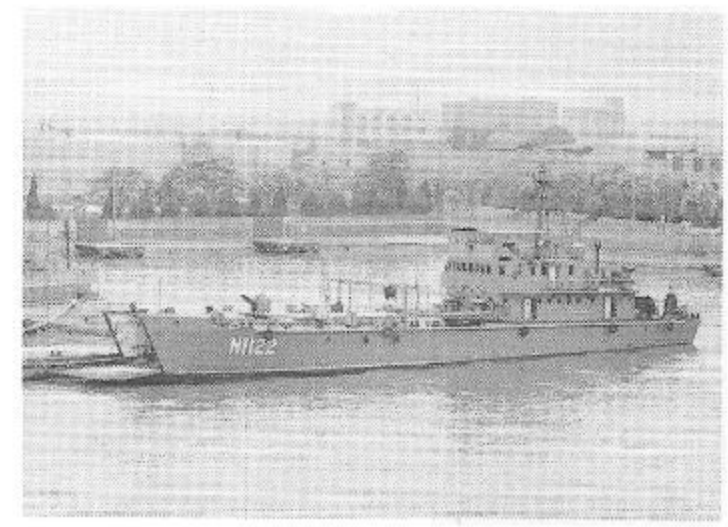
Series production started 1980 in three or four smaller yards, including Shantou. Production has since ended in favour of newer classes of LSL, although this remains the principle type of LCT. The exact numbers produced remain uncertain and Western estimates have recently been adjusted downwards.

DESIGN

It would appear that simplicity was a significant factor in this design.

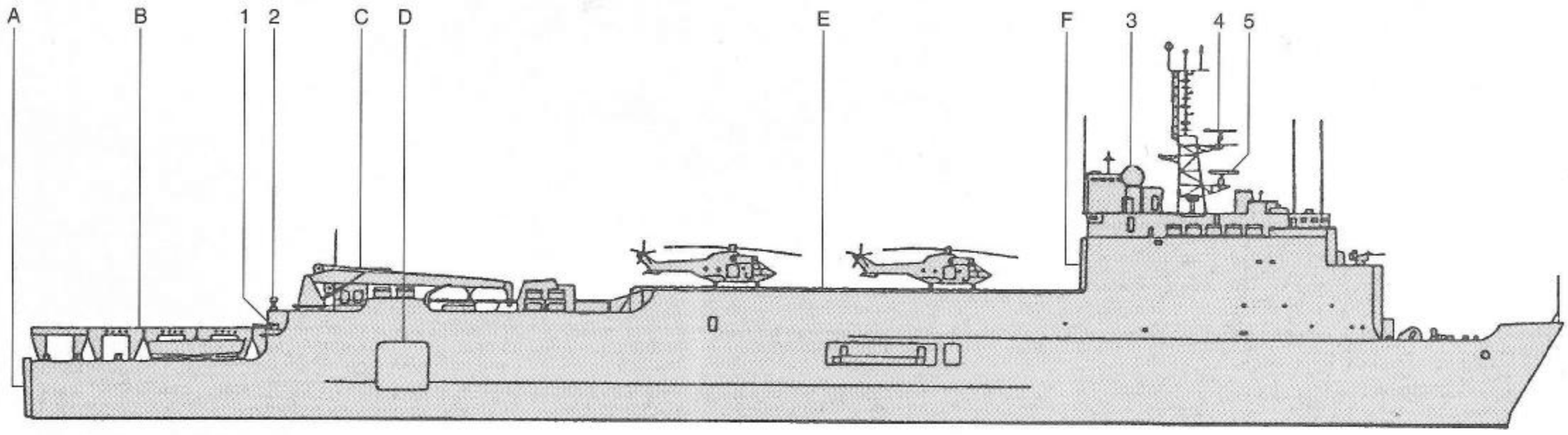
DEPLOYMENT

Most are based in South Sea fleet.



Yuliang (*N1122)* (Henry Dodds)

FOUDRE



Foudre (Ian Sturton)
Amphibious A *Stern door to docking well* **B** *Aft flight deck (26 × 9.5 m)* **C** *Crane (37 t capacity)* **D** *Loading/unloading door* **E** *Main flight deck (62 × 23 m)* **F** *Hangar*

General 1 *Breda-Mouser 30 mm/70 gun (three)* **2** Racal-Decca 1229 helicopter control radar **3** *Syracuse II Satcom* **4** *Racal-Decca 2459 surface search radar* **5** *Racal-Decca 1229 navigation radar*

GENERAL SPECIFICATIONS

Operator: France
Type: TCD 90/LSD

Class: FOUDRE (Landing Ships Dock)

National designation: *Transport de Chalands de Débarquement* (TCD)

Built: 1

Active: 1
Building: 1

Displacement:
standard: 8,321 t
full load: 12,000 t

Dimensions
Length: 168 m (551 ft)

Beam: 23.5 m (77.1 ft)
Draught: 5.2 m (17 ft)

Speed: 21 kts
Range: 11,000 n miles at 15 kts

Complement: 226 (13 officers)

SHIPS

FOUDRE (L 9011)	
Builder	Naval Dockyard, Brest, France
Laid down	26 Mar 1986
Launched	19 Nov 1988
Commissioned	8 Dec 1990

SIROCO (L 9012)	
Builder	Naval Dockyard, Brest, France
Laid down	11 Apr 1994
Launched	Dec 1996
Commissioned	Apr 1998

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 467 troops (normal), maximum 1,600 troops (emergency)
- 1,810 tonnes cargo
- Can carry one P400 patrol craft.
- Endurance of 30 days with 693 people (467 troops plus 226 crew).

SHIP-SHORE LIFT

- Two CDIC or 10 CTM

AVIATION FACILITIES

Specifications
Main flight deck: 62 × 23.5 m (203.4 × 77.1 ft) with Samahé haul-down system
Second flight deck: 26.25 × 9.5 m (86 × 931 ft)
Hangar capacity: 2 Super Frelon or four Super Puma Can operate up to seven Super Pumas.

RAMPS, DECKS

- Well dock 122 × 14.2 × 7.7 m (400 × 47 × 25 ft).
- 52 tonnes capacity elevator at forward end of well dock.
- 37 tonne crane (starboard side).

HOSPITAL

- 2 Operating theatres
- 47 beds

TYPICAL LOADS

- 1 CDIC, 4 CTM, 10 AMX-10RC armoured cars, and 50 vehicles, or a total of 180-200 vehicles (without landing craft).
  or
- 1 mechanised armoured regiment of the French rapid deployment force.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Matra Simbad

Two Matra Simbad twin launchers for Mistral are mounted at the base of the mainmast. Simbad *(Système Integre de Mistral Bitube d'Auto-Defense)* is manually operated with two missile launcher containers, a missile selector and a prelaunch electronics box. Replaceable battery/coolant units are used to provide up to 45 s of prelaunch power to the missile and to cool the seeker detector cells for lock on.

There is a x3 optical sight which can be deployed from −5 to +55° in elevation.

When the target is designated, the operator tracks it, designates a missile and activates the battery/coolant unit. This cools the seeker and warms up the missile as the prelaunch electronics use the seeker to determine whether the target is in range. If it is, the seeker locks on and the operator receives an audio signal to launch the missile. If for some reason the firing has to be postponed the missile system automatically compensates minor aiming errors and remains ready for launch.

Specifications
Length: 1.81 m (5.9 ft)
Diameter: 9.2 cm (3.6 in)
Wing span: 1.9 cm (0.75 in)
Weight: 18.4 kg (40.6 lb)
Speed: Mach 2.6
Range: 700-5,000 m (2,296-16,400 ft)

Manufacturer/Contractor
Matra Défense, Paris, France.

French Landing-Ship Dock (LCD) Foudre *(L 9011) tests its NBCD wash-down facilities.* Foudre *and second ship* Siroco *(to be completed in 1998) are designed to carry, land and support a mechanised armoured regiment of the* Force Action Rapide *(FAR), with secondary roles of logistic support and humanitarian missions* (DCN/Jean Biaugeaud)

GUNS

Breda/Mauser 30 mm/70

Three Breda/Mauser 30 mm/70 on single compact mountings have been fitted in Siroco during construction and have been retrofitted in Foudre in 1996 (replacing a single 40 mm Bofors L/60). The MK30 Model F is a fully gas-operated weapon using pistons which not only operate the bolt but, autonomously, the ammunition feed system. It is a twin-feed weapon with two boxes each of 80 rounds attached to the trunnion supports and linked to the feed mechanism by a flexible chute.

Specifications

Calibre: 30 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,040-1,220 m/s (3,412-4,003 ft/s) (HEI/APDS)
Traverse: Unlimited
Elevation: −13 to +85°
Rate of fire: 800 rds/min/barrel
Ammunition: 1.05 kg (2.3 lb) (TP, HEI, HEI-SD, API, APDS)
Training speed: 140°/s
Elevation speed: 80°/s
Mounting weight, with ammunition: 1,480 kg (3,263 lb)
Crew: 0

Manufacturer/Contractor

OTOBREDA. La Spezia, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT/ COUNTERMEASURES (ESM/ECM)

ESM/ECM fit has not yet been specified.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Command support system

OPSMER is installed.

Syracuse

Syracuse (French national system). Satcom domes are on pedestals on the after outboard end of superstructure.

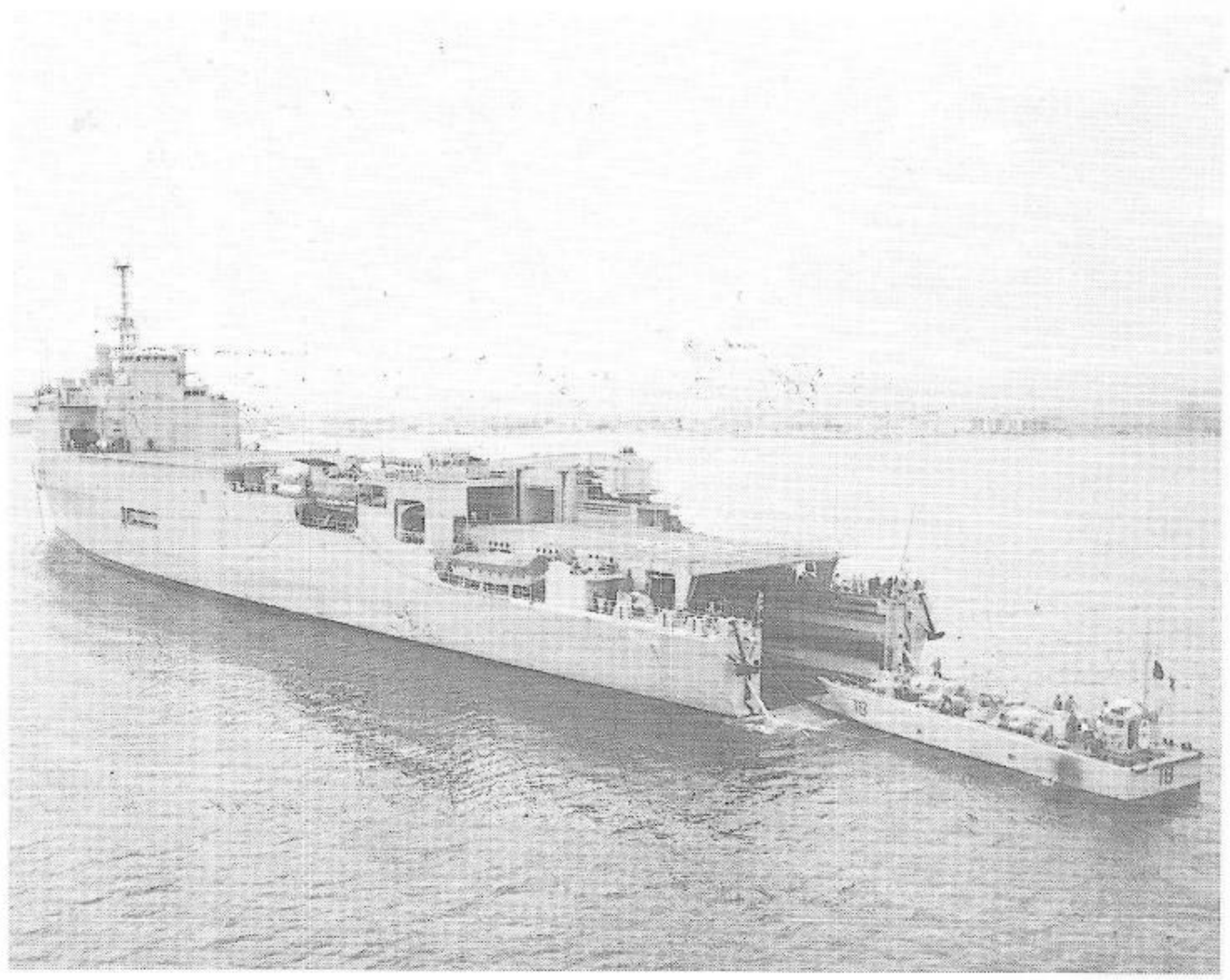
WEAPONS CONTROL

Sagem VIGY-105 optronic system

VIGY-105 is being fitted in *Foudre* during 1996/97 for 30 mm guns. This is an electro-optical fire-control system for guns or short-range missiles and possesses a similar rotating sensor head on the same three-axis gimbal as the earlier VAMPIR MB. The fixed sensor module is repackaged but has similar servo and electronics modules, although the VIGY-105 electronics include a video tracker and fire-control computer as well as a TMS C40 processor. Some of the electronics are incorporated in a CS Defense Calisto workstation.

Foudre. *Among the features visible are the two Syracuse 2 satellite antennas and at the port side after end of the flight deck the Racal-Decca 1229 radar, which is used for helicopter control* (DCN/ Jean Biaugeaud)

Foudre *from astern. Note the large stem door giving access to the docking well, the secondary flight deck (with access to the vehicle hangar) and the primary flight deck with the aircraft hangar at the forward end* (DCN/Jean Biaugeaud)



CTM-18 (CTM = Chalands de Transport de Materiel*) delivers two VAB* (Vehicule de l'Avant Blindé) *to* Foudre. *Two CTMs can be carried in the docking well* (DCN/Jean Biaugeaud)

The sensors consist of a high-resolution TV camera, an IRCCD camera and an eye-safe laser rangefinder which are all harmonised to less than 50 µrad.

Specification
(VIGY-105)
Director dimensions: 600 × 6,500 × 1,500 m (1,968 × 21,320 × 4,920 ft)
Director weight: 150 kg (330.75 lb)
Elevation: −25 to +65°
Fields of view: 9 × 12°, 3 × 4° (TV camera); 9 × 11.5°, 3 × 3.8° (IRCCD camera)

Manufacturer/Contractor
SAGEM, Navigation and Defence Division, France.

RADARS

Thomson-CSF DRBV 21A Mars
The air/surface search set is the Thomson-CSF DRBV 21A. The antenna is mounted on a small platform on the complex mainmast. Mars is a member of the D-band TRS 3011 Jupiter/TRS 3015 Mars/Astral family of naval surveillance radars. It is intended for ocean-capable patrol vessels and operates with a simplified transmitter assembled with the receiver in a single electronics cabinet. Rotation speed is 12 rpm. Instrumented ranges are 110 km for the air channel and 80 km for the optional surface channel. The transmitter is solid state with frequency agility, burst-to-burst with Doppler processing, or pulse-to-pulse.

Manufacturer/Contractor
Thomson-CSF, Systemes Navals de Combat, Bagneux, France.

Racal-Decca 2459
The Racal-Decca 2459 is an I-Band set used for surface search. It is fitted with a combined F/I-band antenna and utilises a variety of transceiver and display units.

Racal-Decca 1229
Two Racal-Decca 1229, I-Band, solid-state sets are installed. One is used for navigation, the other for helicopter control.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 SEMT-Pielstick 16 PC2.5 V 400 diesels, 15.3 MW (20,800 hp) sustained
Shafts: 2
Propellers: Controllable pitch
Thruster: 1 bow thruster, 735 kW (1,000 hp)

FURTHER INFORMATION

PROGRAMME

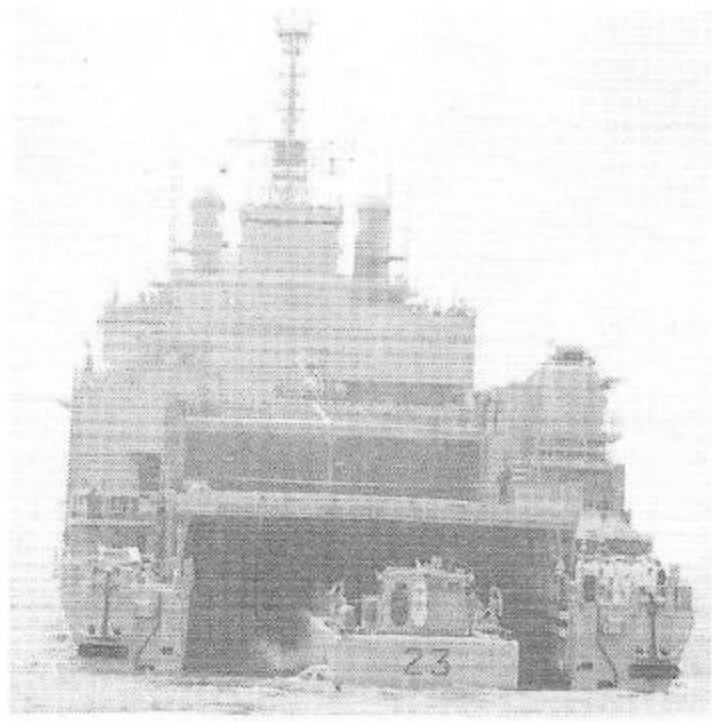
Foudre, first ship of this class, was ordered in November 1984 and the second, *Siroco,* not until nine years later. The long gap is indicative of the debate that has been going on in France as elsewhere about the future of amphibious forces, and is the reason the ageing 'Ouragan' class ships have had their service lives extended into the 21st century.

Foudre is categorised as a TCD *(Transport de Chalands de Debarquement),* indicating that the landing craft are seen as the primary method of assault. Its capability for supporting helicopters is, in contrast, limited. The second of the class, *Siroco*, alters the balance between landing craft and helicopters a little, with a longer flight deck giving a small increase in the aviation capability.

The probability is that if there are to be more ships of this type, and drastic cuts in defence spending since the election of President Chirac make that less likely in the short term, then the design may be more radically updated the next time around, with even greater emphasis on the deployment of helicopters.

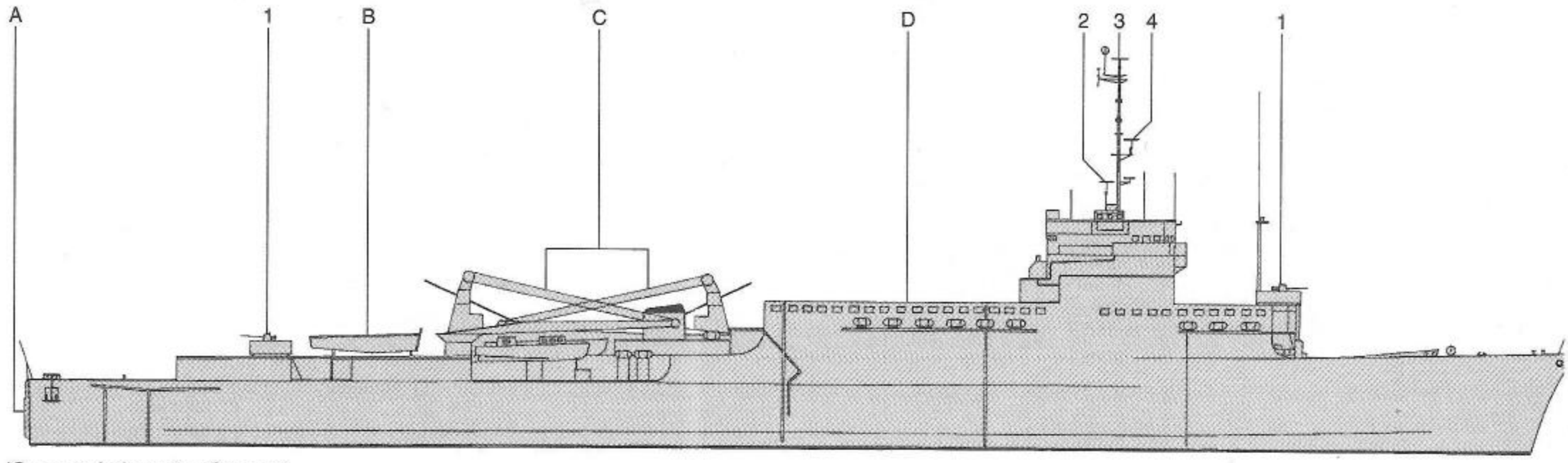
DEPLOYMENT

Foudre is assigned to *Force d'Action Navale* at Toulon. It is designed to embark a mechanised regiment of the Rapid Action Force (FAR) and to act as a logistic support ship. There are extensive command facilities for an amphibious operation.



CTM 23 enters the docking well, with Foudre *ballasted down* (DCN)

OURAGAN



'Ouragan' class (Ian Sturton)
Amphibious A *Stern door to docking well* **B** *LCVP* **C** *Cranes, 35 t capacity* **D** *Flight deck*

General 1 *Bofors 40 mm/60* **2** *Racal-Decca 1226 helicopter control radar* **3** *Thomson-CSF DRBV-51A air/surface search radar* **4** *Racal-Decca 1226 navigation radar*

GENERAL SPECIFICATIONS

Operator: France

Class: OURAGAN (TCD/LSD)

National designation: *Transports de Chalands de Debarquement* (TCD)

Built: 2
Active: 2

Displacement:
standard: 5,893 t
full load: 8,636 t
fully docked down: 15,238 t

Dimensions
Length: 149 m (488.9 ft)
Beam: 23 m (75.4 ft)
Draught: 5.4 m (17.7 ft)

Speed: 17 kts
Range: 9,000 n miles at 15 kts

Complement: 213 including 10 officers

SHIPS

OURAGAN (L 9021)	
Builder	Naval Dockyard, Brest, France
Laid down	Jun 1962
Launched	9 Nov 1963
Commissioned	1 Jun 1965

ORAGE (L 9022)	
Builder	Naval Dockyard, Brest, France
Laid down	Jun 1966
Launched	22 Apr 1967
Commissioned	1 Apr 1968

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops
  normal: 343
  hard-lying: 472
- Light tanks: 22 or
- Cargo: 1,500 t

SHIP-SHORE LIFT

- 2 EDIC LCTs
- 3 LCVPs
- 8 loaded CTMs

AMPHIBIOUS FACILITIES

- 2 cranes, each of 35 tonne capacity
- For logistics operations, two temporary deck sections, one 90 m (295 ft) long, the other 36 m (118 ft) long, can be used to accommodate extra vehicles.
- Docking well 120 × 14 m (394 × 46 ft)
- Stern gate 14 × 5.5 m (46 × 18 ft)

AVIATION FACILITIES

Specifications
Flight deck
Hangar
Helicopters: 4 SA 321G Super Frelon or four Super Pumas or 10 SA 319B Alouette IIIs.

The normal helicopter platform can operate three Super Frelon or 10 Alouette III helicopters, while a second portable platform can be installed over the docking well enabling the ship to operate a further single Super Frelon or three Alouette IIIs.

TYPICAL LOADS

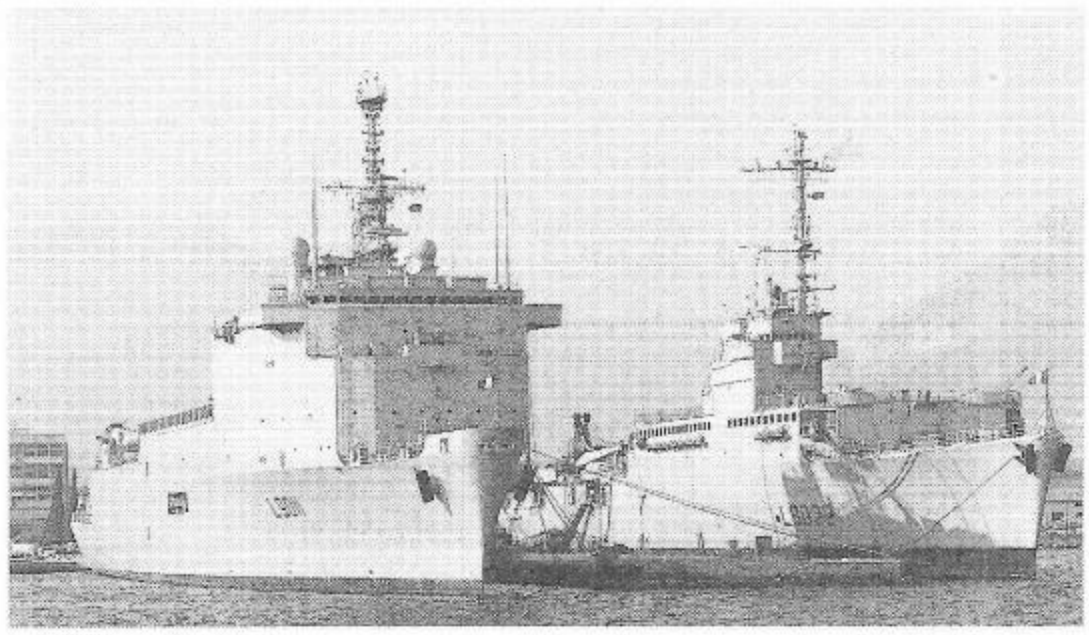
- 1 CDIC, four CTM, 10 AMX 10 RC armoured cars and 21 vehicles
- or a total of 150-170 vehicles without landing craft.
- or 18 Super Frelon or 80 Alouette III helicopters.
- or 120 AMX 13 tanks.
- or 84 DUKWs.
- or 340 Jeeps.
- or 12 50-tonne barges.

WEAPONS SYSTEMS

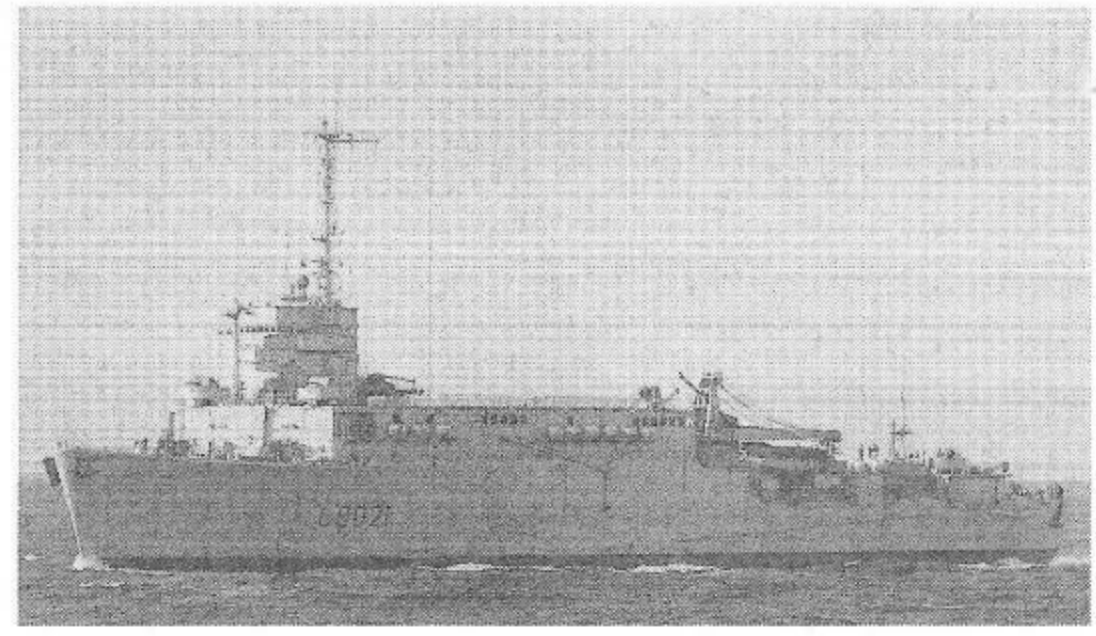
SURFACE-TO-AIR MISSILES (SAM)

Matra Simbad
Two Matra Simbad twin launchers for Mistral were fitted in 1993. Simbad (Système Integre de Mistral Bitube d'Auto-Defense) is a manually operated system which has two missile launcher-containers and a loaded weight of 250 kg (551 lb). When the target is designated, the operator tracks it, designates a missile and activates the battery/coolant unit. This cools the seeker and warms up the missile as the prelaunch electronics use the seeker to determine whether the target is in range. If it is, the seeker locks on and the operator receives an audio signal to launch the missile. If for some reason the firing has to be postponed the missile system automatically compensates minor aiming errors and remains ready for launch.

Specifications
Length: 1.81 m (5.9 ft)
Diameter: 9.2 cm (3.6 in)
Wing span: 1.9 cm (0.75 in)
Weight: 18.4 kg (40.6 lb)



Ouragan *(L 9021) (right) with* Foudre *(L 9011) (left). Delays in the second 'Foudre' class ship have caused the two 'Ouragan' class ships to be extended into the next century* (H & L van Ginderen Collection)



Ouragan *(L 9021), France's first purpose-built amphibious warfare ship. Note that the bridge superstructure is on the starboard side as in an aircraft carrier* (Albert Campanera i Rovira)

Speed: Mach 2.6
Range: 700-5,000 m (2,296-16,400 ft)

Manufacturer/Contractor
Matra Defense, France.

GUNS

OTOBREDA/Mauser 30 mm/70
Two OTOBREDA/Mauser 30 mm/70 cannon on single compact mountings were fitted in 1996/97 to replace the four 40 mm Bofors L/60s. The MK30 Model F is 3.35 m (10.99 ft) long, weighs 132.5 kg (292.2 lb) and uses the 30 mm × 173 GAU 8/A round. It is a fully gas-operated weapon using pistons which not only operate the bolt but, autonomously, the ammunition feed system. The Single Compact mounting is on an 80 cm diameter base. It is a twin-feed weapon with two boxes each of 80 rounds attached to the trunnion supports and linked to the feed mechanism by a flexible chute. The mounting weighs 1.33 tonne when loaded. The mounting is 3.57 m (11.71 ft) long, 1.6 m (5.2 ft) high and 1.8 m (5.9 ft) in width, with a swept radius of 2.72 m (8.9 ft).

Specifications
Calibre: 30 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,040-1,220 m/s (3,412-4,002 ft/s) (HEI/APDS)
Traverse: 360° at 140°/s
Elevation: −13 to +85° at 80°/s
Rate of fire: 800 rds/min/barrel
Ammunition: 1.05 kg (2.3 lb) (TP, HEI, HEI-SD, API, APDS)
Mounting weight, with ammunition: 1,480 kg (3,263 lb) (SC)
Crew: 0

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Sagem VIGY-105 optronic system
VIGY-105 was fitted in 1996/97 for the 30 mm guns. This is an electro-optical fire-control system for guns or short-range missiles and possesses a similar rotating sensor head on the same three-axis gimbal as the earlier VAMPIR MB. The fixed sensor module is repackaged but has similar servo and electronics modules, although the VIGY-105 electronics include a video tracker and fire-control computer as well as a TMS C40 processor. Some of the electronics are incorporated in a CS Defense Calisto workstation. The sensors consist of a high-resolution TV camera, an IRCCD camera and an eye-safe laser rangefinder which are all harmonised to less than 50 µrad.

Specifications
(VIGY-105)
Director dimensions: 600 × 6,500 × 1,500 m (1,968 × 21,320 × 4,920 ft)
Director weight: 150 kg (330.75 lb)
Elevation: −25 to +65°
Fields of view: 9 × 12°, 3 × 4° (TV camera); 9 × 11.5°, 3 × 3.8° (IRCCD camera)

Manufacturer/Contractor
SAGEM, Navigation and Defence Division.

RADARS

Thomson-CSF DRBV 51A
The Thomson-CSF DRBV 51A, G-Band radar is used for air/surface search. This was the most frequently used French naval radar a few years ago, but is now being replaced in some ships by more up-to-date systems.

Racal-Decca 1226
The Type 1226, I-band radar is used for navigation. It has a 30 cm PPI Plan Position Indicator display, a 20 kW output and a 1.83 m antenna.

SONAR

EDO AN/SQS-17
Ouragan only. Ouragan is fitted with an AN/SQS-17, a 1950s-vintage sonar, which was designed by EDO and built under licence in France. It is a hull-mounted, active search set, working at 12, 13 and 14 kHz, using a 24 stave 50 cm diameter array. While the sonar may give warning of a submarine, Ouragan actually carries no ASW weapons to deal with it.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 SEMT-Pielstick diesels, delivering 6.32 MW (8,600 hp)
Shafts: 2
Propellers: Controllable pitch

FURTHER INFORMATION

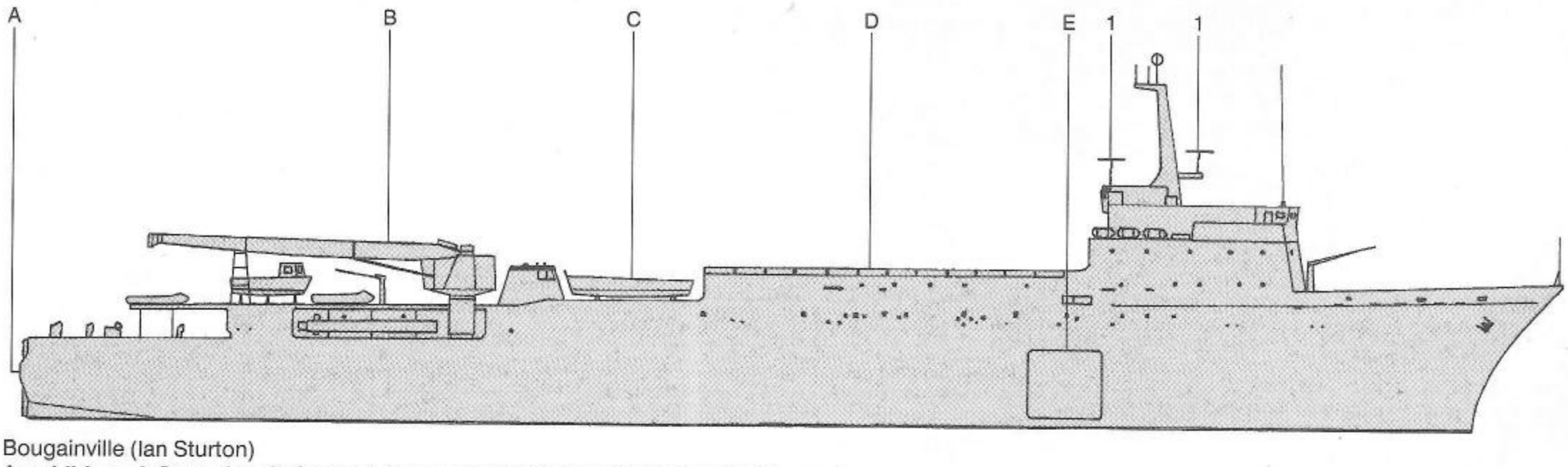
PROGRAMME

In the early post-war years the French Navy operated a number of ex-US Navy landing ships and one landing platform, dock (LPD). The two ships of the 'Ouragan' class were the first French-designed and -built amphibious warfare ships and have proved very successful. They were completed in 1965 and 1968, and were due to be replaced by two 'Foudre' class TCDs in the early 1990s. Due to delays in that programme, however, the lives of these two ships have been extended into the next century. Thus, as with the British Royal Navy and its two 'Fearless' class LPDs, the French Navy is being forced into retaining the two 'Ouragan' class ships well beyond the point where they should have retired, while it awaits decisions on future LPDs. In practice, the French position is a little ahead of the British since one LPD, *Foudre,* has been in service now for some years, and a second, *Siroco,* is due to be commissioned in 1998. Further, the cessation of nuclear testing in the Pacific may free the relatively modern *Bougainville* multipurpose amphibious ship for a more conventional naval role. Meanwhile, the 'Ouragan' class ships are being updated in terms of weaponry and control systems.

DEPLOYMENT

Both ships are assigned to the FAN (Force d'Action Navale) at Toulon. They have command facilities for directing amphibious and helicopter operations.

BOUGAINVILLE



Bougainville (Ian Sturton)
Amphibious A *Stern door* **B** *Crane; 37 t capacity* **C** *LCVP* **D** *Flight deck* **E** *Entry port*

General 1 *Racal-Decca 1226 navigation*

GENERAL SPECIFICATIONS

Operator: France

Class: BOUGAINVILLE

National designation: *Batiment de Transport et de Soutien* (BTS) (transport and logistic support ship).

Built: 1
Active: 1

Displacement:
standard: 4,954 t
full load: 5,181 t

Dimensions
Length: 113.5 m (372.3 ft)
Beam: 17 m (55.8 ft)
Draught: 4.3 m (14.1 ft)

Speed: 15 kts
Range: 6,000 n miles at 12 kts

Complement: 53 (including five officers) plus 10 staff

SHIP

BOUGAINVILLE (L 9077)

Builder	Chantier Dubigeon, Nantes, France	**Laid down**	28 Jan 1986
Completed by	Chantiers de l'Atlantique, St Nazaire, France	**Launched**	3 Oct 1986
		Commissioned	5 Jun 1988

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 500 troops for eight days
- 1,180 tonnes of cargo

SHIP-SHORE LIFT

- Amphibious role: 10 LCP plus two LCM
- Logistic support role: two LCU

AVIATION FACILITIES

Specifications
Flight deck: Aft of forward superstructure.
Helicopters: 2 Aerospatiale 332B Super Pumas.

AMPHIBIOUS FACILITIES

- Well deck 78 × 10.2 m (255.84 × 33.45 ft).
- Can receive tugs and one BSR support vessel or two CTM (Chalands de Transport de Materiel) LCM-type vessels, a supply tender of the 'Chamois' class, containers and mixed bulk cargo.
- Can dock a 400 tonne ship.
- There is a 37 tonne crane aft of the flight deck.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Two Matra Simbad twin launchers
Simbad *(Système Integre de Mistral Bitube d'Auto-Defense)* is a manually operated system for firing Mistral missiles which has two missile launcher-containers and a loaded weight of 250 kg (551.25 lb). Simbad is 2.3 m (7.54 ft) high with an operating radius of 1.5 m (4.92 ft) and it can be installed on any 20 mm gun mounting. It has a ×3 optical sight and can be deployed from −5 to +55° in elevation.

Specifications
Missile
Length: 1.81 m (5.93 ft)
Diameter: 9.2 cm (33.32 in)
Wing span: 1.9 cm (0.74 in)
Weight: 18.4 kg (40.57 lb)
Speed: Mach 2.6
Range: 700-5,000 m (2,296-16,400 ft)

Manufacturer/Contractor
Matra Defense, Paris, France

GUNS

M2HB 12.7 mm machine guns
Two M2HB are carried. The M2 automatic was designed as an anti-tank weapon in 1919 but was used during the Second World War for both air defence and surface fire support. The common air-cooled version is the M2HB (Heavy Barrel) which has a 1,143 mm long barrel. There are numerous mountings available.

Specifications
(M2HB)
Calibre: 12.7 mm
Length of barrel: 90 calibres
Gun weight: 38.1 kg (84.0 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca Type 1226
The Racal Decca Type 1226 is an I-band equipment: one set is used for navigation, the other for helicopter control. The Type 1226 uses a 30 cm PPI (Plan Position Indicator) display, operates in the I-band, has 20 kW outputs and is equipped with a 1.83 m antenna.

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 SACM AGO 195 V12 RVR diesels, 3.24 MW (4,410 HP) sustained.
Shafts: 2
Propellers: Controllable pitch
Thruster: 1 bow thruster, 294 kW (400 hp).

FURTHER INFORMATION

PROGRAMME

Bougainville was ordered in November 1984 for the *Direction du Centre d'Experimentations Nucleaires* (DIRCEN) and is based in the Pacific Squadron for use at the nuclear test base at Muroroa. It is a one-off vessel built to support the nuclear test site in the South Pacific but has extensive amphibious capabilities as well. Its future role is uncertain because of French defence cuts and the end of nuclear testing in the Pacific, though it is well-equipped for a more conventional amphibious role or for service as a command vessel. *Bougainville* was built and launched at Chantiers Dubigeon at Nantes, but the yard closed down after her launch and it was fitted out at Alsthom's Chantiers de l'Atlantique.

DESIGN

The ship has a dual designation as an LPD amphibious craft and a BTS *(Batiment de Transport et de Soutien)* which relates to her role as support vessel in the South Pacific. There are large-scale repair workshops and repair facilities for helicopters, and the ship can act as a mobile crew accommodation. There are extensive facilities for medical treatment, and large storerooms for spare parts, food and ammunition.

Bougainville *(L 9077). The smallest operational LPD in any navy, this ship was built specifically for use in the Pacific on France's nuclear testing range and the hull was built to civil standards* (Alsthom)

EDIC/EDIC 700/CDIC

OVERVIEW

The original series of EDIC *(Engins de Debarquement d'Infanterie et de Chars)* was built by CN Franco-Belge and the Toulon naval dockyard in the late 1950s. These were essentially updated versions of the British Landing Craft Tank (LCT) Mk 4, of which a number had been supplied to the French Navy both during and after the Second World War. The EDIC design led to a long-running series of LCTs, which have been built in France and other countries over a period of some 20 years.

Two batches of EDICs were built for the French Navy:

L 9091, L 9093, L 9094, L 9096. These were launched in 1958. All were stricken between 1988 and 1991, but L 9096 has subsequently been restored to the register.

L 9070, L 9072, L 9073, L 9074. These were launched in 1967-69 and L 9074 alone remains in service.

Besides being built in France, the EDIC has also been built in Portugal, Spain and Turkey.

A modified version, designated EDIC 700 (or EDIC III), was also produced. It originated with an order for two vessels (L 9051, L 9052) for use at the French nuclear testing site in the Pacific, which were financed out of the nuclear budget, rather than paid for by the navy, although they have naval crews. A third EDIC 700 was built for Senegal, and another two for Lebanon.

A further variation on the design, the CDIC, was developed specifically to operate with the 'Foudre' class LPDs. Two were built for the French Navy.

TABLE I: EDIC/EDIC 700 PRODUCTION

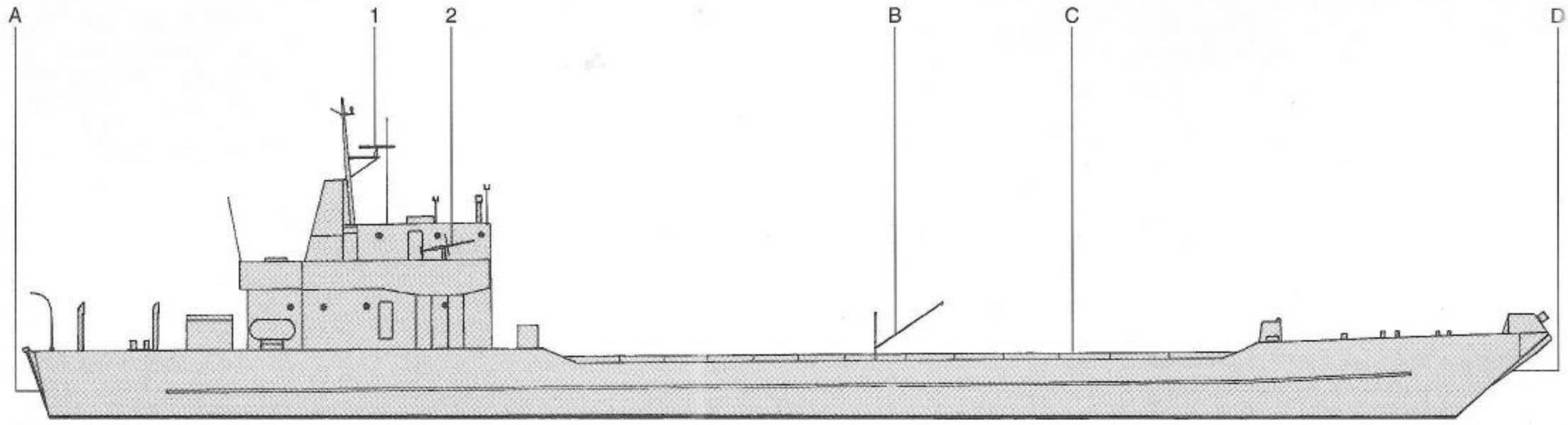
Type	Country	Number built	Launched	In service 1 Jan 1997	Remarks
EDIC	France	8	4 - 1958 4 - 1967-69	1 1	
	Ethiopia	2	1977	—	Ethiopian Navy has ceased to exist (see note)
	Madagascar	1	1964	1	One BATRAM-type built in Madagascar is very similar to EDIC
	Morocco	1	1963	1	
	Portugal	3	1969-1985	3	Built in Portugal
	Senegal	1	1986	1	Also has one EDIC 700 (below)
	Spain	3	1966	3	Built by Bazan, La Caracca
	Turkey	12	1966-1973	7	Built at Golcuk
EDIC 700	France	2	1987	2	
	Lebanon	2	1985	2	
	Senegal	1		1	
CDIC	France	2	1988	2	For use with 'Foudre' class LPDs
TOTALS		**38**		**25**	

Note: The Ethiopian Navy received two EDIC vessels from France, of which one remained in late 1996. With the loss of Ethiopia's coastline, however, all ships of the former Ethiopian Navy were being offered for sale in late 1996.

TABLE II: CHARACTERISTICS

Class	EDIC	Turkish C 107	EDIC 700	CDIC
Displacement (full load)	645 t	589 t	747 t	751 t
Dimensions				
length	59 m (193.5 ft)	57 m (186 ft)	59 m (193.5 ft)	59.4 m (194.9 ft)
beam	12 m (39.2 ft)	12 m (39.4 ft)	11.6 m (38.1 ft)	11.9 m (39.0 ft)
draught	1.3 m (4.2 ft)	1.4 m (4.6 ft)	1.7 m (5.8 ft)	1.1 m (3.61 ft)
Speed	8 kts	10 kts	12 kts	11 kts
Range	1,800 n miles at 8 kts	600 n miles at 10 kts	1,800 n miles at 12 kts	2,880 n miles at 8 kts
Complement	17	15	17	18
Machinery	2 SACM MGO 175 V12	3 GM 6-71 diesels	2 SACM Uni-Diesel UD30 V12M1	2 SACM UD350V12 M1 diesels
number engines				
power	753 kW (1,000 hp)	390 kW (522 hp)	882 kW (1,200 hp)	390 kW (1,080 hp)
Shafts	**2**	**3**	**2**	**2**

EDIC



Bombarda (LCT) (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Crane* **C** *Tank deck* **D** *Bow door/ramp*

General 1 *Racal-Decca RM-316P navigation radar* **2** *Oerlikon 20 mm cannon*

GENERAL SPECIFICATIONS

Country of origin: France
Operators: France, Madagascar, Morocco, Portugal, Senegal, Spain, Turkey

Class: EDIC

Built: 37
Active: 24

Displacement:
standard: 254 t
full load: 645 t

Dimensions
Length: 59 m (193.5 ft)
Beam: 12 m (39.2 ft)
Draught: 1.3 m (4.2 ft)

Speed: 8 kts
Range: 1,800 n miles at 8 kts

Complement: 17

SHIPS

France

L 9074
Commissioned 7 Feb 1970

L 9096
Builder Naval Dockyard, Toulon, France
Launched 11 Oct 1958
Commissioned 15 May 1959

Madagascar

AINA VAO VAO (ex-L 9082)
Builder Chantiers Navals Franco-Belges, France
In service (France) 1964 (L 9082)
Stricken and laid up 1981
Transferred (Madagascar) 28 Sep 1985

Morocco

LIEUTENANT MALGHAGH (401) (ex-21)
Builder Chantiers Navals Franco-Belges, France
Commissioned 1965

Portugal

BOMBARDA (LDG 201)
Builder Estaleiros Navais do Mondego, Portugal
Commissioned Jan 1969

ALABARDA (LDG 202)
Builder Estaleiros Navais do Mondego, Portugal
Commissioned Dec 1970

BACAMARTE (LDG 203)
Builder Arsenal do Alfeite, Alfeite, Portugal
Commissioned Dec 1985

Spain

A 06
Builder Bazan, La Carraca, Spain
Commissioned 6 Dec 1966

A 07
Builder Bazan, La Carraca, Spain
Commissioned 30 Dec 1966

A 08
Builder Bazan, La Carraca, Spain
Commissioned 30 Dec 1966

Turkey

C 108, C 110, C 113, C 114, C 117, C 118, C 120
Builder Naval Yard , Gölcük, Turkey
Commissioned 1966-1973

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Five LVTs
- 11 trucks
- Eight armoured personnel carriers
- 250 tonnes

AMPHIBIOUS FACILITIES

- Flat, bottom-hinged bow door
- Tank deck 28.5 × 8 m (93.5 × 26.25 ft)
- Kedge anchor at stern

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm cannon

Specifications
Calibre: 20 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,101 ft/s)
Traverse: 325°
Elevation: −15 to +80°
Mounting weight, loaded: 470 kg (1,036 lb)
Crew: 2
Range: 3.5-5.5 n miles (6.75-10 km)

Giat 20F2 20 mm

Specifications
(M693/F2 A)
Calibre: 20 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,101 ft/s)

Traverse: 325°
Elevation: −15 to +80°
Mounting weight, loaded: 470 kg (1,036 lb)
Crew: 2
Range: 3.5-5.5 n miles (6.75-10 km)

M2HB 12.7 mm machine gun

Specifications
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

81 mm mortar

These ships carry one 81 mm mortar for use in the run in to amphibious landings. Typical range for such a weapon is 1.94 n miles (3.6 km), firing a 4.05-4.15 kg (8.9-9.1 lb) bomb at a rate of approximately 10 rds/min.

Weapons summary

	Oerlikon 20 mm	Giat 20F2 20 mm	12.7 mm machine gun	81 mm mortar	120 mm mortar
France	2				
Madagascar		2			
Morocco		2			1
Spain			2	1	
Turkey	2		2		
Portugal	2				

COMMAND AND CONTROL SYSTEMS

RADAR

All appear to have a navigation radar, of which the Racal-Decca 1226 is the most frequently found.

Racal-Decca 1226

Specifications
Role: Navigation
Band: I
Range: 48 n miles (81 km)
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm

Manufacturer/Contractor
Racal-Decca.

PROPULSION

France, Madagascar

Specifications
System: Diesel
Main machinery: 2 SACM MGO 175 V12 diesels, 753 kW (1,000 hp) sustained
Shafts: 2

Portugal

Specifications
System: Diesel
Main machinery: 2 MTU MD-225 diesels, 669 kW (910 hp)
Shafts: 2

Spain

Specifications
System: Diesel
Main machinery: 2 MTU-Bazan MA 6 R 362 SB70 diesels; 823 kW (1,120 hp)
Shafts: 2

Turkey

Specifications
System: Diesel
Main machinery: 3 GM 6-71 diesels; 390 kW, (522 hp)
Shafts: 3

FURTHER INFORMATION

France
L 9074 has been based in French Guiana since February 1995. L 9096 was paid off in 1990 but is now active again as a special harbour craft at Brest.

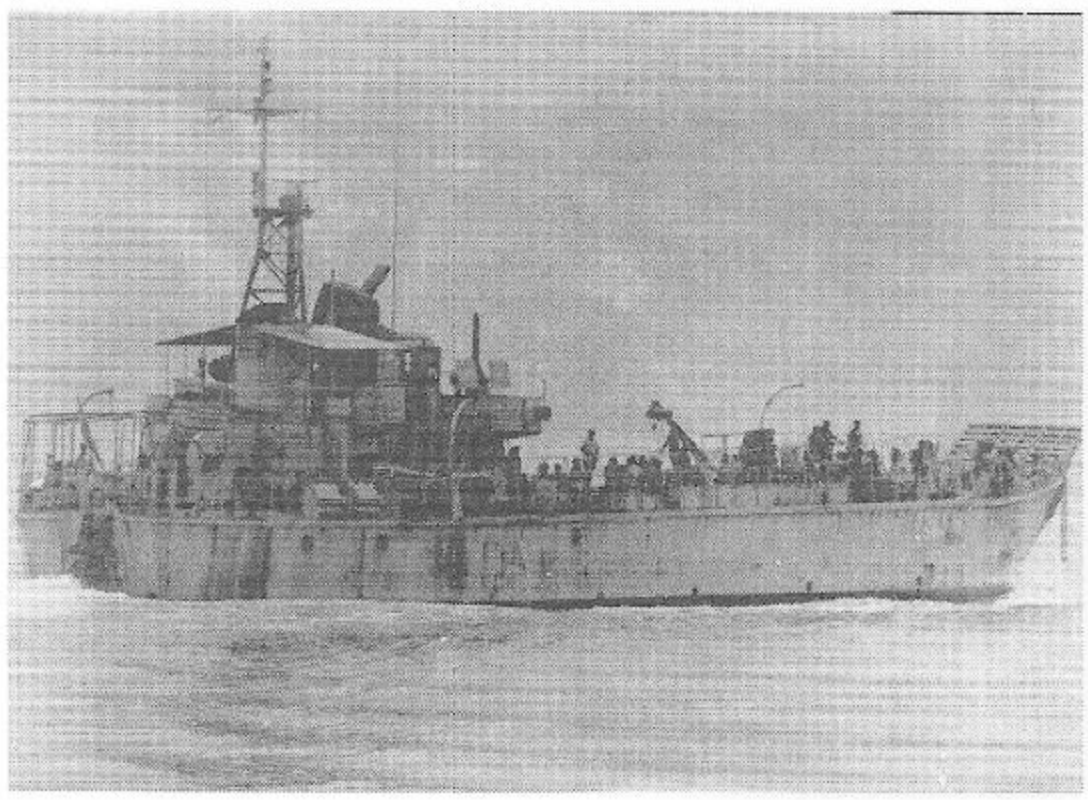
Madagascar
The Madagascar vessel served in the French Navy from 1964 to 1981, spending most of that time in the Pacific. It was laid up at Tahiti in 1981 but was sold to Madagascar in 1985.

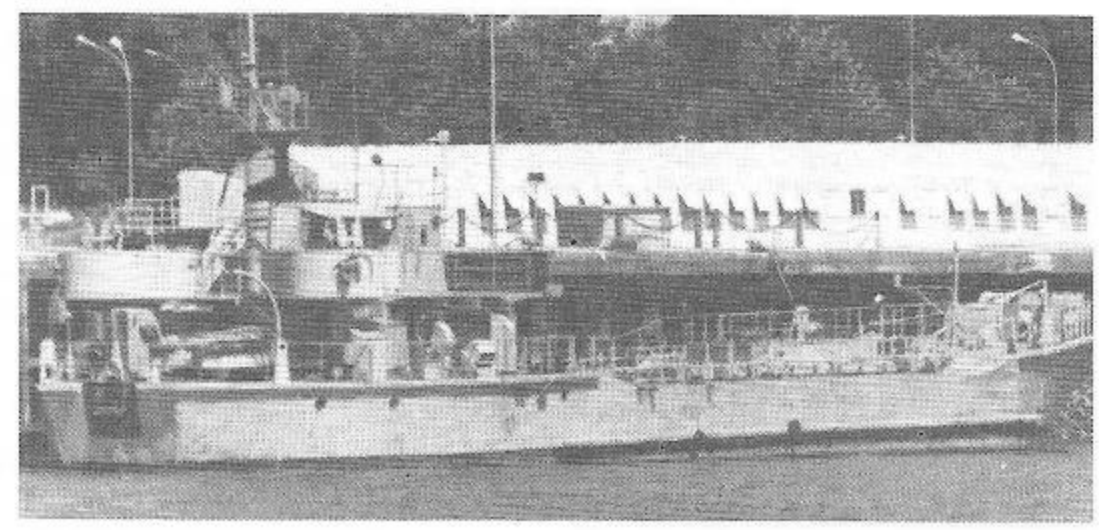
Morocco
This vessel was built in France and delivered to Morocco in 1965.

Portugal
The design of these Portuguese-built landing craft was based on that of the French EDIC. It should be noted that *Bacamarte,* the third of class, was built a full 15 years after the second vessel.

Spain
Spanish-built, but the design was based on that of the French EDIC class. They were redesignated logistics support craft in 1986, but still carry armament.

Turkey
Twelve landing craft were built in Turkey between 1966 and 1973, of which four were scrapped in 1991 and one in 1993. The Turkish version has three engines and three propellers.

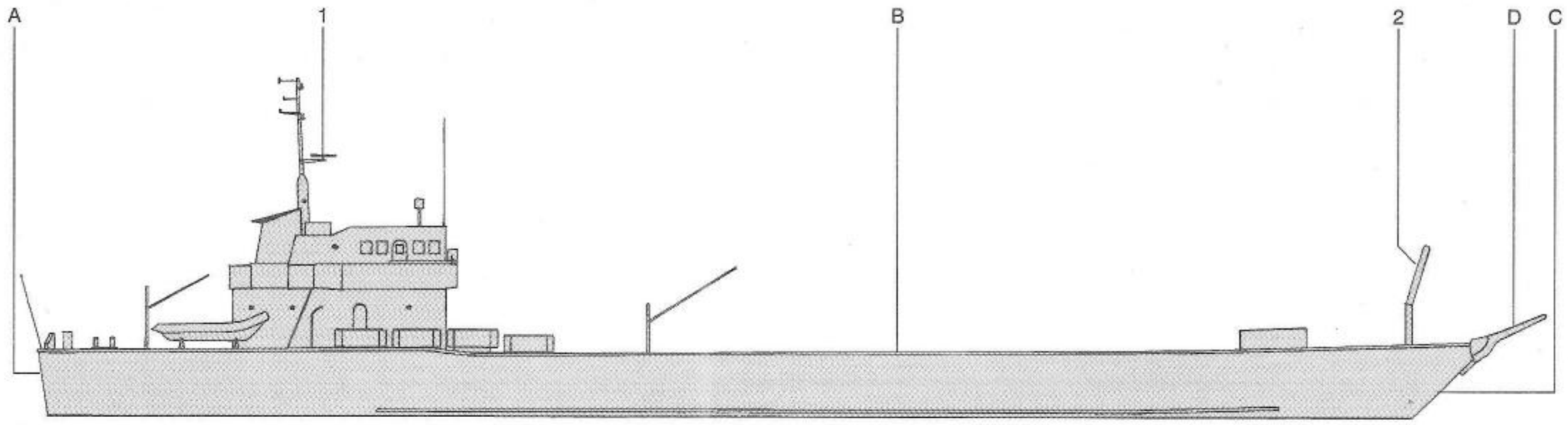




EDIC of the Madagascar Navy (J Y Robert)

A French-built 'EDIC' class landing craft in service with the Ethiopian Navy. This vessel was probably included in the sell-off of the former Ethiopian Navy in late 1996 but its fate is unknown (Ethiopian Navy)

EDIC 700



EDIC 700 class L 9052 (Ian Sturton)
Amphibious A *Kedge anchor (inset in stern)* **B** *Tank deck* **C** *Bow door/ramp* **D** *Ramp extensors*

General 1 *Racal-Decca 1226 navigation radar* **2** *Gantry foremast*

GENERAL SPECIFICATIONS

Country of origin: France
Operators: France, Lebanon, Senegal

Class: EDIC 700

Built: 5
Active: 5

Displacement:
full load: 747 t

Dimensions
Length: 59 m (193.5 ft)
Beam: 11.6 m (38.1 ft)
Draught: 1.7 m (5.8 ft)

Speed: 12 kts
Range: 1,800 n miles at 12 kts

Complement: 17 (France); 20 (Lebanon); 18 (Senegal)

SHIPS

France

L 9051
Builder SFCN, Villeneuve la Garenne, France
Commissioned 13 Jun 1987

L 9052
Builder SFCN, Villeneuve la Garenne, France
Commissioned 19 Dec 1987

Lebanon

SOUR (21)
Builder SFCN, Villeneuve la Garenne, France
Commissioned 28 Mar 1985

DAMOUR (22)
Builder SFCN, Villeneuve la Garenne, France
Commissioned 28 Mar 1985

Senegal

KARABANE (841)
Builder SFCN, Villeneuve la Garenne, France
Delivered 23 Jun 1986
Commissioned 30 Jan 1987

—
Builder SFCN, Villeneuve la Garenne, France
Launched 30 Mar 1967
Commissioned (French Navy) (L 9070)
Transferred (Senegal) 16 Oct 1995

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Cargo 350 tonnes

RAMPS, DECK

- Tank deck 28.5 × 8 m (93.5 × 26.25 ft)
- Flat-fronted bow door, bottom-hinged

WEAPONS SYSTEMS

GUNS

Giat 20F2 20 mm

French ships only. Two Giat 20F2 20 mm cannon in a swivel fork-type mount revolving on a fixed ferrule. The mounting, which is unpowered, is largely made up of light alloys and stainless steel to reduce weight.

Specifications
(M693/F2 A)
Calibre: 20 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,101 ft/s)
Traverse: 325°
Elevation: −15 to +80°
Mounting weight, loaded: 470 kg (1,036 lb)
Crew: 2
Range: 3.5-5.5 n miles (6.75-10 km)

Two 12.7 mm machine guns

There are two 12.7 mm machine guns. The M2HB is a selective short recoil automatic operation air-cooled weapon using 110-round belts. Giat has developed a single pintle mounting in the P.127A weighing 125 kg (276 lb) loaded and an elevation arc of −15 to +50°.

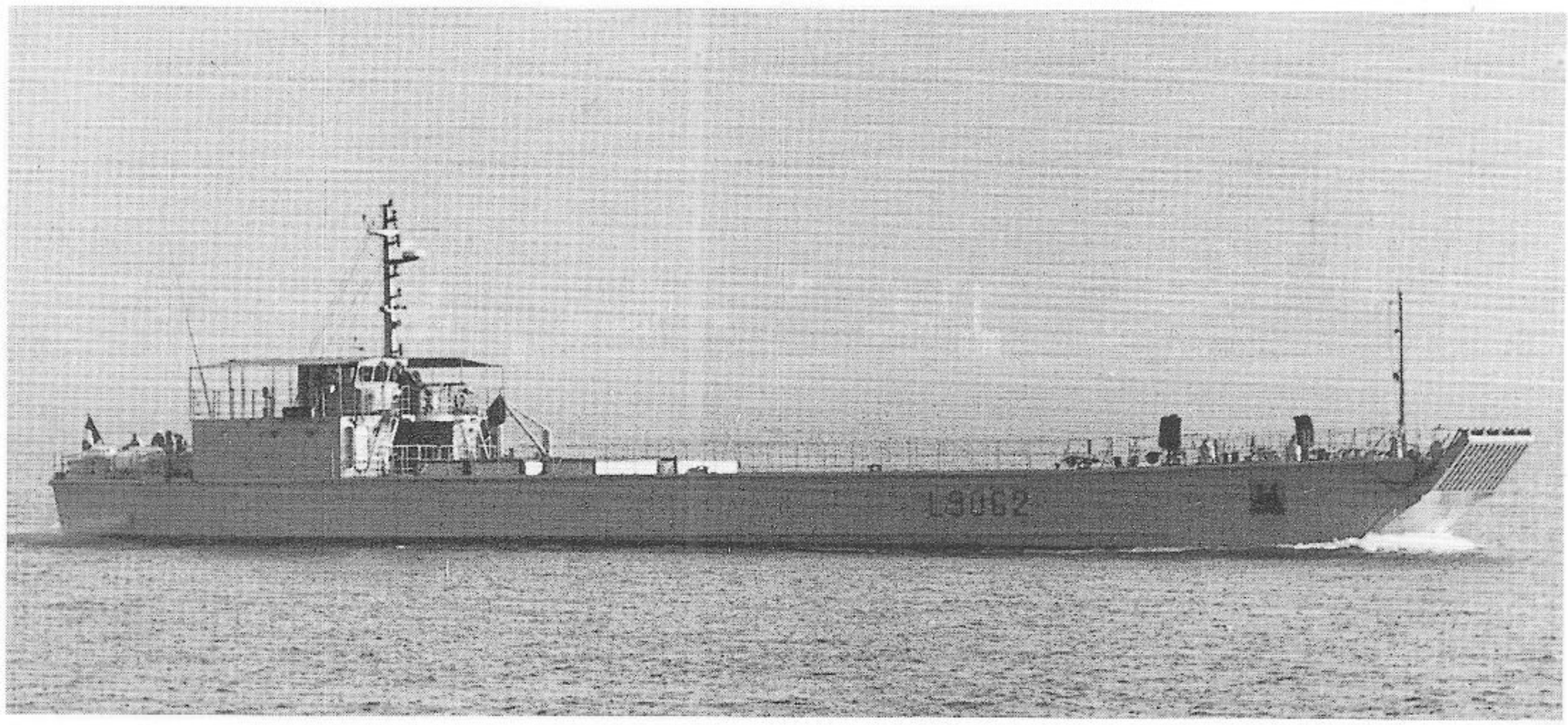
Specifications
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

Two Oerlikon 20 mm in a twin US Mk 24 mounting

Lebanese and Senegalese vessels only. There is one Mk 24 mounting, with two Oerlikon 20 mm cannon, although the weapons are only normally fitted in the Lebanese vessels. The barrel has an approximate life of 9,000 EFC.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,773 ft)
Rate of fire: 450 rds/min/barrel
Round weight: 241 g
Projectile: 122 g

US Mk 24 mounting
Elevation: −15 to +90°
Weight: 481-649 kg (1,060-1,431 lb) (unloaded)



EDIC 700, L 9052, of the French Navy. This is an improved version of the original EDIC 700 (H & L van Ginderen Collection)

81 mm mortar

Lebanese ships only. These ships carry one 81 mm mortar for use in the run in to amphibious landings. Typical range for such a weapon is 1.94 n miles (3.6 km), firing a 4.05-4.15 kg (8.9-9.1 lb) bomb at a rate of approximately 10 rds/min.

Two 12.7 mm machine guns

French and Lebanese vessels only. These ships have standard 12.7 mm machine guns in a French Giat mounting.

Specifications
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 898 m/s (2,946 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

One 7.62 mm machine gun

There is one rifle calibre (7.62 mm) machine gun for self-protection duties against both air and sea threats.

Specifications
Gun weight: 10.55 kg (23.25 lb)
Muzzle velocity: 840 m/s (2,756 ft/s)
Cyclic rate of fire: 700 rds/min
Practical rate of fire: 300 rds/min
Effective range: 0.66 n miles (1.2 km)

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca

Lebanon only. An I-band set is used; model unknown.

Racal-Decca 1226

Senegal only. One I-band Racal-Decca 1226 navigation set. The Type 1226 is part of the Solid State series and uses a 30 cm (12 in) PPI (Plan Position Indicator) display. It operates in the I-band, has 20 kW output and is equipped with a 1.83 m (6.0 ft) antenna.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 SACM Uni-Diesel UD 30 V12 M1 diesels, delivering 882 kW (1,200 hp) sustained
Shafts: 2

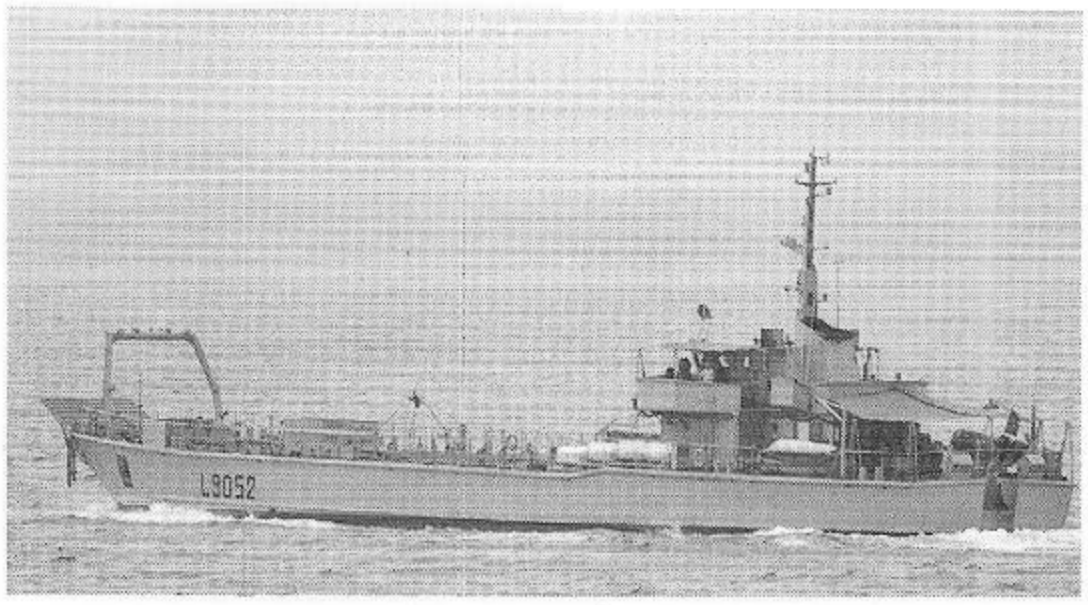
Lebanon, Senegal
System: Diesel
Main machinery: 2 SACM MGO 175 V 12 M1 diesels, delivering 882 kW (1,200 hp)
Shafts: 2

FURTHER INFORMATION

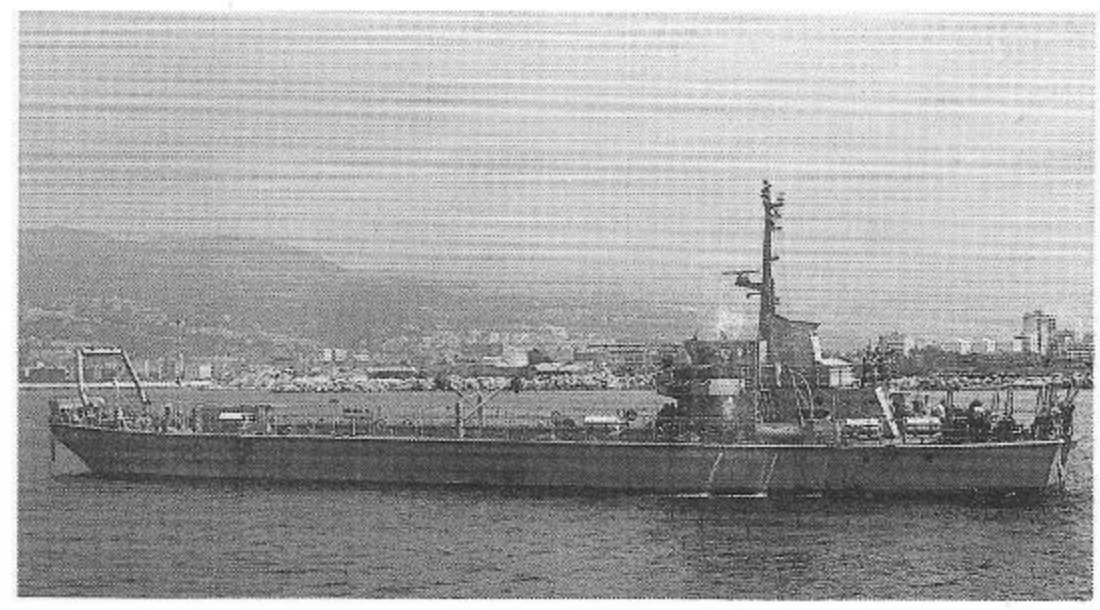
France
L 9051 is based at the Pacific Nuclear Test Centre at Mururoa, and L 9052 at Djibouti.

Lebanon
Lebanon borrowed an EDIC (L 9096) from the French Navy from November 1983 to January 1985, pending the delivery of these two new-build vessels. Both were damaged in early 1990, but were repaired the following year.

Senegal
A French EDIC was lent to Senegal from January 1974 to 23 June 1986, when it was replaced by the newly built *Karakene,* an EDIC 700 type. A second ex-French Navy vessel, ex-L 9070, one of the Batch 2 EDICs, was transferred in 1995.

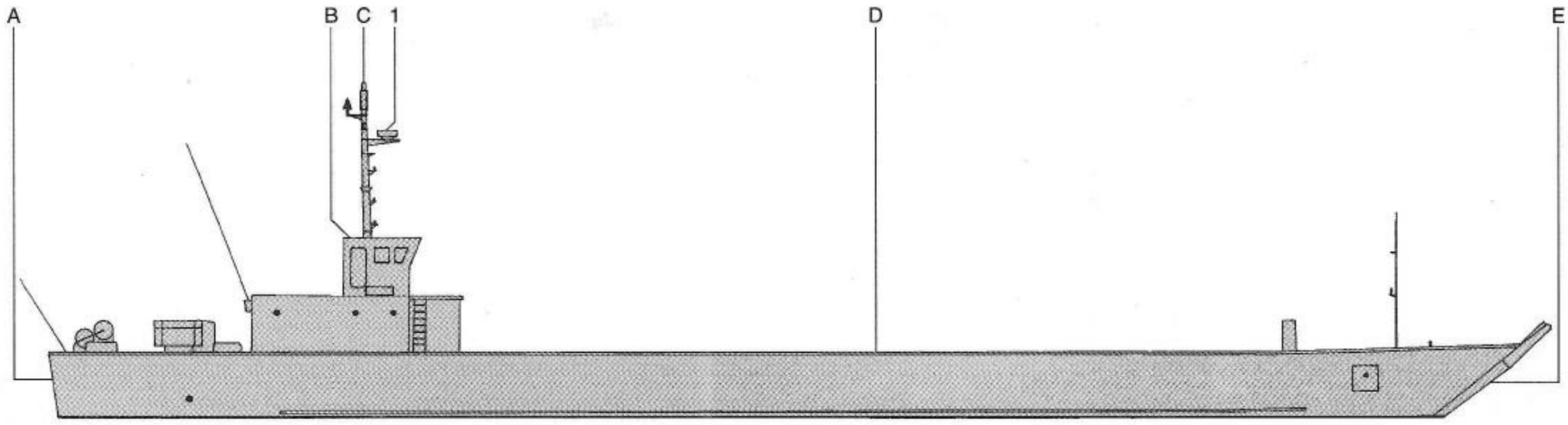


EDIC 700, L 9052



Damour *(22) of the Lebanese Navy* (Lebanese Navy)

CDIC



CDIC (Ian Sturton)
Amphibious A *Kedge anchor in stern recess* **B** *Retractable wheelhouse* **C** *Mast (lowered for entry into LPD)* **D** *Tank deck* **E** *Bow door/ramp*

General 1 *Racal-Decca 1226 navigation radar*

GENERAL SPECIFICATIONS

Operator: France

Class: CDIC *(Chaland de Debarquement d'Infanterie et de Chars)*

Built: 2
Active: 2

Displacement:
standard: 386 t
full load: 721 t

Dimensions
Length: 59.4 m (194.9 ft)
Beam: 11.9 m (39 ft)
Draught: 1.8 m (5.9 ft)

Speed: 10.5 kts
Range: 1,000 n miles at 10 kts

Complement: 12, including one officer

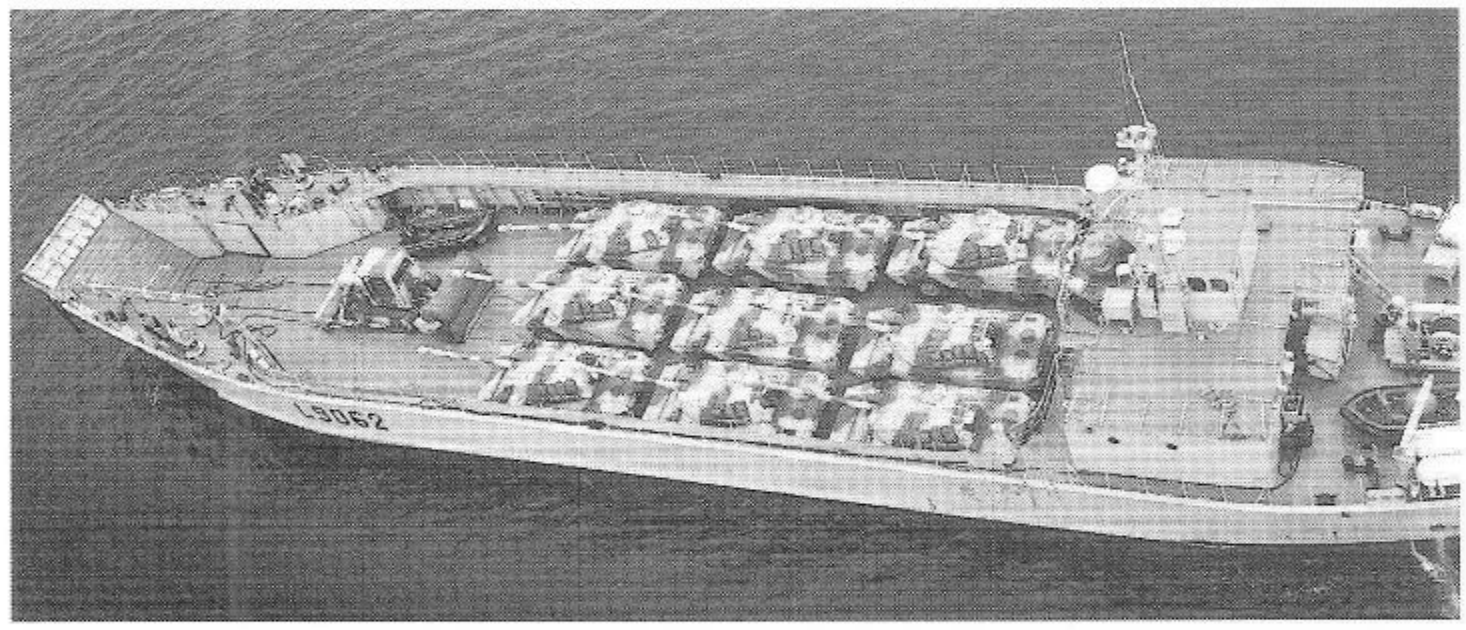
SHIPS

L 9061

Builder	SFCN, Villeneuve-la-Garenne, France
Laid down	Sep 1987
Commissioned	19 Oct 1988

L 9062

Builder	SFCN, Villeneuve-la-Garenne, France
Commissioned	2 Mar 1989



CDIC L 9062 with typical load of nine AMX-10RC wheeled, light armoured vehicles, each armed with a 105 mm gun. At the front is a special track-laying vehicle, which will hit the beach first, dispensing its track to enable the AMX-10RCs to cross the softest parts without bogging down (DCN)

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 336 tonnes
- Troops
- Vehicles

RAMPS

- There is a single, bottom-hinged, flat ramp; 4.5 m (14.8 ft) wide.
- Tank deck 40.0 × 10.4 m (131 × 34.12 ft)

WEAPONS SYSTEMS

GUNS

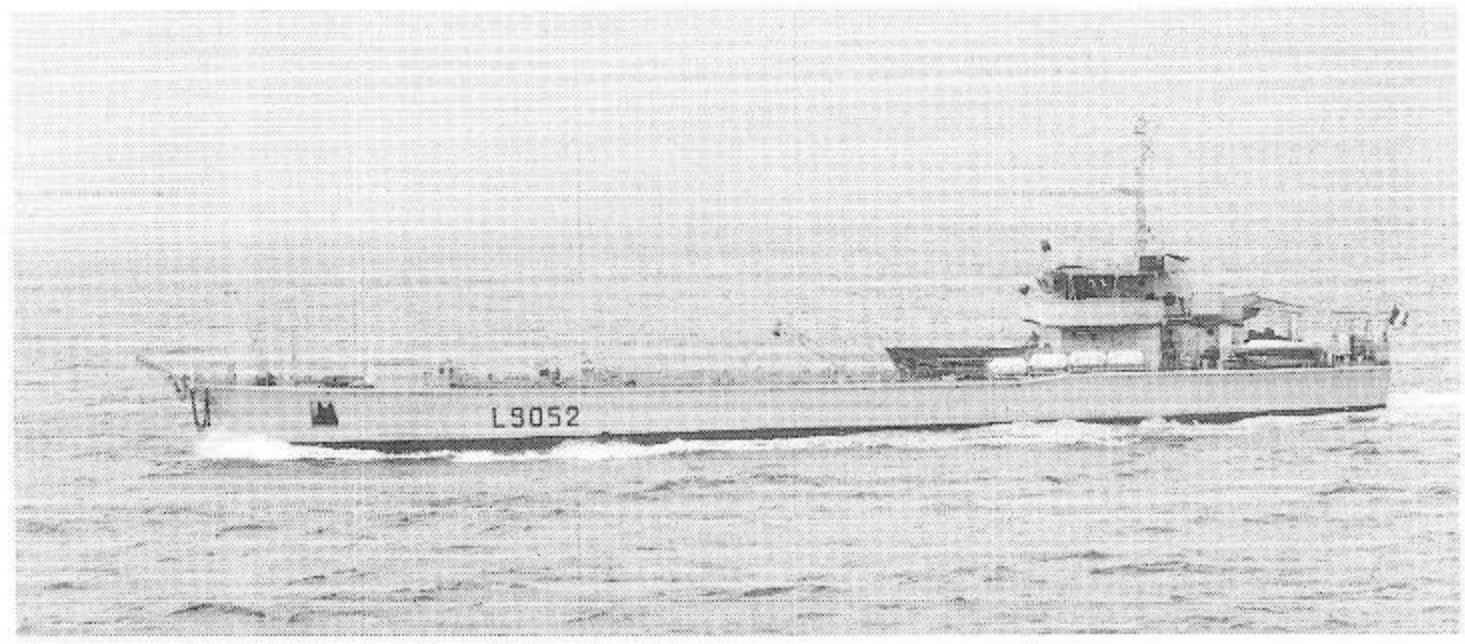
Giat 20F2 20 mm

There are two Giat 20F2 Type A 20 mm cannon in single mounts on the superstructure.

Specifications
Calibre: 20 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,100 ft/s)
Traverse: 325°
Elevation: −15 to +80°
Crew: 2
Range: 3.5-5.5 n miles (6.75-10 km)

Two 12.7 mm machine guns

The M2HB is a selective-fire, short-recoil, automatic-operation, air-cooled weapon with a 1,143 mm long



L 9062 (H & L van Ginderen Collection)

barrel and eight right-hand grooves turning once every 381 mm. Muzzle energy is 1,867 mkp and the weapon uses 110-round belts. Giat has developed a single pintle mounting in the P.127A weighing 125 kg (276 lb) loaded and an elevation arc of −15 to +50°.

Specifications
(M2HB)
Calibre: 12.7 mm
Barrel: 90 calibres
Gun weight: 38.1 kg (84.0 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca 1229
The Type 1229 is an I-band, navigation radar in Racal-Decca's Solid State series and uses a 30 cm PPI (Plan Position Indicator) display.

Specifications
(AC 1229)
Role: Navigation
Frequency: I/J-band
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25.1.0 µs
PRF: 1,300/650 pps
Scan rate: 25 rpm
Typical range: 48 n miles

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 SACM Uni-Diesel UD 30 V12 M1 diesels, 882 kW (1,200 hp) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME
This is a modern design of tank landing craft, developed from the EDIC 700, and specifically built to work with the 'Foudre' class dock landing ships (LPD), although they can also work with the 'Ouragan' class ships. At one time it was proposed to order a further three, but this was postponed, although the fact that there are only two of these landing craft — and four large ships that they can work with, plus perhaps others in the pipeline — will need to be faced soon.

DESIGN

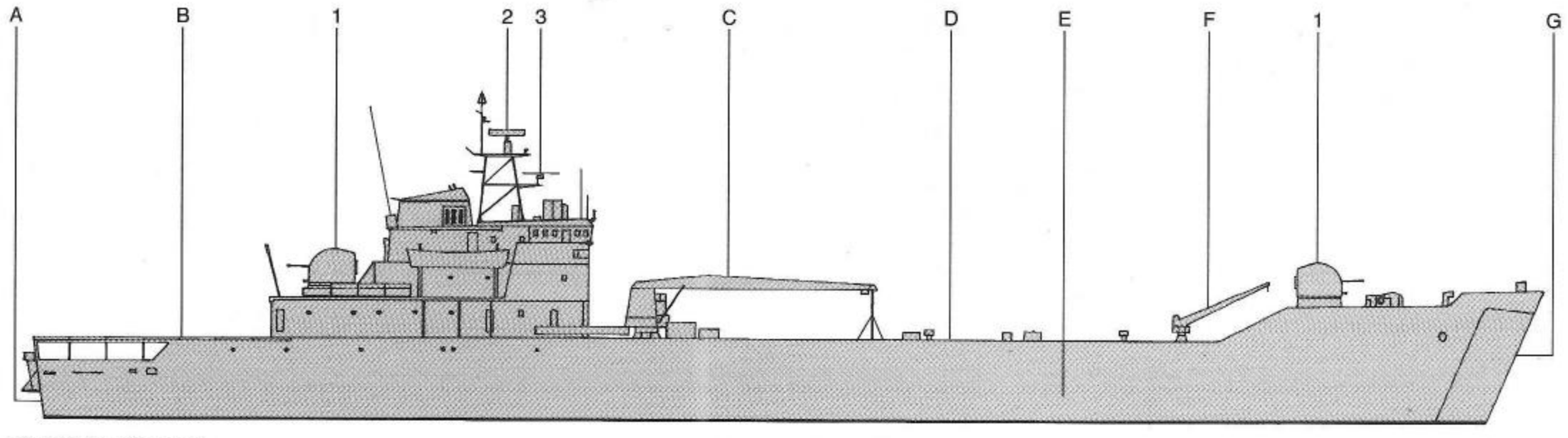
The mast is lowered, the wheelhouse retracted into the superstructure and the rails around the superstructure dropped to facilitate docking manoeuvres inside the LPDs.

DEPLOYMENT

Both vessels are assigned to the *Force d'Action Navale* (FAN)

CDIC approaching Foudre, *which can accommodate four loaded CTMs and one loaded CDIC. On the CDIC note the Giat 20F2 209 mm cannon on the stern* (DCN)

IBN OUF (PS 700)



PS 700 (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Flight deck* **C** *Crane* **D** *Vehicle deck* **E** *Tank deck* **F** *Crane* **G** *Clamshell doors and internal ramp*

General 1 *OTOBREDA 40 mm/70* **2** *Thomson-CSF Triton air search radar* **3** *Racal-Decca 1226 navigation radar*

GENERAL SPECIFICATIONS

Country of Origin: France
Operator: Libya
Type: PS 700 (LST)

Class: IBN OUF

Active: 2

Displacement:
standard: 2,200 t
full load: 2,844 t

Dimensions
Length: 99.5 m (326.4 ft)
Beam: 15.6 m (51.2 ft)
Draught: 2.4 m (7.9 ft)

Speed: 15.4 kts
Range: 4,000 n miles at 14 kts

Complement: 35

SHIPS

IBN OUF (132)

Builder	CNI de la Mediterranee, La Seyne, France
Laid down	1 Apr 1976
Launched	22 Oct 1976
Commissioned	11 Mar 1977

IBN HARISSA (134)

Builder	CNI de la Mediterranee, La Seyne, France
Laid down	18 Apr 1977
Launched	18 Oct 1977
Commissioned	10 Mar 1978

AMPHIBIOUS CAPABILITY

MILITARY LIFT

- Troops: 240
- Tanks: 11
- Cargo: 570 t

AVIATION FACILITIES

- Helicopter flight deck aft
- No hangar
- One Aerospatiale SA 316B Alouette III

AMPHIBIOUS FACILITIES

- Clamshell bow doors
- Large crane on upper deck
- Kedge anchor at stern.

WEAPONS SYSTEMS

GUNS

Breda 40 mm/70 in twin mountings

Main armament is three twin OTOBREDA 40 mm/70; two are on the forecastle, one abaft the stack. The 40 mm Bofors L/70 is an automatic cannon for air defence roles which may also be used to engage surface targets. The Compact twin 40 mm mounting is designed for use against high-performance combat aircraft, against anti-ship missiles and for surface engagements. The mounting consists of two 40 mm guns 300 mm apart, a feeding system with magazine, a local control panel, a power supply rack, a converter and an air-water panel.

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s) (Breda)
Range:
anti-surface: 6.75 n miles (12.5 km)
anti-air: 8,700 m (28,500 ft)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (13,124 ft)
Rate of fire: 600 rds/min

Ammunition: 2.4 kg (5.3 lb) (HCHE, PFHE), 2.5 kg (5.5 lb) (HE-T)

Mounting
Traverse: Nominal 360° at 90°/s
Elevation: −13 to +85° at 60°/s
Crew: 2

One 81 mm mortar

One 81 mm mortar is carried for use in the run in to amphibious landings. Typical range for such a weapon is 1.94 n miles (3.6 km), firing a 4.05-4.15 kg (8.93-9.15 lb) bomb at a rate of approximately 10 rds/min.

WEAPONS CONTROL

CSEE Panda director with RADOP 20

Panda is an autonomous deck-mounted optical director for use in air defence and anti-surface operations, which operates in two modes: surveillance/target tracking and fire control. In the former the target may be designated by the ship's radar and the director slews to face it. The target is acquired visually and identified then tracked by the operator who moves the director with a joystick. In the fire-control mode the operator selects air or surface engagement and inserts target range data. The relevant guns are then slaved to the director whose operator then conducts the engagement.

Specifications
Panda
Height: 1.35 m (4.42 ft)
Width: 1.5 m (4.92 ft)
Weight: 480 kg (1,058 lb)
Elevation: −25 to +65°
Max velocity traverse: 60°/s
elevation: 60°/s

RADARS

Thomson-CSF Triton

This is a G/H-band, 5 cm wavelength, air and surface surveillance radar for shipboard mounting, and is used for surveillance and target designation functions with a range of 18 n miles (33 km). It is no longer in production.

Racal-Decca 1226

The Type 1226 surface search radar is part of the Solid State series and uses a 30 cm (11.8 in) PPI (Plan Position Indicator) display. It has an output of 20 kW, and comes equipped with a 1.83 m (6 ft) antenna.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 SEMT-Pielstick 16 PA4 V 185 diesels, delivering 3.93 MW (5,344 hp) sustained
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

These two tank landing ships were built for the Libyans by CNIM at La Seyne, France in the mid-1970s.

At several points, a third of the class has appeared in reference books: this appears to have been an error, probably caused by renumbering. Both ships were currently reported to be non-operational in 1995.

Ibn Harissa *(134) in 1981* (H & L van Ginderen Collection)

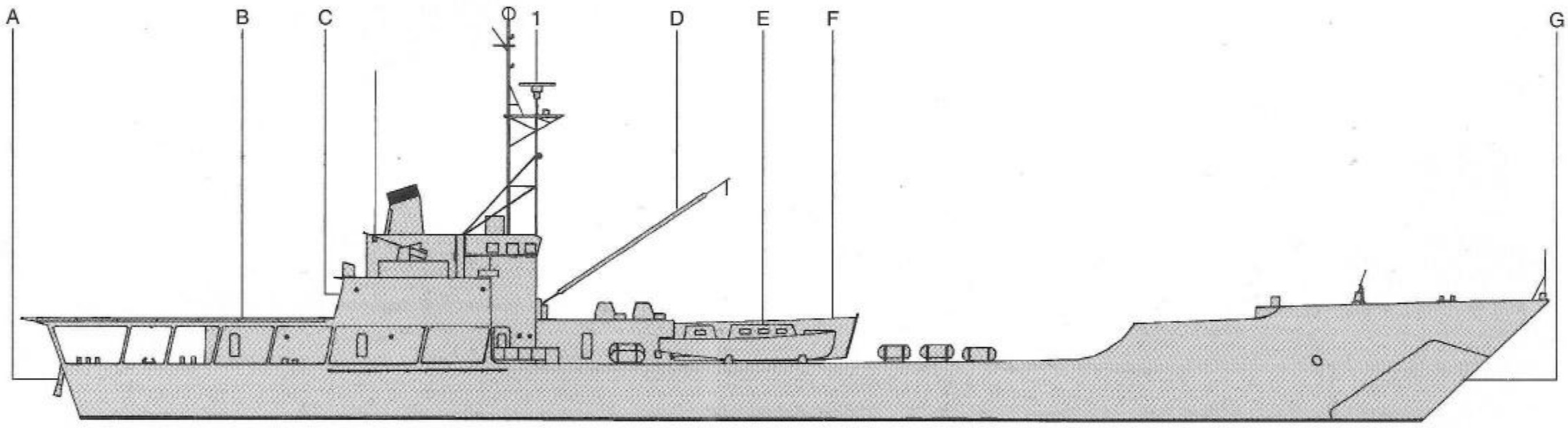
BATRAL

OVERVIEW

This small LST design has achieved some success, 13 having been built for five customers, including the French Navy, three Francophone countries and Chile. As with several other French amphibious vessels, the ships have been tailored to meet individual customer's requirements, and thus differ in detail, but all are to the general LST design of clamshell bow doors, an internal tank deck, a vehicle park on the upper deck and a helicopter platform aft. In the later ships, however, the helicopter platform is larger, and the bridge is one deck level higher.

Country	Class Name	Number in service	Commissioned	Built	Remarks
France	Champlain	5	1974 - 2 1983 - 2 1987 - 1	France	1987 ship from Gabon order
Chile	Maipo	3	1982 - 1 1983 - 1 1986 - 1	Chile	
Ivory Coast	L'Elephant	1	1977 - 1	France	
Gabon	Bongo	1	1984 - 1	France	Second ship ordered but not paid for; added to French fleet in 1987
Morocco	Daoud ben Aicha	3	1977 - 2 1978 - 1	France	One more may be on order
TOTAL		**13**			

BATRAL



Champlain (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Flight deck* **C** *Hangar* **D** *Boom (10 tonne)* **E** *LCVP* **F** *LCPL* **G** *Clamshell doors*

General 1 *Racal-Decca 1226 navigation radar*

GENERAL SPECIFICATIONS

Country of origin: France
Operators: France, Chile, Gabon, Ivory Coast, Morocco

Class: CHAMPLAIN

National designation: BATRAL *(BAtiment de TRAnsport Léger)*

One of the original batch, Champlain *(L 9030), and one of the second batch,* Jacques Cartier *(L 9033). Note that the later ships have an extra deck in the superstructure and a crane in place of boom* (H & L van Ginderen Collection)

	France		Chile	Gabon	Ivory Coast	Morocco
	L 9031-9033	L 9034				
Built	4	1	3	1	1	3 (+1?)
Active	4	1	3	1	1	3
Displacement						
standard	762 t	782 t	887 t	782 t	762 t	762 t
full load	1,351 t	1,357 t	1,431 t	1,357 t	1,351 t	1,431 t
Dimensions						
length	80 m (262.4 ft)	80 m (262.4 ft)	79.4 m (260.4 ft)	80 m (262.4 ft)	80 m (262.4 ft)	80 m (262.4 ft)
beam	13 m (42.6 ft)	13 m (42.6 ft)	13 m (42.6 ft)	13 m (42.6 ft)	13 m (42.6 ft)	13 m (42.6 ft)
draught	2.4 m (7.9 ft)	2.4 m (7.9 ft)	2.5 m (8.2 ft)	2.4 m (7.9 ft)	2.4 m (7.9 ft)	2.4 m (7.9 ft)
Speed	16 kts	16 kts	16 kts	16 kts	16 kts	16 kts
Range	4,500 n miles at 13 kts	4,500 n miles at 13 kts	3,500 n miles at 13 kts	4,500 n miles at 13 kts	4,500 n miles at 13 kts	4,500 n miles at 13 kts
Complement						
officers	5	5	5	5	5	3
enlisted	45	45	44	45	42	44

SHIPS

France

CHAMPLAIN (L 9030)
Builder Naval Dockyard, Brest, France
Launched 17 Nov 1973
Commissioned 5 Oct 1974

FRANCIS GARNIER (L 9031)
Builder Naval Dockyard, Brest, France
Launched 17 Nov 1973
Commissioned 27 Oct 1974

DUMONT D'URVILLE (L 9032)
Builder Atelier Français de l'Ouest, Rouen, France
Launched 27 Nov 1981
Commissioned 5 Feb 1983

JACQUES CARTIER (L 9033)
Builder Atelier Français de l'Ouest, Rouen, France
Launched 28 Apr 1982
Commissioned 23 Sep 1983

LA GRANDIERE (L 9034)
Builder Atelier Français de l'Ouest, Rouen, France
Launched 15 Dec 1985
Commissioned 20 Jan 1987

Chile

MAIPO (91)
Builder Asmar, Talcahuano, Chile
Launched 26 Sep 1981
Commissioned 1 Jan 1982

RANCAGUA (92)
Builder Asmar, Talcahuano, Chile
Launched 6 Mar 1982
Commissioned 8 Aug 1983

CHACABUCO (95) (ex-93)
Builder Asmar, Talcahuano, Chile
Launched 16 Jul 1985
Commissioned 15 Apr 1986

Ivory Coast

L'ELEPHANT
Builder Chantier Naval Querqueville, Cherbourg, France
Ordered 20 Aug 1974
Commissioned 2 Feb 1977

Gabon

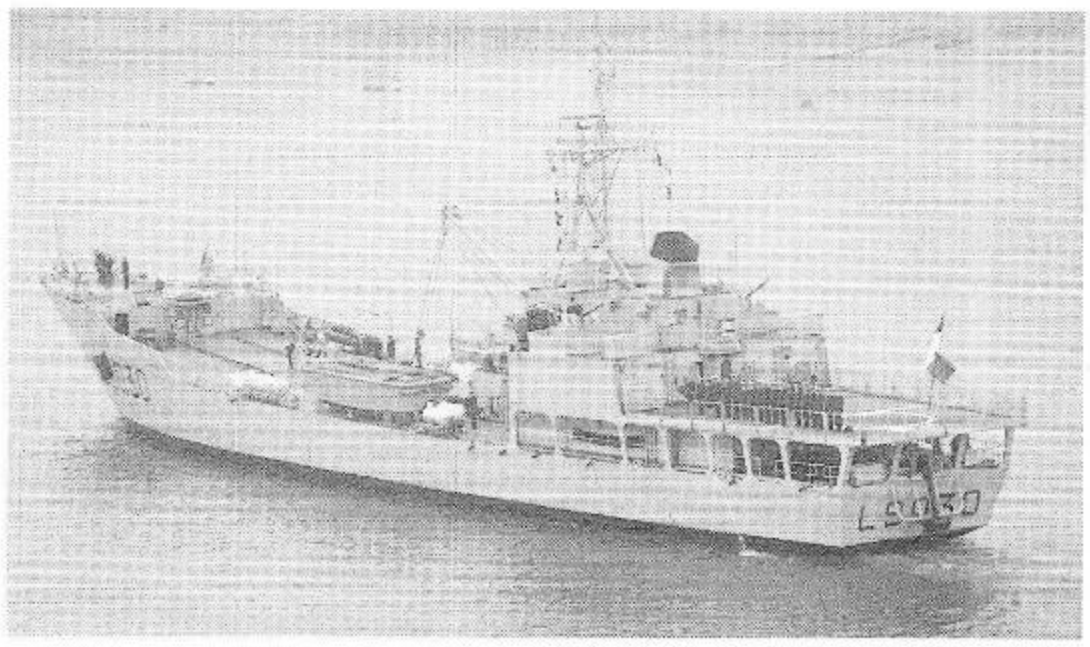
PRESIDENT EL HADJ OMAR BONGO (L 05)
Builder Atelier Français de l'Ouest, Rouen, France
Launched 16 Apr 1984
Commissioned 26 Nov 1984

Morocco

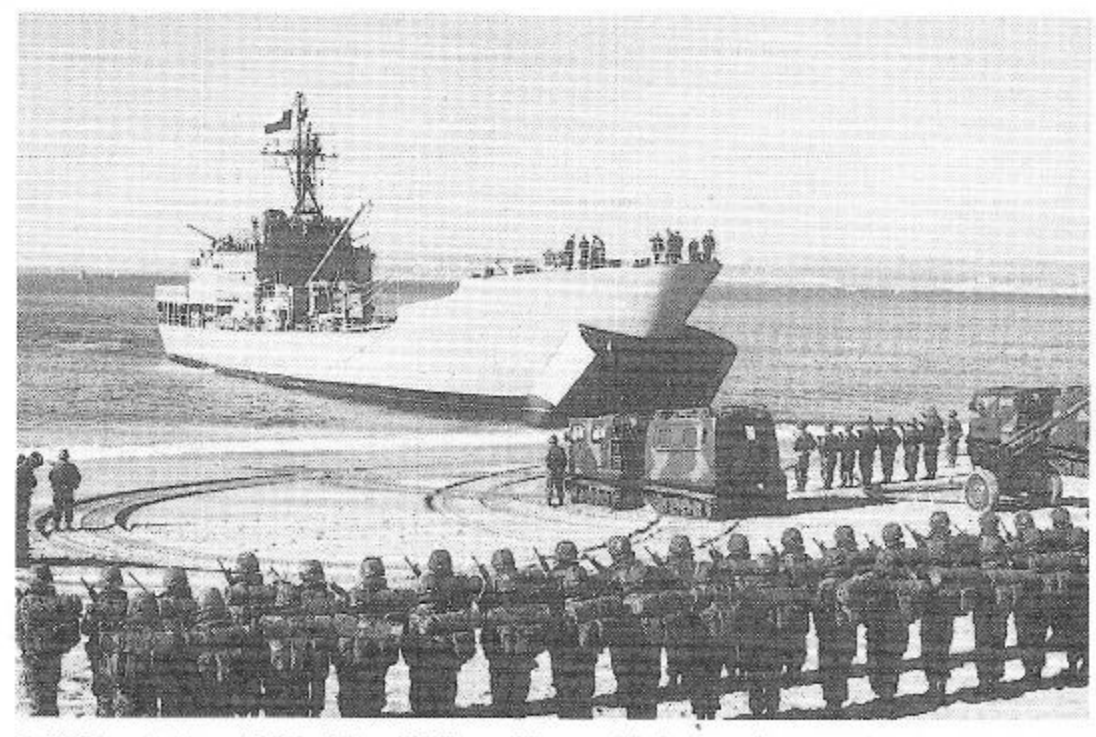
DAOUD BEN AICHA (402)
Builder Chantier Dubigeon, Nantes, France
Ordered 12 Mar 1975
Commissioned 28 May 1977

AHMED ES SAKALI (403)
Builder Chantier Dubigeon, Nantes, France
Ordered 12 Mar 1975
Commissioned Sep 1977

ABOU ABDALLAH EL AYACHI (404)
Builder Chantier Dubigeon, Nantes, France
Ordered 19 Aug 1975
Commissioned Mar 1978



Champlain *(L 9030). Two LCVPs are stowed on the upper deck and are lifted in and out of the water by the 10 tonne boom. Note also the large Kedge anchor on the stern, used for handling the ship off after beaching* (H & L van Ginderen Collection)



A 'Maipo' class LST of the Chilean Navy with its marine combat team on the beach (Chilean Navy)

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops
  First series — 138
  Second series (L 9032/9033/9034 plus *Bongo*) — 180
- Vehicles 12, including armoured personnel carriers
- Cargo 350 tonnes

SHIP-SHORE LIFT

- Two LCVPs
  or
- One LCVP plus one LCPL

AVIATION FACILITIES

- Flight deck. Large flight deck aft.
- Hangar. Hangar in superstructure.
- Helicopter
  French ships: one SA 319B Alouette III
  Chilean ships: one Nurtanio NAS 332SC Cougar

AMPHIBIOUS FACILITIES

- Two vertically hinged, clamshell bow doors.
- Internal ramp to upper deck with 40 tonne load capacity.
- Kedge anchor at the stern.
- Boom on first nine ships, crane on remainder; capacity 10 tonnes.
- No stern door.

WEAPONS SYSTEMS

Weapon summary

		Bofors 40 mm/60	Bofors 40 mm/70 in OTOBREDA mount	Oerlikon 20 mm/70	Giat 20F2 20 mm/90	81 mm mortar	12.7 mm machine guns
France	L 9030/9031	2				1	2
	L 9032/9033				2	1	2
	L 9034	1				1	2
Chile	*Maipo*	1		1		1	1
Gabon	*Bongo*	1				1	2
Ivory Coast	*L'Elephant*		2			1	2
Morocco	*Daoud ben Aisha*	2				1	2

GUNS

Bofors 40 mm/60

The 40 mm/60 automatic cannon is designed for air defence roles, but can also be used to engage surface targets. Although described as a 60 calibre weapon it is, in fact, a 56.25 calibre gun.

Specifications

Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s) (new gun); 850 m/s (2,789 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,600 ft)
Rate of fire: 60 rds/min (practical), 120 rds/min (cyclic)
Ammunition: 2.21 kg (4.87 lb)

Breda 40 mm/70

The Breda 107 mount uses the 40 mm Bofors L/70 automatic cannon for air defence roles, with a secondary anti-surface role. Breda 107 single mounting has a 32-round feeder mechanism.

Specifications

Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s)
Range:
anti-surface: 6.75 n miles (12.5 km)
anti-air: 8,700 m (28,543 ft)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (13,100 ft)
Rate of fire: 600 rds/min
Ammunition: 2.4 kg (5.39 lb) (HCHE, PFHE), 2.5 kg (5.5 lb) (HE-T)

Mounting
Traverse: Nominal 260° at 90°/s
Elevation: −13 to +85° at 60°/s
Crew: 2

Giat 20F2 20 mm

This mounting is of the swivel fork-type, revolving on a fixed ferrule. The mounting, which is unpowered, is largely made up of light alloys and stainless steel to reduce weight.

Specifications

Calibre: 20 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,100 ft/s)
Traverse: 325°
Elevation: −15 to +80°
Crew: 2
Range: 3.5-5.5 n miles (6.75-10 km)

81 mm mortar

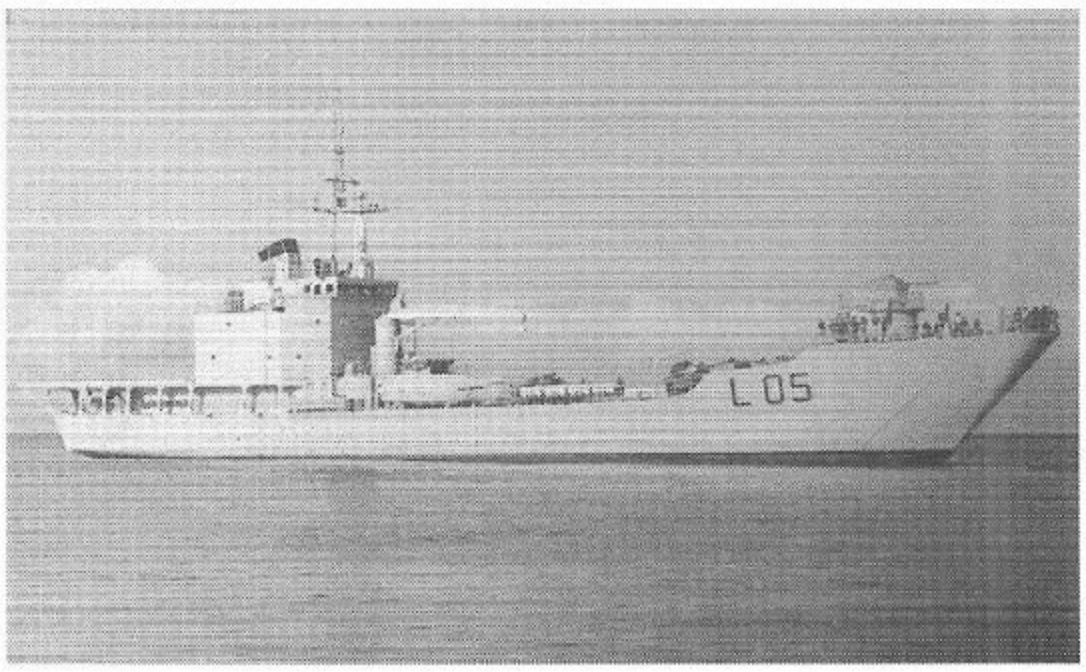
One 81 mm mortar is carried for use in the run in to amphibious landings. Typical range for such a weapon is 1.94 n miles (3.6 km), firing a 4.05-4.15 kg (8.93-9.15 lb) bomb at a rate of approximately 10 rds/min.

M2HB 12.7 mm machine guns

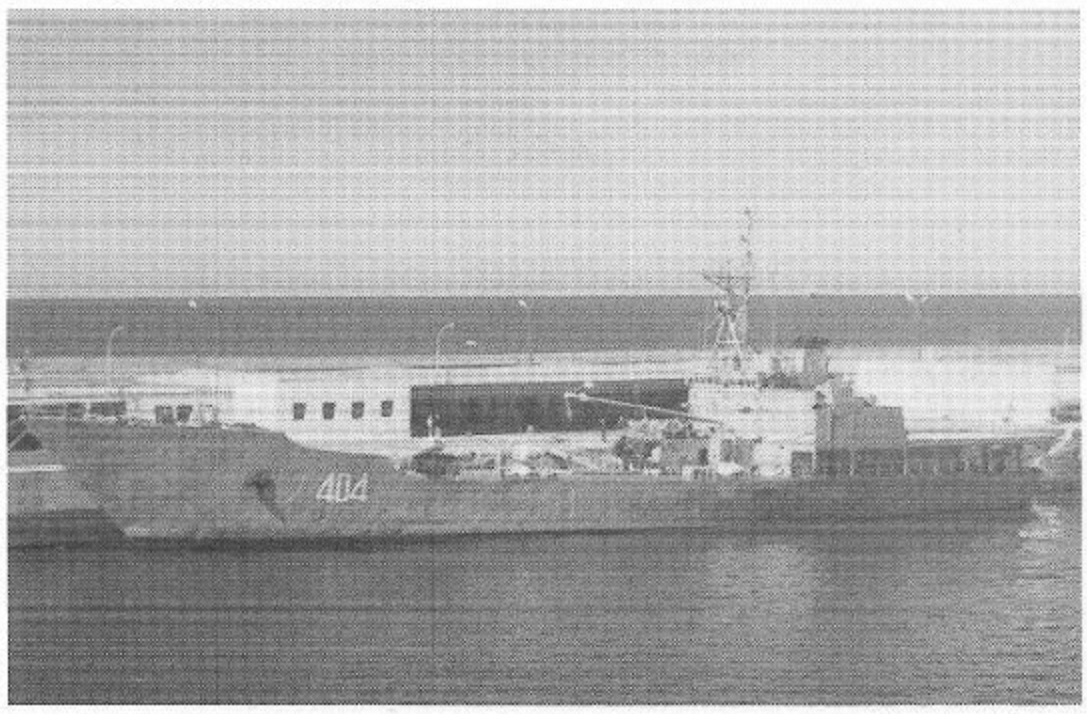
This is a selective-fire, short-recoil, automatic operation, air-cooled weapon with a 1,143 mm (45 in) long barrel and eight right-hand grooves turning once every 381 mm (1.5 in). The weapon uses 110-round belts.

Specifications

(M2HB)
Calibre: 12.7 mm
Length of barrel: 90 calibres
Gun weight: 38.1 kg (84.0 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)



President El Hadj Omar Bongo *(L 05). Note that in this second batch ship the 40 mm gun is mounted on a pedestal on the forecastle* (Gabon Navy)



Abou Abdallah el Ayachi *(404)* (Paul Beaver)

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca DRBN-32

All, less 'Maipo' class (Chile). DRBN-32 is the French designation for the Racal-Decca Type 1226 navigation radar.

Specifications

(DRBN 32/Type 1226)
Role: Navigation
Frequency: I-band
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm
Typical range: 48 n miles

Manufacturer/Contractor

Racal-Decca, UK.

Racal-Decca 1229

Navigation radar is the widely used Racal-Decca, I-band Type 1229. Part of the company's 'Solid State' series, the type 1229 has a 30 cm (12 in) PPI (Plan Position Indication) display, a 20 kW output and 2.7 m (8.9 ft) antenna.

Manufacturer/Contractor

Racal-Decca, UK.

Specifications

(AC 1229)
Role: Navigation
Frequency: I/J-band
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
PRF: 1,300/650 pps
Scan rate: 25 rpm
Typical range: 48 n miles

Manufacturer/Contractor

Racal-Decca, UK.

SONARS

Some reports credit these ships with two hull-mounted sonars, although as they are regularly beached it is difficult to assess where they might be mounted.

PROPULSION

All, less 'Maipo' class (Chile).

Specifications

System: Diesel
Main machinery: 2 SACM AGO 195 V12 diesels, 2.65 MW (3,600 hp) sustained
Shafts: 2
Propellers: Controllable pitch

'Maipo' class (Chile)

Specifications

System: Diesel
Main machinery: 2 SEMT-Pielstick 12 PA4 V 185 VC diesels, 2.95 MW sustained
Shafts: 2
Propellers: Controllable pitch

FURTHER INFORMATION

PROGRAMME

The first two ships for the French Navy were commissioned in 1974 and there was then a nine-year gap before the second two, which were then built to a modified design.

- Chile. Three were built in Chile, being completed between 1981 and 1984. These are to the original Batral design.
- Gabon. Gabon ordered two to the modified Batral design, one of which, *President el Hadj Omar Bongo,* was delivered in 1984. Gabon could not, however, pay for the second, which was eventually purchased by the French Navy and commissioned as *La Grandiere.*
- Ivory Coast. One was ordered in 1974 and delivered in 1977. It is built to the original design. It is reported in 1996 to be in poor condition but still seaworthy.

Morocco. Two were ordered in March 1975 and the third in August 1975. All were to the original Batral design. It is also reported that an order for a fourth was placed in 1995.

DESIGN

The Batral design is a classical LST, with a normal, ship-type bow with clamshell doors, a long, unobstructed tank deck with a ramp to enable vehicles to move between the tank and upper decks, and superstructure and machinery aft. There is also a medium-sized flight deck and a small hangar. LCVPs can be carried on the upper deck and there is a 37 tonne crane.

The first nine ships (two for France, three for Chile, one for the Ivory Coast and three for Morocco) were all to the same design. When the second French order was placed, however, the design was updated, which included an additional deck level in the superstructure, an enlarged helicopter deck and a crane in place of the boom on the upper deck. This enabled troop accommodation to be increased from 138 to 180.

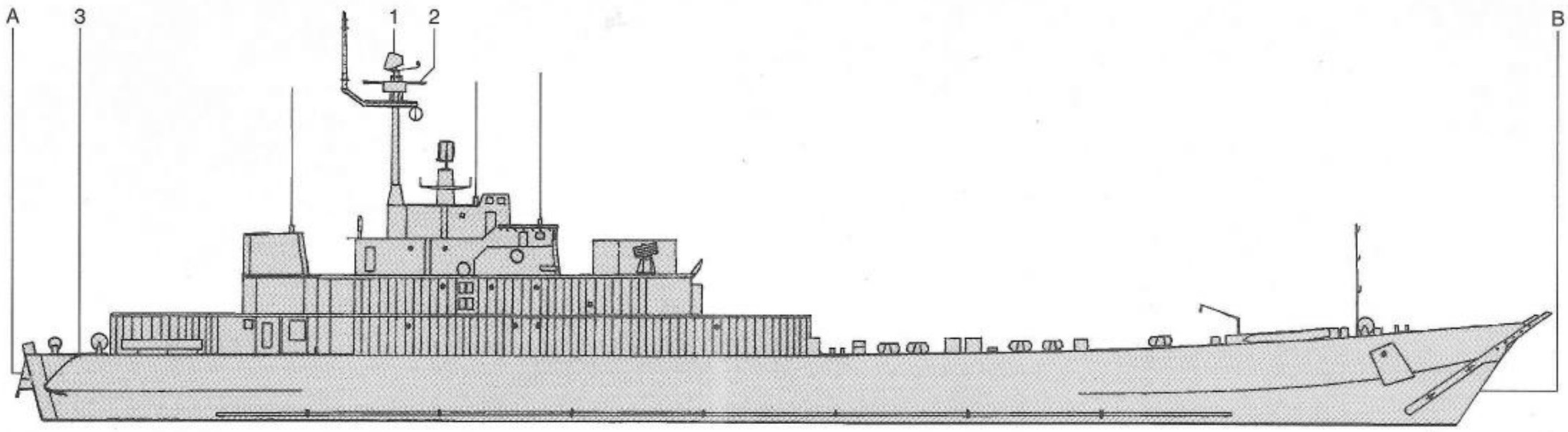
CURRENT STATUS

All ships are in service, although there are reports that the Ivory Coast ship is in poor condition. Deployment of the French ships is:

- *Champlain* (L 9030) — Indian Ocean
- *Francis Garnier* (L 9031) — Antilles/French Guiana
- *Dumont D'Urville* (L 9032) — Papeete/Tahiti
- *Jacques Cartier* (L 9033) — New Caledonia
- *La Grandière* (L 9034) — FAN, Toulon.

Ahmed es Sakali *(403) of the Moroccan Navy* (H & L van Ginderen Collection)

TELUK GILIMANUK (FROSCH I/II)



Teluk Gilimanuk (Frosch I) class (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Bow door*
General 1 *Strut Curve air/surface search radar* **2** *TSR 333 navigation radar (Note that all weapons were removed during the predelivery refit at Peenewerft)* **3** *Minelaying ramps*

GENERAL SPECIFICATIONS

Country of origin: Germany (former-DDR)
Operator: Indonesia
Type: Frosch I Type 108

Class: TELUK GILIMANUK

Purchased: 14 (Frosch I – 12; Frosch II – 2)
Active: 14

Displacement:
standard: 1,500 t
full load: 1,981 t

Dimensions
Length: 90.7 m (297.5 ft)
Beam: 11.1 m (36.4 ft)
Draught: 2.8 m (9.2 ft)

Speed: 18 kts

Complement: Frosch I – 42; Frosch II – 32

SHIPS

Frosch I

TELUK GILIMANUK (531)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 12 Nov 1976 (*Hoyerswerda* (611))
Sold to Indonesia 25 Aug 1993
Recommissioned 12 Jul 1994

TELUK CELUKAN BAWANG (532)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 1 Dec 1976 (*Hagenow* (632))
Sold to Indonesia 25 Aug 1993
Recommissioned 25 Feb 1994

TELUK CENDRAWASIH (533)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 2 Feb 1977 (*Frankfurt am Oder* (613))
Sold to Indonesia 25 Aug 1993
Recommissioned 9 Dec 1994

TELUK BERAU (534)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 28 May 1977 (*Eberswalde-Finow* (634))
Sold to Indonesia 25 Aug 1993
Recommissioned 10 Mar 1995

TELUK PELENG (535)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 15 Mar 1978 (*Lübben* (631))
Sold to Indonesia 25 Aug 1993
Recommissioned 23 Sep 1993

TELUK SIBOLGA (536)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 19 Oct 1977 (*Schwerin* (612))
Sold to Indonesia 25 Aug 1993
Recommissioned 15 Dec 1993

TELUK MANADO (537)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 28 Dec 1977 (*Neubrandenburg* (633))
Sold to Indonesia 25 Aug 1993
Recommissioned 2 Jun 1995

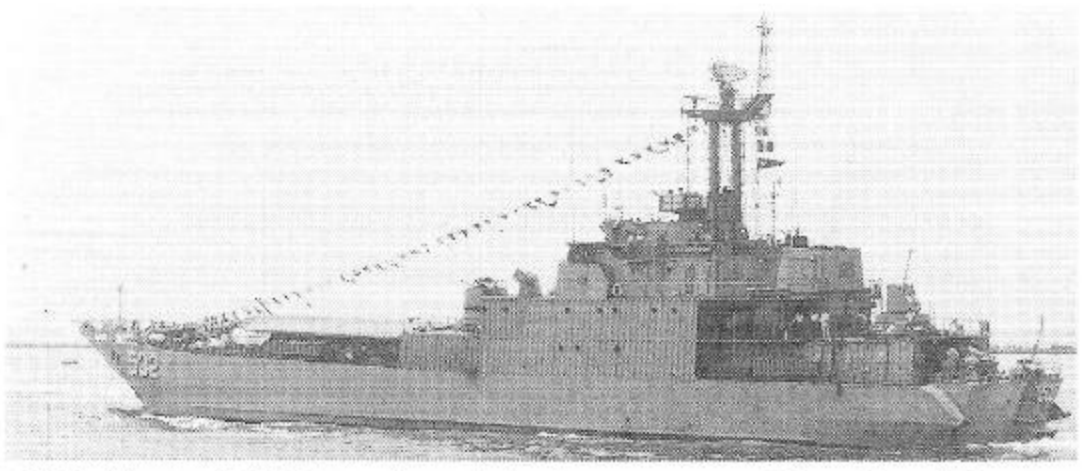
TELUK HADING (538)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 26 May 1978 (*Cottbus* (614))
Sold to Indonesia 25 Aug 1993
Recommissioned 12 Jul 1994

TELUK PARIGI (539)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 14 Jul 1978 (*Anklam* (635))
Sold to Indonesia 25 Aug 1993
Recommissioned 21 Jul 1995

TELUK LAMPUNG (540)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 7 Sep 1979 (*Schwedt* (636))
Sold to Indonesia 25 Aug 1993
Recommissioned 26 Apr 1994

TELUK JAKARTA (541)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 4 Jan 1979 (*Eisenhüttenstadt* (615))
Sold to Indonesia 25 Aug 1993
Recommissioned 19 Sep 1994

TELUK SANGKULIRANG (542)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 4 Jan 1979 (*Grimmen* (616))



Teluk Jakarta *(541). Note the minelaying ramps on either side of the stern* (Hartmut Ehlers)

Teluk Celukan Bawang (532)

Sold to Indonesia 25 Aug 1993
Recommissioned 9 Dec 1994

Frosch II

TELUK CIREBON (542)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 3 Oct 1979 (*Nordperd* (E 171))
Sold to Indonesia 25 Aug 1993
Recommissioned 25 Apr 1995

TELUK SABANG (544)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR *Volksmarine*) 26 Feb 1980 (*Südpered* (E 172))
Sold to Indonesia 25 Aug 1993
Recommissioned 25 Apr 1995

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops 180-200
- Medium tanks 12
- Total payload 600 tonnes

SHIP-SHORE LIFT

- No special boats are carried.

AMPHIBIOUS FACILITIES

- Vehicle deck 425 m² (4,580 sq ft).
- There is a large, bottom-hinged hold ramp, with a shaped foot to provide minimal streamlining.
- There is no stern ramp.
- Cranes
  Frosch I. No crane
  Frosch II. 8 tonne capacity crane on upper deck.

WEAPONS SYSTEMS

GUNS

37 mm cannon
Since arrival in Indonesia all ships have been fitted with two twin 37 mm cannon in open mounts. This is most likely to be the Russian W-11-M mounting, which is used on some other Indonesian Navy ships, or a derivative of the Bofors 40 mm/60.

MINES

These vessels can be used as minelayers. The mine-rails run either side of the after superstructure leading to two angled chutes on either side of the stern. Maximum of 40 mines.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve
Strut Curve is a medium-range, general purpose, F-band radar, providing both air and surface search facilities. It has an elliptical lattice reflector, but no balance vanes. Performance against a 2 m² (21.5 sq ft) aircraft target at medium altitude is about 60.5 n miles (111 km), with a likely maximum range of 152 n miles (278 km).

TSR 333
The navigation radar is a TSR-333 operating in the I-band.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 diesels, 3.68 MW (5,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These are similar in design, although somewhat smaller than the 'Ropucha' class, which was built in Polish shipyards for the (then) Soviet Navy and formed part of the amphibious fleet assembled by the Baltic members of the erstwhile Warsaw Pact. Twelve Frosch Is and two Frosch IIs were built, all for the East German *Volksmarine*.

On reunification they became surplus to German requirements and were sold en bloc to Indonesia, in a sale which caused some political controversy in Indonesia at the time.

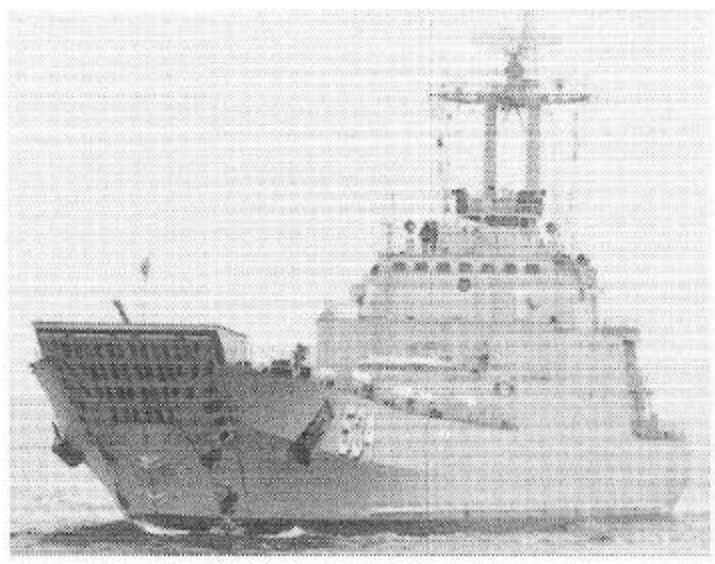
DESIGN

As built, the vessels were armed with four 57 mm and four 30 mm guns, arranged in four sets of twin mountings, together with two 122 mm rocket launchers. Prior to transfer to Indonesia, however, all these ships were refitted at Rostock, and the work included the removal of all weapons, as well as the associated Muff Cob fire control radar and High Pole B IFF.

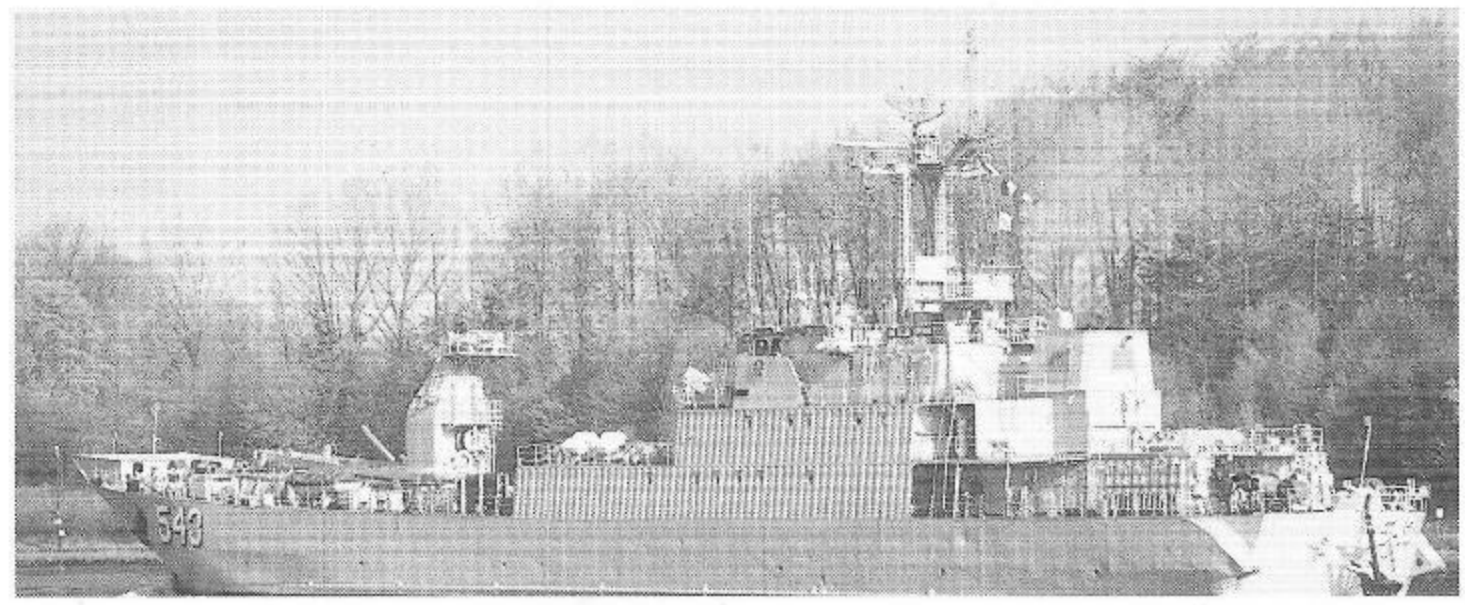
There are two types of ship (Frosch I, Frosch II) which have the same hull, propulsion and weapons, differing only in their purpose and minor fittings. Frosch I is the standard amphibious warfare vessel, while Frosch II is an 'armed resupply' *(Hochseeversorger)* type, intended for moving cargo, although it retains its beach-landing capability. For this role Frosch II has two large cargo hatches in the upper deck and an 8 tonne capacity crane.

DEPLOYMENT

Teluk Lampung was damaged by heavy seas during transit to Indonesia in June 1994 but has since been repaired. All ships are employed in moving troops, equipment and general cargo among the many islands in the Indonesian archipelago.

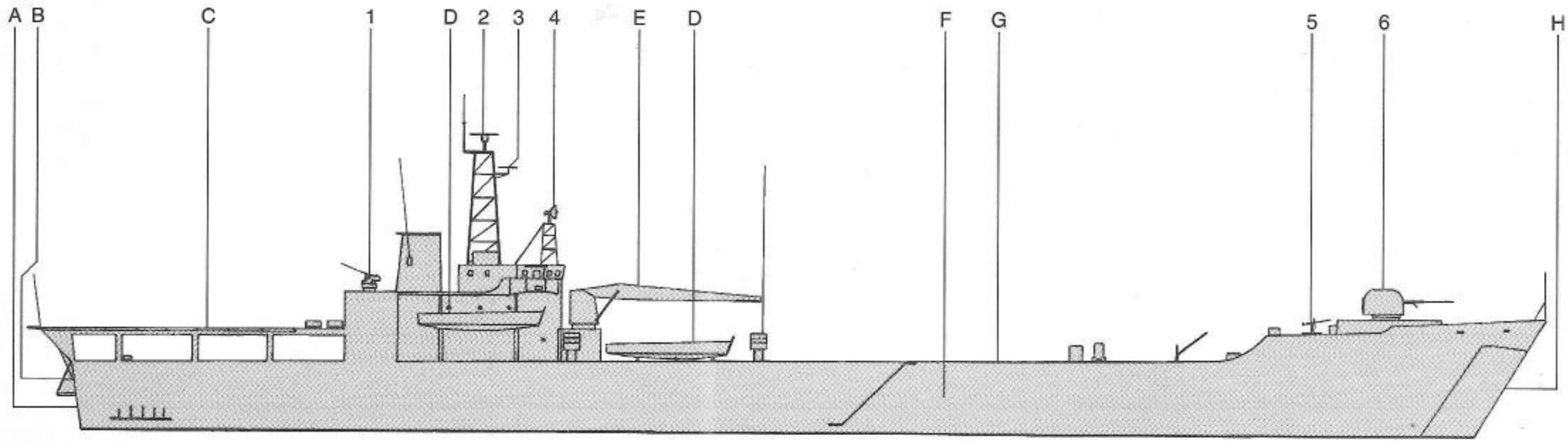


Teluk Berau *(534). Note the unusual flat, rectangular deck on the forecastle, the plate filling the gap left by the removal of the twin 57 mm and minelaying rails* (92 Wing NAAF)



Teluk Cirebon *(543), one of two 'Frosch IIs', is generally similar to 'Frosch I' but has a large, 8 tonne capacity crane on the foredeck and two cargo hatches* (92 Wing RAAF)

JASON



Jason (Ian Sturton)

Amphibious A *Stern door* **B** *Kedge anchor* **C** *Flight deck* **D** *LCVP* **E** *Crane* **F** *Tank deck* **G** *Vehicle deck* **H** *Bow doors with internal ramp (55 t)*

General 1 *OTOBREDA 40 mm/70 twin mountings* **2** *Thomson-CSF Triton II air/surface search* **3** *Kelvin Hughes Type 1007 navigation radar* **4** *Thomson-CSF Pollux fire-control radar* **5** *Rheinmetall RH-202 20 mm cannon* **6** *OTOBREDA 76 mm/62 Compact gun*

GENERAL SPECIFICATIONS

Operator: Greece

Class: JASON (LST)

Active: 2
Building: 3

Displacement:
full load: 4,470 t

Dimensions
Length: 116 m (380.5 ft)

Beam: 15.3 m (50.2 ft)
Draught: 3.4 m (11.2 ft)

Speed: 16 kts

SHIPS

CHIOS (L 173)

Builder	Eleusis Shipyard, Greece
Laid down	18 Apr 1987
Launched	16 Dec 1988
Commissioned	Apr 1996

SAMOS (L 174)

Builder	Eleusis Shipyard, Greece
Laid down	Sep 1987
Launched	6 Apr 1989
Commissioned	20 May 1994

LESBOS (L 176)

Builder	Eleusis Shipyard, Greece
Laid down	May 1988
Launched	5 Jul 1990
Commissioned	Aug 1997

IKARIA (L 175)

Builder	Eleusis Shipyard, Greece
Laid down	Apr 1989
Commissioned	Feb 1998

RODOS (L 177)

Builder	Eleusis Shipyard, Greece
Laid down	Nov 1989
Commissioned	Oct 1998

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 300 troops plus vehicles.

SHIP-SHORE LIFT

- 4 LCVPs

AVIATION FACILITIES

Specifications
Flight deck: Large flight deck at stern, capable of accommodating two Seaking-size helicopters
Hangar: None
Helicopters: The platform could be used by any of the Greek Navy's helicopters, including Sikorsky S-70B-6 Seahawks, Aerospatiale SA 319B Alouette IIIs and Agusta 212ASW/212EW.

AMPHIBIOUS FACILITIES

- There are two clamshell doors and a bow ramp capable of handling 55 t vehicles (for example, Greek Army M60 and Leopard main battle tanks).
- Stern ramp.
- Crane.

WEAPONS SYSTEMS

GUNS

OTOBREDA 76 mm/62 Mod 9 Compact

There is one OTOBREDA 76 mm/62 gun mounted on the forecastle. The 76/62 Compact can fire 80 rounds without reloading, and the rate of fire is adjustable from 10 to 85 rds/min. The system is remotely controlled and a reaction time of 2.8 seconds is quoted.

Specifications
Calibre: 76 mm
Length of barrel: 62 calibres
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Weight (unloaded): 7.5 t
Muzzle velocity: 925 m/s (3,034 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.6 n miles (16 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Breda 40 mm/70 in twin compact mountings

The 40 mm Bofors L/70 is an automatic cannon for air defence roles which may also be used to engage surface targets. The Compact twin 40 mm mounting is designed for use against high-performance combat aircraft, against anti-ship missiles and for surface engagements. The mounting consists of two 40 mm guns 300 mm apart, a feeding system with magazine, a local control panel, a power supply rack, a converter and an air-water panel.

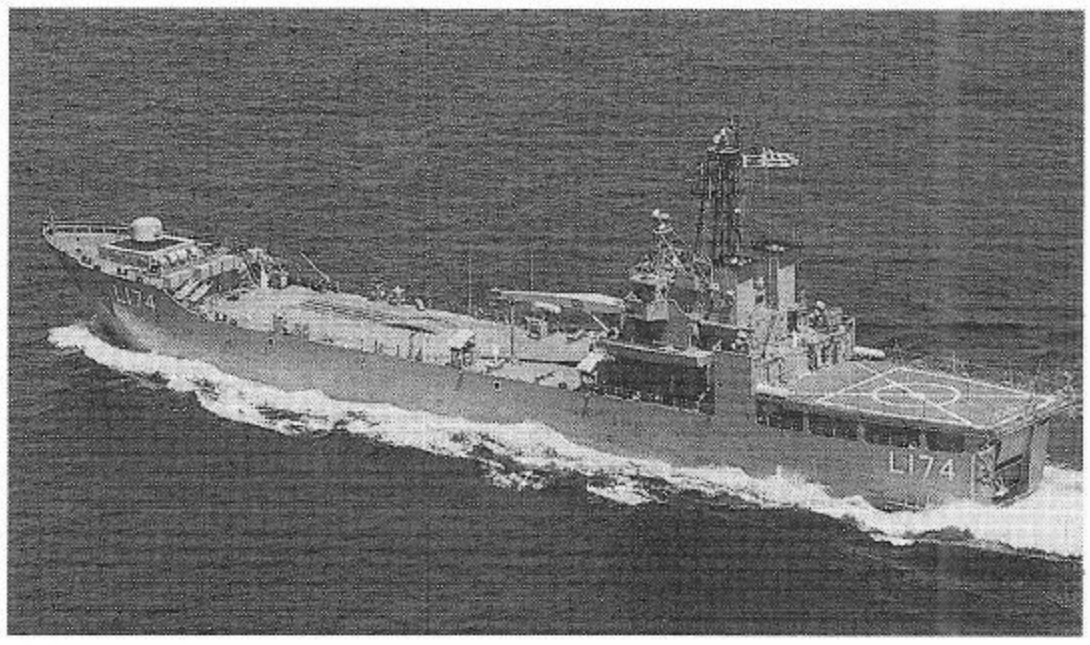
Specifications
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,280 ft)
Range:
anti-surface: 6.75 n miles (12.5 km)
anti-air: 8,700 m (28,500 ft)
Rate of fire: 600 rds/min
Ammunition: 2.4 kg (5.29 lb) (HCHE, PFHE), 2.5 kg (5.51 lb) (HE-T)

Mounting
Traverse: 360° at 90°/s
Elevation: −13 to +85° at 60°/s
Crew: 2

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Rheinmetall Rh-202 20 mm/85 multipurpose cannon

The 85 calibre Rh 202 is 2.61 m (8.56 ft) long, is capable of single shot or automatic fire. Naval versions use either a conventional single belt feed in which rounds enter from the right and spent cartridges are ejected to the left, or the Type 2 two-way belt-feed mechanism. The Rheinmetall powered twin mounting installed in the 'Jason' class is 4.05 m (13.28 ft) long, 1.67 m (5.47 ft)



Samos *(L 174)* (Hellenic Navy)

Chios *(L 173)* (H & L van Ginderen Collection)

high and 2.3 m (7.54 ft) across, and weighs 1.64 t. The twin guns, their ammunition boxes and the operator's seat are on a platform that can rotate through 360° . It has a three- or four-man crew.

Specifications

Gun - Rh 202
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,250 m/s (3,444-4,100 ft)
Rate of fire: 800-1,000 rds/min

WEAPONS CONTROL

One CSEE Panda optical director

Panda is an autonomous deck-mounted optical director for use in air defence operations, the manned element rotating through a nominal 360° on a mounting bracket with electrical connectors. This element consists of the binocular optical unit with auxiliary sight, gyrometric units, bearing and elevation electrical units, servo controls, a ballistics computer on the right of the mounting, control and communications units. The optical sensor offers ×8 and ×2.5 magnification with fields of view of 19° and 6° respectively.

Panda operates in two modes: surveillance/target tracking and fire-control. In the former the target may be designated by the ship's radar and the director slews to face it. The target is acquired visually and identified then tracked by the operator who moves the director with a joystick. In the fire-control mode the operator selects air or surface engagement and inserts target range data. The relevant guns are then slaved to the director whose operator then conducts the engagement.

Manufacturer/Contractor

CS Defense, Paris, France.

COMMAND AND CONTROL SYSTEMS

RADARS

Thomson-CSF Triton II (TRS 3030/3035)

Triton II (TRS 3030/3035), G-band radar is used primarily for air/surface search, although it can also be used for target designation and navigation. It features a roll-stabilised antenna and a tunable magnetron transmitter with a peak power of 250 kW to provide a continuously variable transmission frequency over a wide band together with two pulse lengths of 0.5 and 0.7 µs. It has a claimed performance of detecting a 2 m² air target at a range of 16 n miles (30 km) and an altitude of 6,000 m (19,680 ft), while 10 m² surface targets can be detected at 24.25 n miles (45 km). (In the French Navy Triton II is designated DRBV 51.)

Specifications

(DRBV 51C)
Role: Air search
Frequency: G-band
Peak power: 250 kW
Pulsewidth: 0.5/0.7 µs
PRF: Varied
Scan rate: 30 rpm
Typical ranges:
2 m² air target at 16 n miles (30 km) and an altitude of 6,000 m (19,680 ft)
10 m² surface targets at 24.25 n miles (45 km)

Manufacturer/Contractor

Thomson-CSF, Paris Cedex 8, France.

Thomson-CSF Pollux

Triton can be used for fire-control purposes, but this task is normally allocated to the Pollux (TRS 3220), a fast-scanning radar with optional linear digital MTI processing, which uses a transmitter with a peak power of 200 kW to produce 0.3 µs pulses in a 3 beam. Circular polarisation and solid-state circuitry are employed in the system. Tracking accuracy is to within 20 m (65.6 ft) and angular accuracy on a point target is 0.5 mrad.

Manufacturer/Contractor

Thomson-CSF, Paris Cedex 8, France.

Kelvin Hughes Type 1007

Specifications

Role: Navigation/surface search
Frequency: H/I-band (9,410 MHz)
Beam: 1.0 × 18°/0.75 × 18°
Peak power: 25 kW
Pulsewidth: 0.08/0.3/0.8 µs
PRF: 1,600/800/400 pps
Scan rate: 26 rpm

Manufacturer/Contractor

Kelvin Hughes Ltd, Hainault, Essex, UK.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Wärtsilä Nohab 16V25 diesels, 6.76 MW (9,200 hp) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

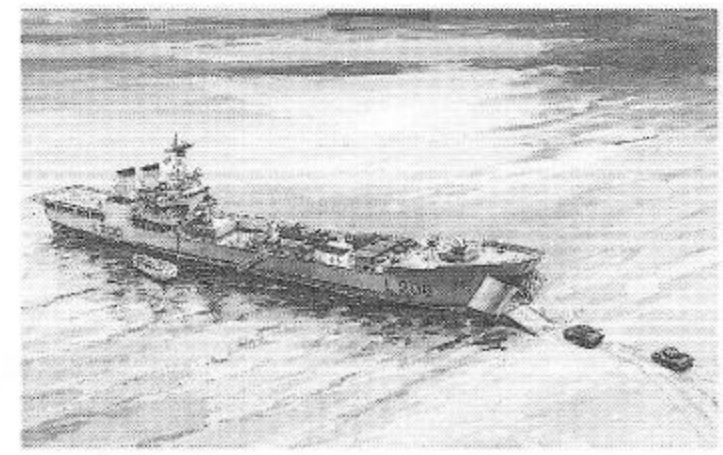
With its many islands, the Greek Navy has a requirement for a sizeable number of amphibious warfare ships, and currently operates some eight LSTs, one LSD, two LSMs, and a number of smaller vessels. Like many other smaller navies, however, it has made do with ex-US Navy vessels for many years, most of them of Second World War vintage. Some of these have now left service while most of the others are worn-out after many years service. The 'Jason' class is intended to replace the ex-US Navy LSTs.

The 'Jason' class is of Greek design and the contract for five ships was signed with the Eleusis shipyard on 15 May 1986. All five ships had been laid down by the end of 1989, but by late 1996, only two had been completed, due to severe financial difficulties at the yard. Completion dates for the remaining three must be regarded as provisional.

DESIGN

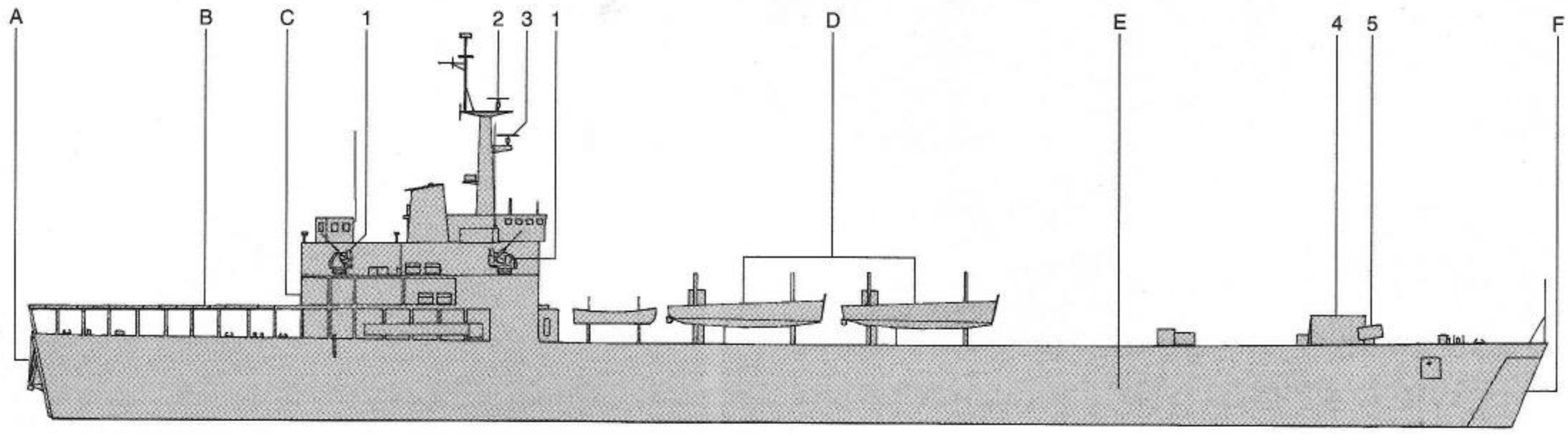
The design is a modern drive-through LST, with ramps at both bow and stern. There is also a ramp from the upper deck to the tank deck.

These ships are comparatively heavily armed, with one 76 mm gun, together with four 40 mm and four 20 mm cannon. The OTOBREDA 76 mm gun mounted on the forecastle is an unusual feature for an LST and will give good fire support, particularly during the final run in to a beach landing.



Chios *(L 200). Note the two-section bow ramp, vehicles parked on the upper deck, centreline ramp from upper- to tank-deck; and LCVP which has just been lowered by the onboard crane* (Thomson-CSF)

MAGAR



Magar (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Flight deck* **C** *Hangar* **D** *Sea Truck LCVP (four)* **E** *Tank deck* **F** *Clamshell bow doors with internal ramp*

General 1 *Bofors 40 mm/60 cannon* **2** *Surface search radar* **3** *Bharat navigation radar* **4** *Rocket efflux deflection screen* **5** *BM-21 rocket launchers (two)*

GENERAL SPECIFICATIONS

Operator: India

Class: MAGAR (LST)

Built: 2
Active: 2
Planned: 1(?)

Displacement:
full load: 5,745 t

Dimensions
Length: 124.8 m (409.4 ft) oa; 120 m (393.7 ft) wl
Beam: 17.5 m (57.4 ft)
Draught: 4 m (13.1 ft)

Speed: 15 kts
Range: 3,000 n miles at 14 kts

Complement: 136, including 16 officers

SHIPS

MAGAR (L 20)

Builder	Garden Reach, Calcutta, India
Launched	7 Nov 1984
Commissioned	15 Jul 1987

GHARIAL (L 23)

Builder	Hindustan Shipyard/Garden Reach, Calcutta, India
Launched	1 Apr 1991
Commissioned	1996

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Not known

SHIP-SHORE LIFT

- 4 LCVPs on davits (Rotork Sea Truck)

AVIATION FACILITIES

Specifications
Flight deck: Large flight deck aft
Hangar: In superstructure
Helicopter: Normally 1 Westland Sea King Mk 42C

AMPHIBIOUS FACILITIES

- Large, vertically-hinged, clamshell bow doors with internally-mounted ramp.
- No stern door (Not ro-ro)
- Beaching limits 1 in 40 or greater gradient.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

There are four single 40 mm Bofors L/60 mounted at each corner of the superstructure. The Bofors 40 mm is an automatic cannon for air defence roles which may also be used to engage surface targets. The type of mounting in the 'Magar' class is not known, but there are minor differences, between US and UK mounts.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,880 ft/s)(new gun); 850 m/s (2,778 ft/s) (mid-life)

Range:
anti-surface: 5.5 n miles (10 km)
anti-air: AA: 6,900 m (22.600 ft)
Rate of fire: 80 rds/min (practical); 160 rds/min (cyclic) for water-cooled weapons
Ammunition: 2.21 kg (4.87 lb)

BM-21 multiple rocket launchers in the bow

Following Russian practice, there are two naval rocket mountings on the forecastle, with large blast screens to deflect the efflux. The naval BM-21s are used immediately before an amphibious assault and consist of two clusters, each of 20 tubes, on either side of an electrically operated mounting which holds the training and elevation gears. They are reloaded automatically from a below-deck magazine. The mounting can traverse 360° and elevate from 0 to +55°.

Specifications
Rockets
M-21-OF (9M22U)
Diameter: 122 mm
Length: 3.226 m (10.58 ft)
Weight: 77.5 kg (170.88 lb)
Range: 500-20,380 m (1,640-66,846 ft)
Warhead weight: 19.3-19.4 kg (42.55-42.77 lb)
Max velocity: 690 m/s (2,263 ft/s)

COMMAND AND CONTROL SYSTEMS

RADARS

Surface search radar

There is a surface search radar at the masthead; type unknown.

Bharat navigation radar

The Bharat navigation radar is an I-band equipment, which can also be used for short-range surface surveillance. It consists of a 1.83 m (6 ft) slotted array, transmitter/receiver, sector control unit and a 51 or 61 cm raster display. Two displays can be operated with one acting as master. The transmitter is solid state, apart from the thyratron and the magnetron. Sector transmission or blanking is a special feature which enables the operator to shut-off transmission intentionally in an

unwanted zone, and still have the radar coverage in the zone of interest. Optional features include a radar test set, a remote control for operating the transmitter/receiver, and RRA interface.

Specifications

Frequency: I-band (9,375 ±30 MHz)
Peak output power: 35 kW short pulse; 45 kW long pulse
Pulse length and PRF: 0.1 µs at 4,000 Hz (short pulse); 0.8 µs at 1,000 Hz (long pulse)
Beamwidth: 1.4 × 22°
Gain: 26 dB
Rotation speed: 22 rpm at 50 Hz or 27 rpm at 60 Hz

Manufacturer/Contractor

Bharat Electronics Limited, Bangalore, India.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 SEMT-Pielstick 12 PA6 V280 diesels, 6.29 MW (8,560 hp) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

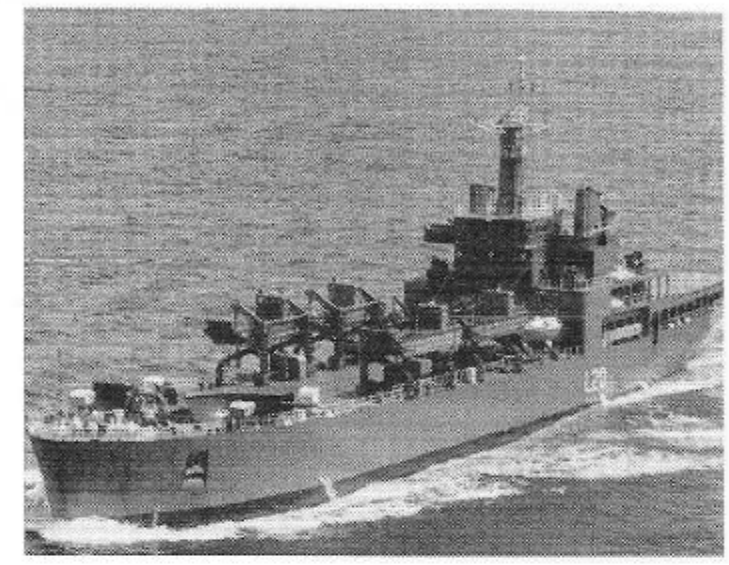
The first of class was launched in 1984 and commissioned in 1987. The original plan was for eight of the class, but there has been a nine year gap before the second *(Gharial)* was launched at the Hindustan shipyard and it was then transferred to Garden Reach to be fitted out. It is understood that the third has not yet been ordered.

DESIGN

This design has been reported in some quarters as being based on that of the British *Sir Lancelot* LSL. It has, however, been confirmed in the UK that, apart from a superficial physical resemblance, there is no connection between the two designs.

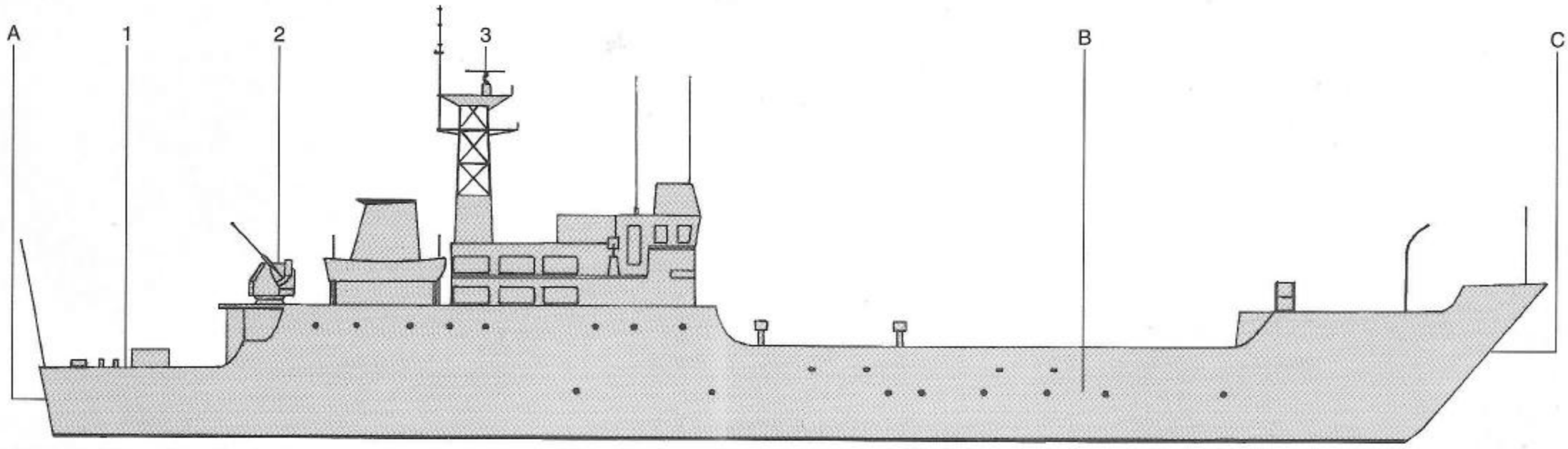
MODERNISATION/REFIT

Magar was refitted in 1995.



Magar *(L 20) the first major landing ship to be designed and built in India. Contrary to previous reports its design was not based on that of the British LSLs* (92 Wing RAAF)

VASCO DA GAMA



Vasco da Gama (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Tank deck* **C** *Bow door/ramp*
General 1 *Mine rails* **2** *Bofors 40 mm/60 (two)* **3** *Racal-Decca 1229 navigation radar*

GENERAL SPECIFICATIONS

Operator: India
Type: Mk 3 Landing Craft Utility (LCU)

Class: VASCO DA GAMA

Built: 10
Active: 10

Displacement:
full load: 508 t

Dimensions
Length: 57.5 m (188.6 ft)
Beam: 8.2 m (26.9 ft)
Draught: 1.6 m (5.3 ft)

Speed: 11 kts
Range: 1,000 n miles at 8 kts

Complement: 287 including troops

SHIPS

- (L 31)
Builder Goa Shipyard, Goa, India

- (L 32)
Builder Goa Shipyard, Goa, India

- (L 33)
Builder Goa Shipyard, Goa, India

VASCO DA GAMA (L 34)
Builder Hooghly D & E Co, Calcutta, India
Launched 29 November 1978
Commissioned 28 Jan 1980

- (L 35)
Builder Hooghly D & E Co, Calcutta, India
Launched 16 Mar 1980
Commissioned 17 Dec 1983

- (L 36)
Builder Goa Shipyard, Goa, India
Launched 13 Jan 1979
Commissioned 1 Dec 1980

- (L 37)
Builder Goa Shipyard, India
Launched 22 Jul 1985

Midhur (L 38)
Builder Goa Shipyard, India
Commissioned 1987

Mangala (L 39)
Builder Goa Shipyard, India
Commissioned 1987

- (L 40)
Builder Goa Shipyard, India
Commissioned 1987

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops 200-250
- Vehicles: 2 PT 76 or 2 armoured personnel carriers.
- Cargo 250 tonnes

AMPHIBIOUS FACILITIES

- There is a flat-fronted, single-piece bow ramp.
- There is no stern door or ramp.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60
Armament is two Bofors 40 mm/60 mounted aft which is an automatic cannon for air defence roles which may also be used to engage surface targets.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,889 ft/s) (new gun); 850 m/s (2,788 ft) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,600 ft)
Rate of fire: 80 rds/min (practical); 160 rds/min (cyclic) for water-cooled weapons
Ammunition: 2.21 kg (4.87 lb)

MINES

As with Soviet-designed amphibious vessels, these Indian vessels have a minelaying capability, dropping mines through chutes in the stern.

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca TM 1229
Part of the Solid State series, the Type 1229 has a 30 cm (12 in) Plan Position Indicator display, an output of 20 kW and a 2.7 m (8.8 ft) antenna.

PROPULSION

Specifications
System: Diesel
Main machinery: 3 Kirloskar-MAN V8V 17.5/22 AMAL diesels, 1.24 MW (1,686 hp)
Shafts: 3

FURTHER INFORMATION

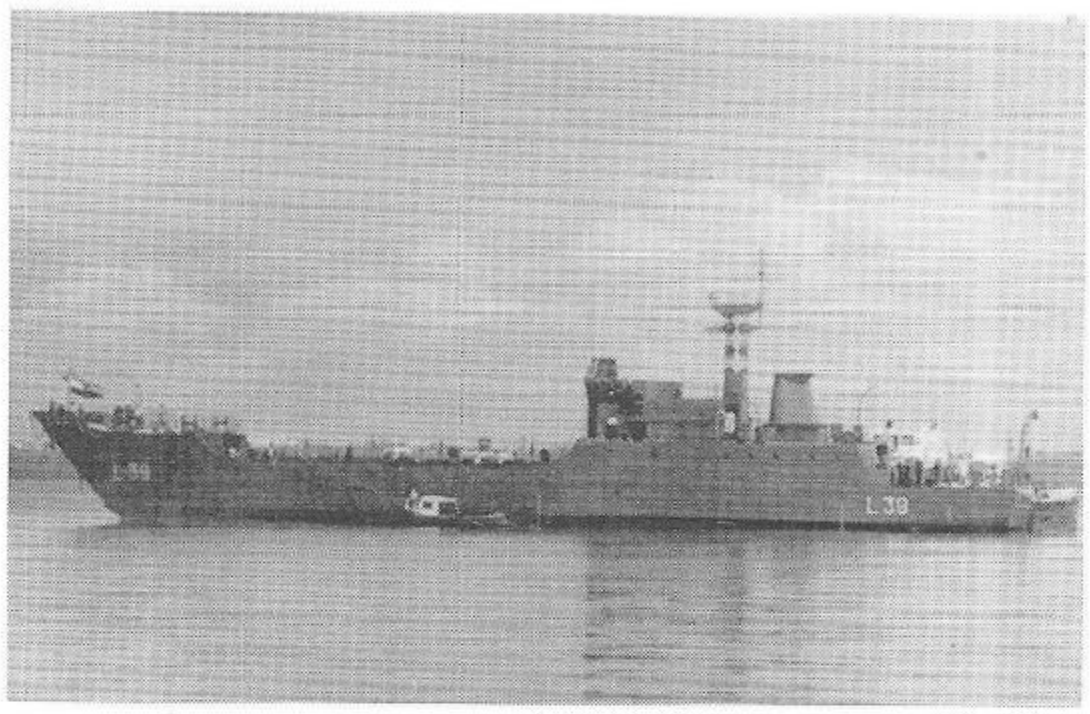
PROGRAMME

These are Indian-designed and -built landing craft, which can also be used also for minelaying. The first ship to be completed was *Vasco da Gama,* which was one of eight built by Goa Shipyard. The final ship in the series was commissioned on 25 Mar 1987. Two ships were built by Hooghly Dockyard and Engineering Company.

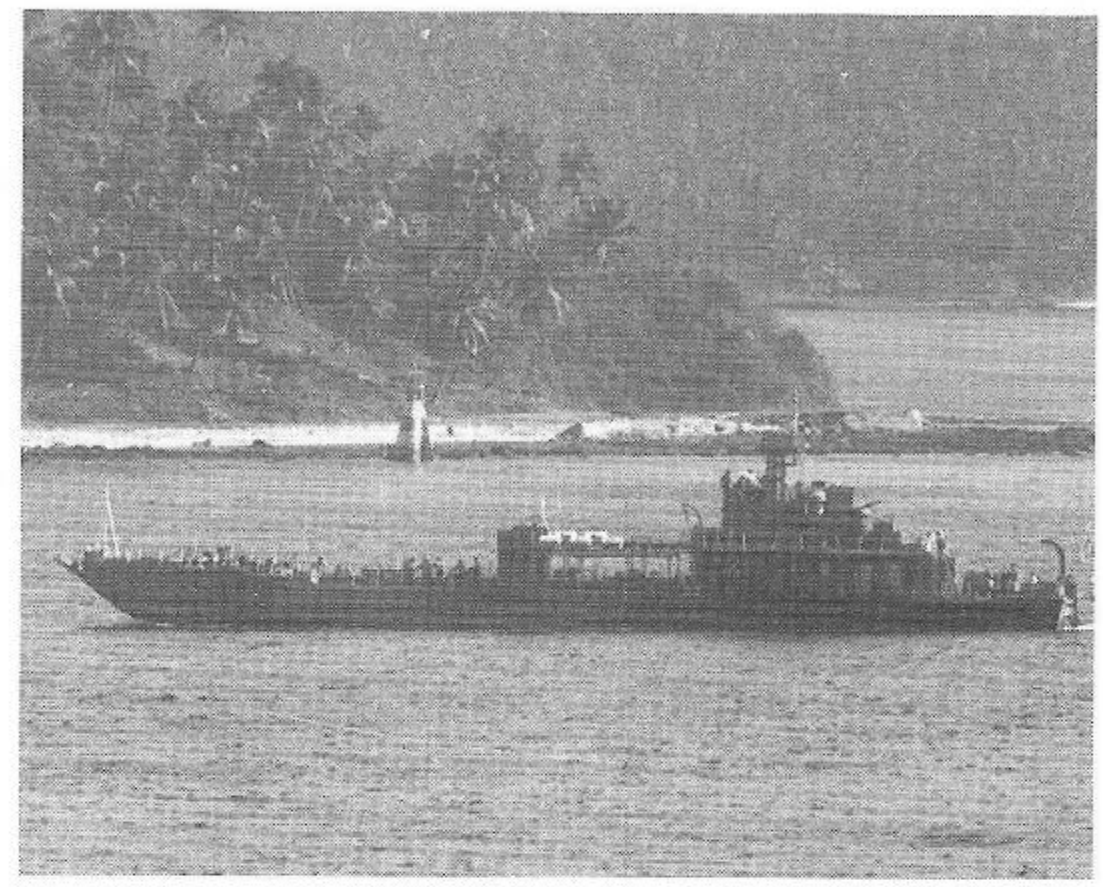
DESIGN

These are of conventional landing-craft design, with a flat bow ramp, a long open tank deck, and the superstructure, engine room and crew accommodation aft.

Differences can be seen between vessels in the class. At least one vessel, L 31, has a platform some 11 m (37 ft) long, forward of the bridge at 01 deck level. This is similar to the platform on the Polnochny D, which is also in service with the Indian Navy, and may also be a helicopter flight deck.



Mangala *(L 39)* (Mazagon Dock)



L 31, one of the class fitted with an additional platform forward of the bridge (92 Wing RAAF)

IRAN HORMUZ 21

GENERAL SPECIFICATIONS

Country of origin: Netherlands
Operator: Iran

Class: HORMUZ 21/MIG-S-5000 (LCT)

Active: 5

Displacement:
full load: 1,280 t

Dimensions
Length: 65 m (213.3 ft)
Beam: 12 m (39.4 ft)
Draught: 2.6 m (8.5 ft)

Speed: 9 kts

Complement: 12

SHIPS

HEJAZ (21)
KARABALA (22)
AMIR (23)
Builders: Ravenstein, Netherlands

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 600 tonnes

PROPULSION

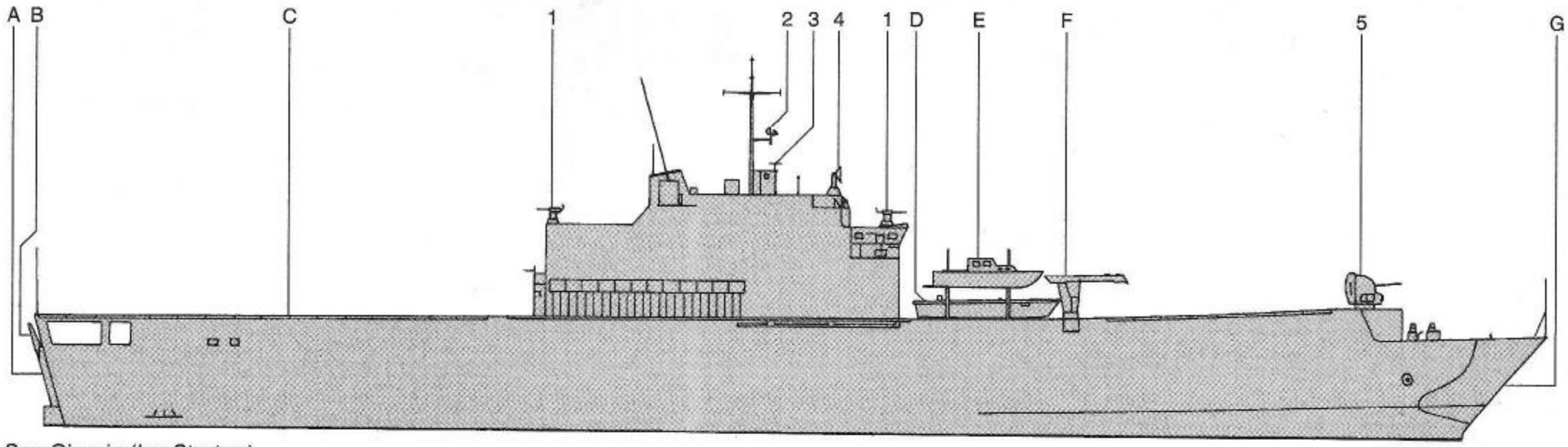
Two MAN V12V-12.5/14 or two MWM TBD 604 V12 diesels; delivering 1.07 MW (1,460 hp); two shafts

FURTHER INFORMATION

These ships have a flat bow ramp and are generally barge-like in design. Three were officially ordered for civilian use from Ravenstein, The Netherlands and delivered to Iran via Britain in 1985. It was reported at the time that they were intended for freighting, but it is believed that at least two of them are used by the Pasdaran revolutionary guards. A local version of the ship designated MIG-S-5000 is being assembled at Boushehr and one was launched in mid-1995, with a second apparently being built. (MIG is the abbreviated title for the Marine Industries Group, Teheran, Iran)

The class has been allocated the international reporting name 'Iran Hormuz 21' class;with individual ships being designated *Iran Hormuz 21, Iran Hormuz 22* and *Iran Hormuz 23.* (They are, though, no relation to the Korean-built class designated 'Iran Hormuz 24').

SAN GIORGIO



San Giorgio (Ian Sturton)

Amphibious A *Stern gate* **B** *Kedge anchor* **C** *Flight deck* **D** *LCVP* **E** *LCPL* **F** *Crane* **G** *Vertically opening bow door with internal ramp*

General 1 *Oerlikon 20 mm cannon* **2** *SMA SPS-702 air/surface search* **3** *SMA SPN-748 navigation radar* **4** *Alenia SPG-70 fire-control radar* **5** *OTOBREDA 76 mm/62 MMI automatic gun*

GENERAL SPECIFICATIONS

Operator: Italy

Class: SAN GIORGIO (LPD)

Built: 3
Active: 3

Displacement:
standard: 6,794 t
full load: 7,788 tonne (San Giusto 8,078 t)

Dimensions
Length: 133.3 m (437.2 ft) (San Giusto 137 m (449.5 ft))
Beam: 20.5 m (67.3 ft)
Draught: 5.3 m (17.4 ft)

Speed: 21 kts
Range: 7,500 n miles at 16 kts; 4,500 n miles at 20 kts

Complement: 163, including 17 officers (San Giusto 196, including 16 officers)

SHIPS

SAN GIORGIO (L 9892)	
Builder	Fincantieri, Riva Trigoso, Italy
Laid down	27 Jun 1985
Launched	25 Feb 1987
Commissioned	9 Oct 1987

SAN MARCO (L 9893)	
Builder	Fincantieri, Riva Trigoso, Italy
Laid down	28 Jun 1986
Launched	21 Oct 1987
Commissioned	18 Mar 1988

SAN GIUSTO (L 9894)	
Builder	Fincantieri, Riva Trigoso, Italy
Laid down	30 Nov 1992
Launched	2 Dec 1993
Commissioned	9 Apr 1994

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops. 400 (one infantry battalion) plus either 30-36 armoured personnel carriers or 30 medium tanks.
- Typical load is 78 VCC-1 APCs (36 on vehicle deck, 42 on flight deck) or 80, 9 m (29.52 ft) long trucks, or 63 semi-trailers.

SHIP-SHORE LIFT

- Three LCMs (in stern docking well).
- Plus two LCVPs (San Giorgio, San Marco) or three LCVPs (San Giusto) on upper deck.
- One LCPL.

AVIATION FACILITES

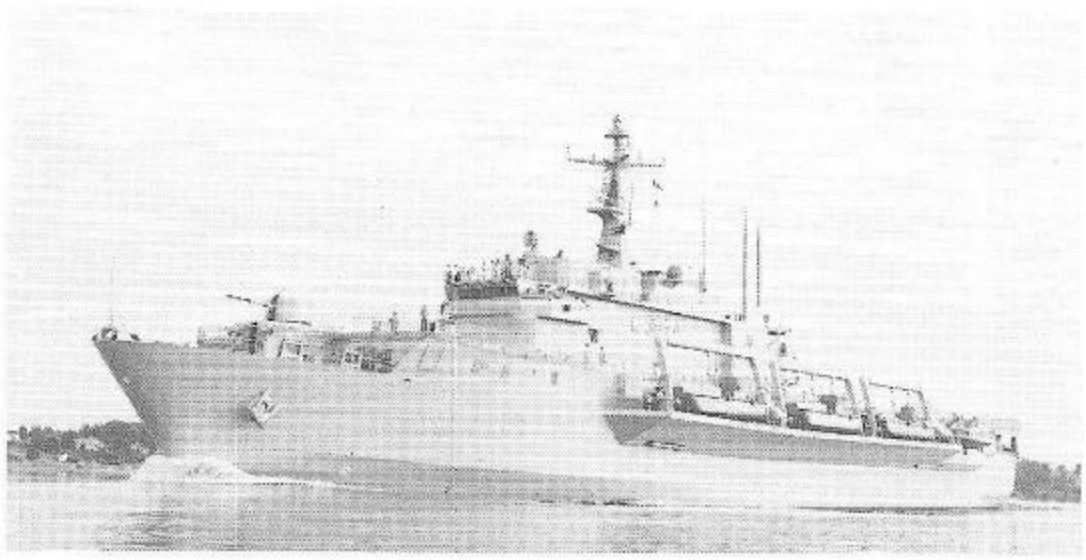
Specifications
Flight deck: 100 × 20.5 m (328.1 × 67.3 ft)
Landing spots: 3
Aircraft: 3 SH-3D Sea Kings or five Agusta AB212s can be carried.

AMPHIBIOUS FACILITIES

San Giorgio, San Marco only
- Visor-type bow door and ramp for discharging vehicles onto a jetty. It is not possible to ground the ship and discharge vehicles directly onto a beach.
- Stern docking well: 20.5 × 7 m (67.2 × 23 ft).

San Giusto only
- Stern docking well: 20.5 × 7 m (67.2 × 23 ft) (Note: San Giusto does not have bow doors)

All ships
- All three ships have an elevator with a 30 tonne capacity, and measuring 13.5 × 3.5 m (44.28 × 11.48 ft) for vehicles and stores (not helicopters)
- Two 40 tonne travelling cranes transfer LCMs between vehicle deck and docking well.
- 16 tonne crane on flight deck.
- All ships have lateral door to discharge vehicles direct from the vehicle deck onto a jetty.
- Vehicle deck is 110 m (360.8 ft) long, 14 m (45.92 ft) wide and 5 m (16.4 ft) high.



San Giusto *(L 9894), third of class. Note the port-side sponson for the LCVPs, which clears the flight deck, and the lack of a bow door* (H & L van Ginderen Collection)

Launch of San Giorgio *(L 9892), showing the bulb at the foot of the stern. The opening bow door is fitted to facilitate loading/unloading to jetties, and the ships are not designed to beach* (Fincantieri)

WEAPONS SYSTEMS

GUNS

OTOBREDA 76 MM (3 in)/62 MMI/ Compact

San Giorgio and San Marco only — one OTOBREDA 76 mm (3 in)

MMI. San Giusto only — one OTOBREDA 76 mm (3 in)/62 Compact.

These three ships each have a single OTOBREDA 76 mm/62 gun, but of slightly different models. San Giorgio and San Marco are armed with refurbished guns of the original MMI (MMI = *Marina Marittimo Italiana* (Italian Navy)) model, while the last to be built, San Giusto has the later Compact version, which is lighter and has a higher and variable rate of fire.

Specifications

Mountings - MMI
Elevation: −15 to +85°
Training speed: 70°/s
Elevation speed: 40°/s
Weight (unloaded): 12 t
Muzzle velocity: 900 m/s (2,952 ft/s)
Rate of fire: 59 rds/min
Range: 8.5 n miles (15.75 km)

Mountings - Compact
Elevation: −15 to +85°
Training speed: 70°/s
Elevation speed: 40°/s
Weight (unloaded): 7.5 t
Muzzle velocity: 925 m/s (3,034 ft/s)
Rate of fire: 10-85 rds/min
Range: 8.6 n miles (16 km)

Manufacturer/Contractor

OTOBREDA, La Spezia, Italy.

Oerlikon 20 mm

There are two Oerlikon 20 mm cannon in each ship.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range
anti-surface: 1.5 km
anti-air: 1,150 m (3,772 ft)
Rate of fire: 450 rds/min
Round weight: 241 g (8.5 oz)
Projectile: 122 g (4.3 oz)
Elevation: −15 to +90°

M2HB 12.7 mm machine guns

At least two M2HB 12.7 mm machine guns are carried.

Specifications (M2HB)

Calibre: 12.7 mm
Barrel: 90 calibres
Gun weight: 38.1 kg (84.0 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

SLR-730

San Giorgio and San Marco only. The SLR-730 radar-frequencies intercept set. These ships appear to have no jamming capability.

SLQ-747

San Giusto only. SLQ-747 combined ESM/ECM suite is installed in San Giusto only, giving both an intercept and a jamming capability.

San Giusto (L 9894)
(H & L van Ginderen Collection)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Selenia Sadoc 2/IPN 10

Sadoc 2 *(Sistema Automatico Direzione delle Operazioni de Combattimento)* entered service aboard the frigate Lupo in September 1977 and was also selected for the San Giorgio ships. Sadoc 2 is designed to produce an up-to-date picture of the tactical situation within the vicinity of both the ship and task group and has a mainframe architecture designed for processing and presenting data acquired by sensors. It can also be used for a number of other functions, including evaluation, threat evaluation and weapons control, ECM management, aircraft control, conducting ASW operations, datalink databank management.

WEAPONS CONTROL

Elsag NA 10 Mod 2

The NA 10 system is designed for surface engagement, air engagements or shore bombardments and can control three guns of two calibres simultaneously. It uses an RTN 10X fire-control radar which was supplemented in earlier versions by two optical periscope sights. Electro-optical equipment which could be mounted on the director included IR camera, TV camera and laser rangefinder while a CW illuminator could also be installed. The system is operated through the Main Control Unit (MCU) which is a console with ballistic computer. A TV display may be added when electro-optical units are used. The MCU is used for target acquisition, tracking and engagement either manually or automatically. Two periscope sights may also be used to provide supplementary target data input to the radar and permit a second target to be engaged.

RADARS

SMA SPS-702

The SMA MM/SPS-702 naval radar is a frequency-agile, I-band system, providing search of surface targets, air search at low and very low altitude optimised for sea skimmers search, helicopter control, assistance to weapon systems, and aids to navigation. It incorporates high angular and range resolution, high capability of operation in dense clutter environments, digital moving target indicator with high subclutter visibility, a power magnetron, a stabilised antenna with narrow beamwidth and extensive electronic counter-countermeasures facilities. A lightweight double curvature parabolic reflector with cosec² vertical pattern, and roll and pitch stabilisation is provided.

Manufacturer/Contractor

SMA, Florence, Italy.

SMA SPN-748

Navigation radar is the I-Band SPN-748

Alenia SPG-70

The Orion RTN-10X (Italian Navy designation SPG-70) is an I-band radar used in conjunction with different fire-control systems (including Alenia Elsag NA-21 and Ferranti WSA-4) to control gun and missile firings. It is based on a conical scan narrow beam antenna, with a tri-port feed and uses a magnetron with fast tuning capabilities. The system employs different receiver signal and data processing techniques to ensure a high-level protection from jamming and interference and also to maintain accurate tracking of both high- and low-flying targets.

Specifications

Frequency: I-band (8-10 GHz)
Antenna type: High-gain, tri-port feed
Tracking method: Conical scan
Transmitter: Frequency changeable, high-power magnetron
Receiver: Linear receiver and ECCM receiver capable of withstanding most jammers
Range: >37 km (22.99 miles) on a fighter aircraft

Manufacturer/Contractor

Alenia Elsag Sistemi Navali, Rome.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Fincantieri GMT A 420.12 diesels, 12.35 MW (16,800 hp) sustained
Shafts: 2
Propellers: Controllable pitch
Thruster: Bow thruster, 1,000 hp
Ship's services: 4 GMT/Ansaldo 770 kW diesel-generator sets.
Emergency power: 1 ,250 kW diesel-generator set

FURTHER INFORMATION

PROGRAMME

These ships provide Italy with an excellent combination of capabilities: amphibious warfare and disaster relief. Both roles require a ship which can carry large numbers of troops, vehicles and supplies, and deploy them ashore rapidly using either helicopters or landing craft. *San Giorgio* was paid for out of the naval budget, but *San Marco* was paid for by the Ministry of Civil Protection and is specially fitted for disaster relief work, though still run by the Navy and still capable of being used as a landing ship if required.

DESIGN

These ships resemble a miniature version of the American 'Tarawa' class, with a virtually full length helicopter deck and a floodable stern dock. There is a stern well and the ships can flood down to allow landing craft to leave and enter. Unusually among LPDs the docking well is below the waterline, enabling it to be flooded by gravity, avoiding a bulky and heavy ballasting installation. *San Giorgio* and *San Marco* have a vertically opening bow door and landing, although as there is a large bulb at the foot of the stem it is doubtful whether they could land troops and vehicles over anything except a sharply shelving beach.

The island is located, aircraft-carrier style on the starboard side. In *San Giorgio* and *San Marco,* the LCVPs are stowed on the flight deck opposite the island, effectively forming a 'waist' and narrowing the usable space on the flight deck.

The last of class, *San Giusto,* has some important differences. First, there is no bow door or ramp and thus there is no option to discharge vehicles through the bows and onto a jetty. Secondly, there is a sponson on the port side, half a deck level below the flight deck, which accommodates three LCVPs, with the davits outboard. This not only increases the landing capability by one LCVP, but also frees a considerable amount of space on the flight deck. San Giusto's island is also longer than on the first two ships. The ship has 300 tonne greater displacement than the first two.

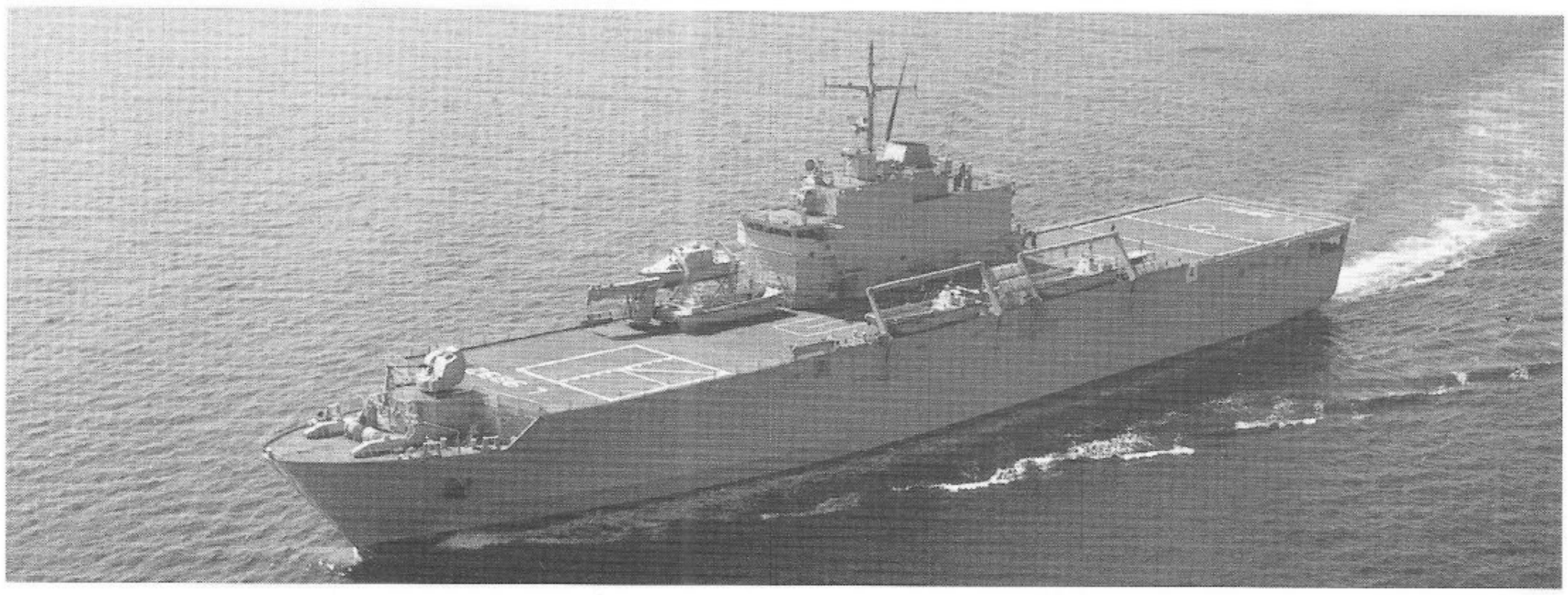
The ships are designed in accordance with Italian Navy stability criteria, so that with any two adjacent compartments (or any three adjacent compartments forward of amidships) flooded, buoyancy, longitudinal trim and transverse stability remain within acceptable limits, even in worst-case load conditions (vehicle and flight deck fully loaded, dock flooded and roll-stabilisation tank empty).

There are four firefighting stations: dock control room, machinery control centre, vehicle deck, and flight deck.

DEPLOYMENT

These ships can be used not just for amphibious operations, but also for a whole range of other roll-on, roll-off tasks including disaster relief, and search and rescue. As such, the design has interested several other navies, though none has so far joined the Italian Navy in ordering one.

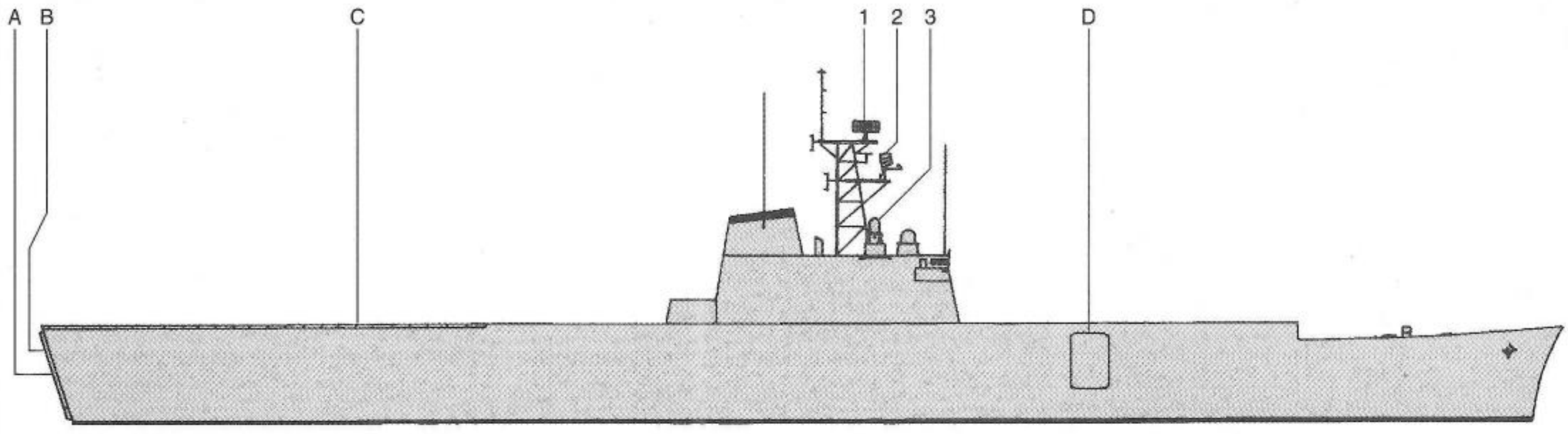
All three are based at Brindisi and assigned to the Third Naval Division. San Giusto is attached to the Naval Academy at Livorno for the duration of the annual three-month summer cruise.



San Giorgio *(L 9892)* (Italian Navy)

San Marco *(L 9893). Note how stowing the LCVPs on the flight deck creates a 'waist' which cannot be used for flying operations, a problem overcome in* San Giusto, *the third ship in the class* (Italian Navy)

JMSDF LST/LPD



Japanese *LST (speculative)* (Ian Sturton)
Amphibious A *Stern gate* **B** *Kedge anchor* **C** *Flight deck* **D** *Loading port*

General 1 *MELCO OPS-14C air/surface search radar* **2** *Navigation radar* **3** *Hughes Mk 15 Vulcan Phalanx CIWS*

GENERAL SPECIFICATIONS

Operator: Japan

Class: LST/LPD

Building: 1

Displacement:
standard: 8,900 t

Dimensions
Length: 170 m (557.7 ft)
Beam: 23 m (75.5 ft)
Draught: 6.1 m (20 ft)

Speed: 20 kts

Complement: 127

SHIPS

(—)

Builder	Mitsui, Tamano, Japan
Laid down	Dec 1995
Launched	Dec 1996
Commissioned	Mar 1998

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops 330
- Type 90 tanks 10
- Cargo 1,400 tonnes

SHIP-SHORE LIFT

- Two LCAC

AVIATION FACILITIES

Specifications
Flight deck: 130 × 23 m (426.5 × 75.5 ft)
The Japanese-built Chinook, CH-47J, is likely to be carried.

AMPHIBIOUS FACILITIES

- No details have been published but if the ship is to carry two LCACs it must have a stern door and a docking well measuring at least 100 × 15 m (328 × 50 ft)

WEAPONS SYSTEMS

GUNS

Hughes Mk 15 CIWS Phalanx
Two Hughes Mk 15 Phalanx close in weapons systems (CIWS) will be mounted to provide the innermost layer of defence against anti-ship missiles (with outer layers being provided by other ships in the task group). The 20 mm M61A1 Vulcan, six-barrel, Gatling-principle gun has a cylindrical magazine with the feed mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min

Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse-Doppler

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA.

COMMAND AND CONTROL SYSTEMS

RADAR

Air/surface search: MELCO OPS-14C
Medium-range air search radar developed by Mitsubishi Electric (MELCO) which is reported to have entered service with the Japanese Maritime Self-Defense Force in 1971. OPS-14 has been developed in A, B and C models.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 diesels, 20.29 MW (27,600 hp);
Shafts: 2
Bow thrusters: 2

FURTHER INFORMATION

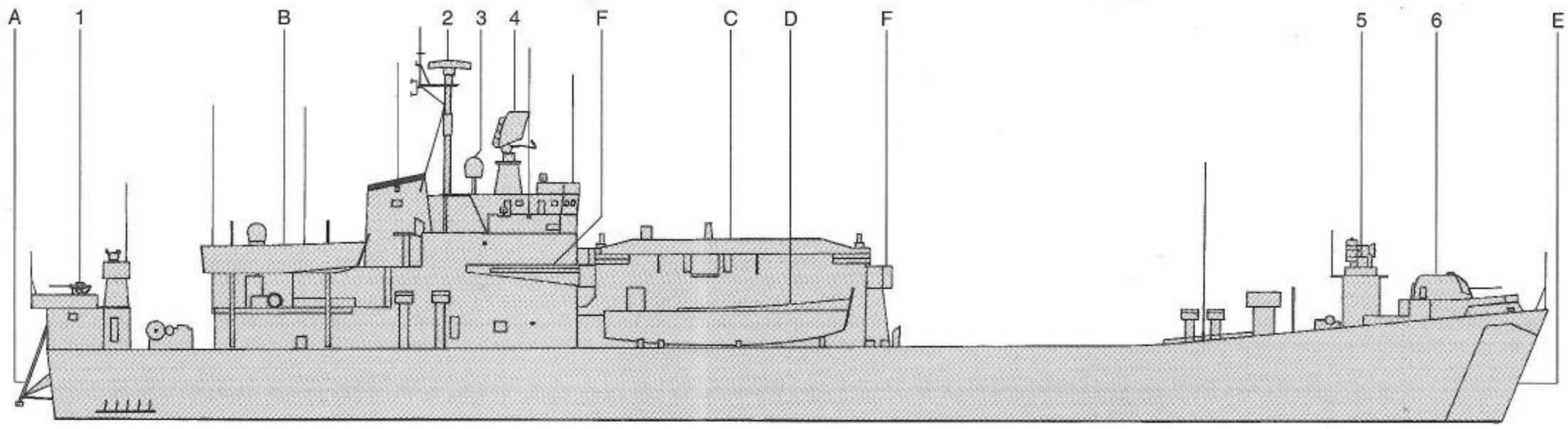
PROGRAMME

The JMSDF already operates six large LSTs and a number of smaller amphibious vessels. Despite this capability, the plan to build a larger tank landing/amphibious transport ship with a significant aviation capability has been politically controversial, and, as a result, almost no information has been released. The original proposal was for a 5,500 tonne LST, with the published design resembled the Italian 'San Giorgio' class. This was put forward for approval in the 1989 budget, but was refused, as was a similar proposal the following year. There was then silence for two years, but the 1993 budget request included a substantially larger ship, apparently based on the US Navy's 'LPH' class, though smaller than the American ships.

This vessel, with some modifications, was approved in the 1993 estimates and was laid down in December 1995 at Mitsui.

The project remains politically sensitive and there have been no statements on the types of aircraft to be carried. Two LCACs for this ship have already been ordered from the USA and will be delivered in 1997.

MIURA



Miura (Ian Sturton)
Amphibious A *Kedge anchor* **B** *LCVP (two)* **C** *Gantry for LCMs* **D** *LCM (two)* **E** *Clamshell doors with ramp inside* **F** *Extending arms for gantry*

General 1 *Bofors 40 mm/70* **2** *JRC OPS-16 surface search radar* **3** *Satcom (not always fitted)* **4** *MELCO OPS-14B air/surface surveillance* **5** *GFCS-1B fire control (for guns)* **6** *Twin US Navy 76 mm/50 gun*

GENERAL SPECIFICATIONS

Operator: Japan

Class: MIURA (LST)

Built: 3
Active: 3

Displacement:
standard: 2,000 t

Dimensions
Length: 98 m (321.4 ft)
Beam: 14 m (45.9 ft)
Draught: 3 m (9.8 ft)

Speed: 14 kts

Complement: 115

SHIPS

MIURA (LST 4151)

Builder	Ishikawajima Harima, Tokyo, Japan
Laid down	26 Nov 1973
Launched	13 Aug 1974
Commissioned	29 Jan 1975

OJIKA (LST 4152)

Builder	Ishikawajima Harima, Tokyo, Japan
Laid down	10 Jun 1974
Launched	2 Sep 1975
Commissioned	22 Mar 1976

SATSUMA (LST 4153)

Builder	Ishikawajima Harima, Tokyo, Japan
Laid down	26 May 1975
Launched	12 May 1976
Commissioned	17 Feb 1977

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200
- Type 74 main battle tanks: 10
- Cargo: 1,800 tonnes

SHIP-SHORE LIFT

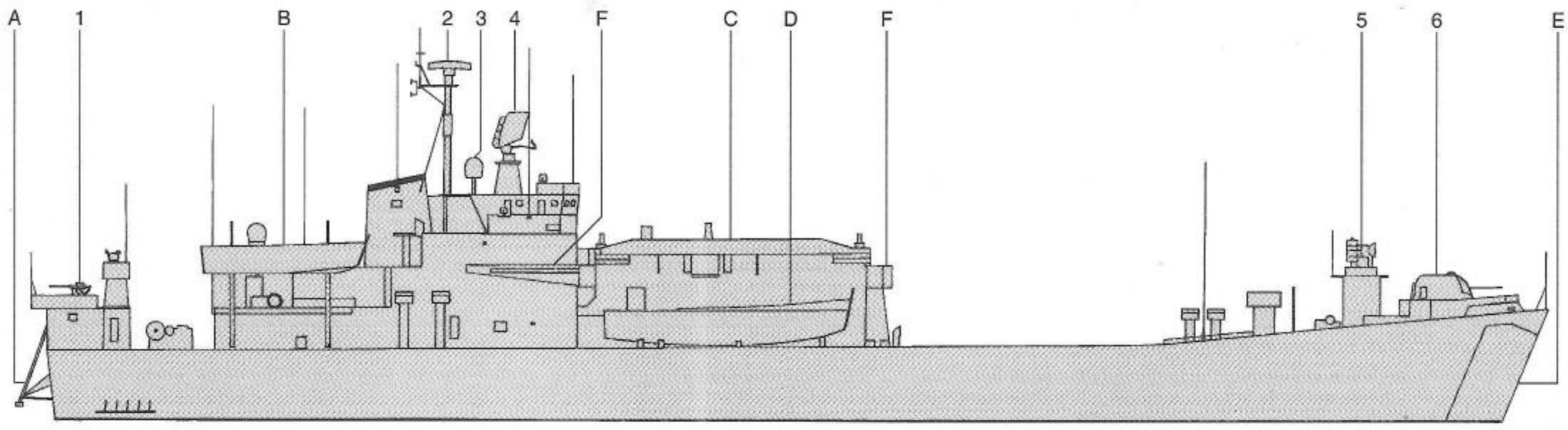
- LCM(6): 2
- LCVP: 2

AMPHIBIOUS FACILITIES

- Twin bow doors, with internal ramp.
- No stern door.
- Large gantry on rails beside tank deck to outload LCM(6), which normally sit on a platform immediately before the bridge.
- The two LCVPs are mounted on gravity davits abaft the stack, with two skids per craft.
- Large kedge anchor at stern.

Satsuma *(L 4153), showing its general resemblance to the US Navy's original LST design. Particular features are the twin 76 mm gun on the forecastle, with its associated GFCS 1 immediately behind and the heavy gantry for outloading the two LCMs* (H & L van Ginderen Collection)

MIURA



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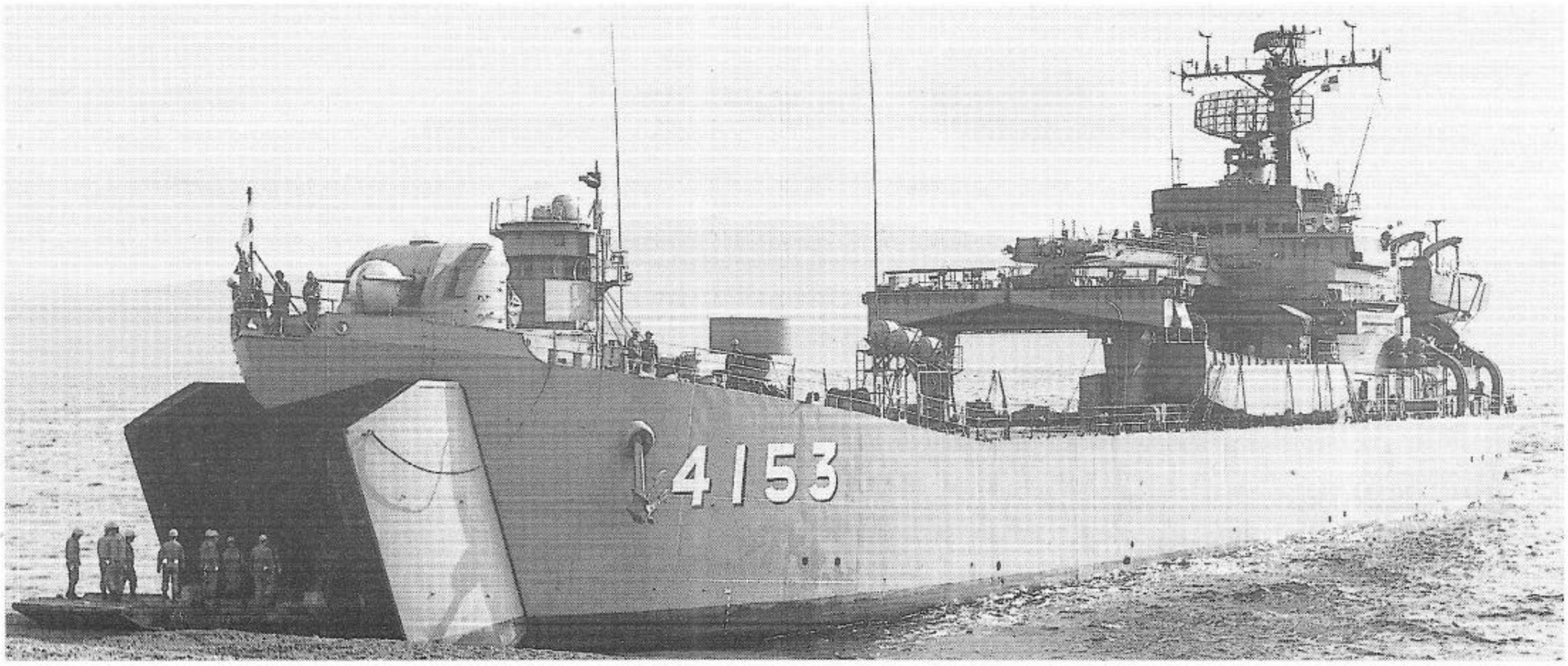


Satsuma *(L 4153), showing its general resemblance to the US Navy's original LST design. Particular features are the twin 76 mm gun on the forecastle, with its associated GFCS 1 immediately behind and the heavy gantry for outloading the two LCMs* (H & L van Ginderen Collection)

WEAPONS SYSTEMS

GUNS

US Navy 76 mm (3 in)/50 in Mk 33 twin mounting

The single twin 76 mm turret is mounted in the bows, where it can be used in the direct fire role during the run into an amphibious landing. The guns are 50 calibre Mk 22 barrels and the Mk 33 twin-barrel mounting can be under local or remote control.

Specifications

Gun

Calibre: 76.2 mm (3 in)
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,699 ft/s) (new); 808 m/s (2,650 ft/s) (mid-life)
Range:
anti-surface: 7 n miles (13 km)
anti-air: 8,800 m (29,000 ft)
Ammunition: 10.9 kg (24 lb)

Mk 33 Mounting

Traverse: 360° at 30°/s
Elevation: −15 to +85° at 24°/s
Rate of fire: 100 rds/min

Bofors 40 mm L/70

One twin Bofors 40 mm AA mount is aft, above the stern.

Specifications

Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000-1,025 m/s (3,280-3,362 ft)
Range:
anti-surface: 6,900 m (22,632 ft)
anti-air: 6.75 n miles (12.5 km)
Rate of fire: 300 rds/min (practical)
Ammunition: 2.21 kg (4.87 lb)

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Gun Fire-Control System 1B (GFCS-1)

Miura (only). GFCS-1B (also known as Type 72-1B) is used by the JMSDF for 76 mm (3 in) guns, but in this class is installed in *Miura* only. The director is mounted on a dedicated platform above and behind the turret.

US Mk 63

Ojika and Satsuma: *Ojika* and *Satsuma* have the US Mk 63 GFCS for their 76 mm (3 in) guns. The FCS is mounted on the turret and has a US AN/SPG-50 radar.

US Mk 51 Mod 2

All ships. The Mk 51 is an elementary remote sight, mounted in all three ships and provides fire control for the 40 mm guns.

Satcom

Satcom terminals were fitted to all three vessels at one stage, but all have now been removed.

RADARS

Mitsubishi OPS 14B

OPS-14B is a B/C-band air search radar. Peak power is 400 kW and beam width is 5°.

Manufacturer/Contractor

Mitsubishi Electric Corporation (MELCO), Tokyo, Japan.

JRC OPS-16

Miura only. OPS-16 is reported to be a D-band surface search radar developed by the Japan Radio Company (JRC).

JRC OPS-18

Ojika and Satsuma only. OPS-18 is a G/H-band surface search radar, developed by JRC, and reportedly based on the American AN/SPS-10 equipment. It is being replaced by OPS-28 in most applications.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Kawasaki-MAN V8V22/30ATL diesels, 2.94 MW (4,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

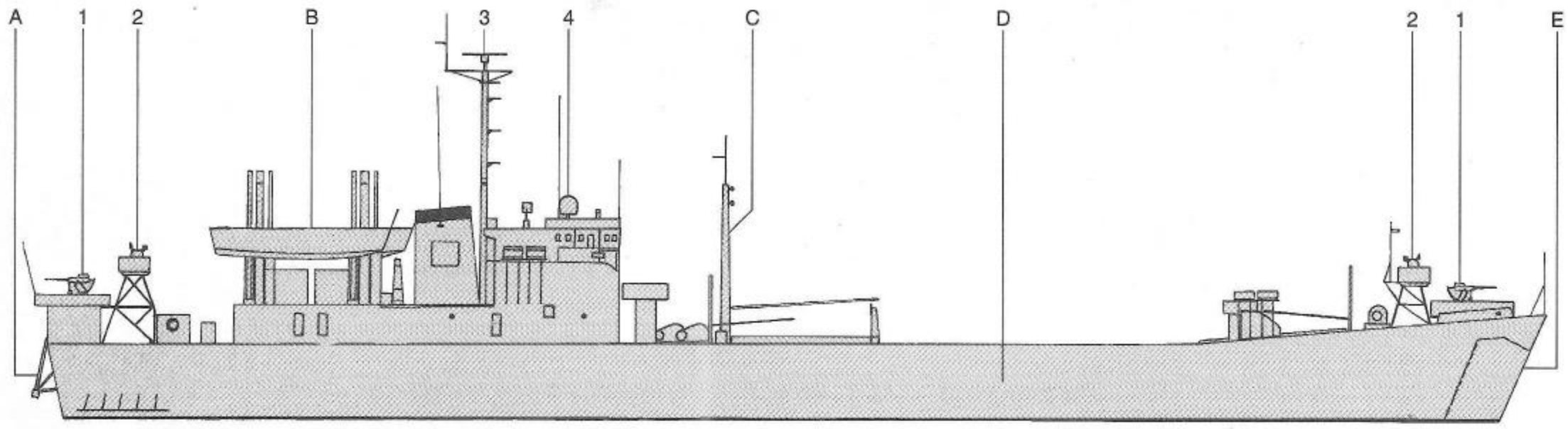
Although they joined the fleet as long ago as the mid-1970s these are the latest large amphibious warfare vessels to be commissioned into the JMSDF.

DESIGN

These are of traditional LST design with clamshell-type bow doors, a long tank deck, and the machinery and superstructure concentrated aft.

Miura *(L 4151) can carry 200 troops and 10 main battle tanks, or 1,800 tonnes of cargo* (Hachiro Nakai)

ATSUMI



Atsumi (Ian Sturton)
Amphibious A *Kedge anchor* **B** *LCVP (two)* **C** *King post* **D** *Tank deck* **E** *Clamshell doors with internal ramp*

General 1 *Bofors 40 mm/70* **2** *US Mk 51 Mod 2 fire control* **3** *Fujitsu OPS-9 navigation radar* **4** *Satcom (not always installed)*

GENERAL SPECIFICATIONS

Operator: Japan

Class: ATSUMI (LST)

Built: 3
Active: 3

Displacement:
standard: 1,503 tonne (LST 4101); 1,574 tonne (LST 4102, 4103)

Dimensions
Length: 89 m (291.9 ft)
Beam: 13 m (42.6 ft)
Draught: 2.7 m (8.9 ft)

Speed: 14 kts (LST4101); 13 kts (LST 4102, 4103)
Range: 9,000 n miles at 12 kts

Complement: 100 (LST 4101); 95 (LST 4102, 4103)

SHIPS

ATSUMI (LST 4101)

Builder	Sasebo Heavy Industries, Japan
Laid down	7 Dec 1971
Launched	13 Jun 1972
Commissioned	27 Nov 1972

MOTOBU (LST 4102)

Builder	Sasebo Heavy Industries, Japan
Laid down	23 Apr 1973
Launched	3 Aug 1973
Commissioned	21 Dec 1973

NEMURO (LST 4103)

Builder	Sasebo Heavy Industries, Japan
Laid down	18 Nov 1976
Launched	16 Jun 1977
Commissioned	27 Oct 1977

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops 130
- Cargo including five Type 74 tanks 400 tonnes

SHIP-SHORE LIFT

- LCVPs 2

AMPHIBIOUS FACILITIES

- All have clamshell bow doors and internal vehicle ramp.
- **Nemuro only.** *Nemuro* has an electric crane fitted at the after end of the tank deck.
- **Atsumi, Nemuro only.** *Atsumi* and *Nemuro* have a king-post and boom, but no crane.
- The two LCVPs are mounted on gravity davits abaft the stack, with two skids per craft.
- Large kedge anchor at stern.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm L/70
Two twin Bofors 40 mm are mounted: one is in the bows, the second on a platform above the stern.

Specifications
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 - 1,025 m/s (3,280-3,362 ft/s)
Range:
anti-surface: 6,900 m (22,632 ft)
anti-air: 6.75 n miles (12.5 km)

Rate of fire: 300 rds/min (practical)
Ammunition: 2.21 kg (4.87 lb)

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

US Mk 51 Mod 2
The Mk 51 is an elementary remote sight, mounted in all three ships and providedes fire control for the 40 mm guns.

RADAR

Fujitsu OPS-9
An I-band (8-10 GHz) surface search/navigation radar produced by Fujitsu.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kawasaki-MAN V8V22/30ATL diesels, 2.94 MW (4,000 hp)
Shafts: 2

FURTHER INFORMATION

For many years the JMSDF operated ex-US Navy amphibious warfare ships of which the largest were three 'Terrebonne County' class LSTs, which were acquired in 1961 and disposed of between 1974 and 1976. To replace these, the JMSDF designed and built these three 'Atsumi' class LSTs, two of which joined the fleet in 1972 and 1973, with the third following some time later in 1977. In design, they are of very similar concept to the US LSTs they replaced.

Atsumi *(L 4101). This class of three were the first LSTs to be built by the JMSDF after the Second World War* (Hachiro Nakai)

YURA

GENERAL SPECIFICATIONS

Operator: Japan

Class: YURA (LSU/LCU)

Built: 2
Active: 2

Displacement:
standard: 590 t

Dimensions
Length: 58 m (190.2 ft)
Beam: 9.5 m (31.2 ft)
Draught: 1.7 m (5.6 ft)

Speed: 12 kts

Complement: 31

SHIPS

YURA (LSU 4171)

Builder	Sasebo Heavy Industries, Tokyo, Japan
Laid down	23 Apr 1980
Launched	15 Oct 1980
Commissioned	27 Mar 1981

NOTO (LSU 4172)

Builder	Sasebo Heavy Industries, Tokyo, Japan
Laid down	23 Apr 1980
Launched	12 Nov 1980
Commissioned	27 Mar 1981

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops 70

AMPHIBIOUS FACILITIES

- Large, flat, bottom-hinged bow door and internal landing ramp.
- There are two cranes above the tank deck.

WEAPONS SYSTEMS

GUNS

Hughes 20 mm/76 Sea Vulcan 20P/ JM-1MB

One Hughes 20 mm/76 Sea Vulcan 20P, with three barrels per mounting. The Sea Vulcan 20P is a manually-operated weapon which has been adopted by the Japanese Maritime Self Defense Force as JM 61MB, and is, in essence, an M-197 gun on the mounting of the old 20 mm single US Navy Oerlikon Mk 10. The M-197 gun is an externally powered weapon using a cluster of three 20 mm barrels. Each barrel is 1.52 m long and weighs 8.18 kg. The weapon uses Mk 149 APDS, Mk 220 TPT and Mk 246 HEI-TSD and each barrel has a life of 15,000 rounds.

Specifications
Calibre: 20 mm
Length of barrel: 76
Muzzle velocity: 1,030 m/s (3,378 ft/s)
Rate of fire: 600-1,200 rds/min
Weight of shell: 294 g (10.36 oz)

Range (effective):
anti-surface: 1 n mile (2 km)
anti-air: 1,200 m (3,936 ft)
Traverse: 360°
Elevation: −15 to +75°

Manufacturer/Contractor
General Electric Company, Armament Systems Department (Sea Vulcan).

COMMAND AND CONTROL SYSTEMS

RADAR

Fujitsu OPS-9

An I-band (8-10 GHz) surface search and navigation radar

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Fuji 6L27.5XF diesel engines, 2.39 MW (3,250 hp)

Shafts: 2
Propellers: Controllable pitch

FURTHER INFORMATION

The JMSDF orders classes of 2-3 amphibious warfare vessels at a time, and these two entered service in 1981. They have a flat, bottom-hinged bow door and a relatively large superstructure.

Yura *(LSU 4171) was the lead ship in a class of two, which entered service in 1981. Note the flat bow ramp, the twin cranes and the relatively large superstructure* (H & L van Ginderen Collection)

YUSOTEI

GENERAL SPECIFICATIONS

Operator: Japan

Class: YUSOTEI (LCU)

Built: 2
Active: 2

Displacement:
standard: 420 t

Dimensions
Length: 52 m (170.6 ft)
Beam: 8.7 m (28.5 ft)
Draught: 1.6 m (5.2 ft)

Speed: 12 kts

Complement: 28

SHIPS

YUSOTEI-ICHI-GO (2001)

Builder	Sasebo Heavy Industries, Tokyo, Japan
Laid down	11 May 1987
Launched	9 Oct 1987
Commissioned	17 Mar 1988

YUSOTEI-NI-GO (2002)

Builder	Sasebo Heavy Industries, Tokyo, Japan
Laid down	17 May 1991
Launched	7 Oct 1991
Commissioned	11 Mar 1992

WEAPONS SYSTEMS

GUNS

GE 20 mm/76 Sea Vulcan 20P/JM-1MB

One GE 20 mm/76 Sea Vulcan 20P, with three barrels per mounting. The Sea Vulcan 20P is a manually operated weapon which has been adopted by the Japanese Maritime Self Defense Force as JM 61MB, and is, in essence, an M-197 gun on the mounting of the old 20 mm single US Navy Oerlikon Mk 10. The M-197 gun is an externally powered weapon using a cluster of three 20 mm barrels. Each barrel is 1.52 m (4.98 ft) long and weighs 8.18 kg (18.03 lb). The weapon uses Mk 149 APDS, Mk 220 TPT and Mk 246 HEI-TSD and each barrel has a life of 15,000 rounds.

Specifications
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,378 ft/s)
Rate of fire: 600-1,200 rds/min
Weight of shell: 294 g (10.36 oz)
Range (effective):
anti-surface: 1 n mile (2 km)
anti-air: 1,200 m (3,936 ft)
Traverse: 360°
Elevation: −15 to +75°

Manufacturer/Contractor
General Electric Company, Armament Systems Department (Sea Vulcan).

COMMAND AND CONTROL SYSTEMS

RADAR

Fujitsu OPS-9

An I-band (8-10 GHz) surface search and navigation radar produced by Fujitsu.

PROPULSION

Specifications
System: Diesels
Main machinery: 2 Mitsubishi S6U-MTK diesel engines, 2.23 MW (3,040 hp (m))
Shafts: 2

FURTHER INFORMATION

These medium-sized landing craft are officially designated 'landing craft utility' with pennant numbers LCU 01 and LCU 02. Plans for a third in the class appear to have been scrapped.

ALLIGATOR[1]

OVERVIEW

The Korea-Tacoma Yard has for some years offered a series of landing ship logistic (LSL) designs for the export market, obviously with a view to replacing the many ex-US Navy LSTs now approaching the end of their useful lives. Six were built for Indonesia and delivered in 1981/82. This was followed by an order for four ships for Venezuela, all of which were delivered in 1984, which were to a slightly different design. Latest is the series now building for the RoK Navy which appears to be generally similar to the last two ships built for Indonesia.

Footnote

1. The South Korean 'Alligator' class LST is totally unrelated to the Russian 'Alligator' class.

ALLIGATOR

GENERAL SPECIFICATIONS

Operator: South Korea

Class: ALLIGATOR (LST)

Active: 2
Building: 1 (+?)

Displacement:
full load: 4,200 t

Dimensions
Length: 106.9 m (350.7 ft)
Beam: 15.3 m (50.2 ft)
Draught: 3 m (9.8 ft)

Speed: 16 kts
Range: 10,000 n miles at 12 kts

Complement: 120 including 14 officers

SHIPS

Neither names nor numbers are known.

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Vehicles 700 tonnes
- Landing craft 200 tonnes

SHIP-SHORE LIFT

- There are several LCMs on the upper deck, with davits. These are probably ex-US LCM 8s of which the RoK Navy operates 10. There are also at least two LCVPs.

WEAPONS SYSTEMS

OTOBREDA 40 mm L/70 Compact (Type 70)

Two twin 40 mm turrets are mounted.

Specifications

Traverse: 360° (nominal) at 90°/s
Elevation: −13° to +85° at 60°/s
Rate of fire: 600 rds/min/mount
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 6 km (3.25 n miles)
anti-air: 4,000 m (2.2 n miles)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

Oerlikon 20 mm cannon

Two single, manually operated Oerlikon 20 mm cannon are mounted, but actual location cannot be confirmed.

Specifications

Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,738 ft/s)
Range:
surface target: 1.5 km (0.93 miles)
air target: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g (8.5 oz)
Projectile: 122 g (4.3 oz)
Elevation: −15 to +90°

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Electro-optic director

There is visual evidence of an electro-optic director; type not known.

RADARS

Surface search

One E/F band set.

Navigation

One I-band set

AVIATION

Specifications

Flight deck: Large flight deck aft.

Hangar: Visual inspection suggests that there is a hangar.

PROPULSION

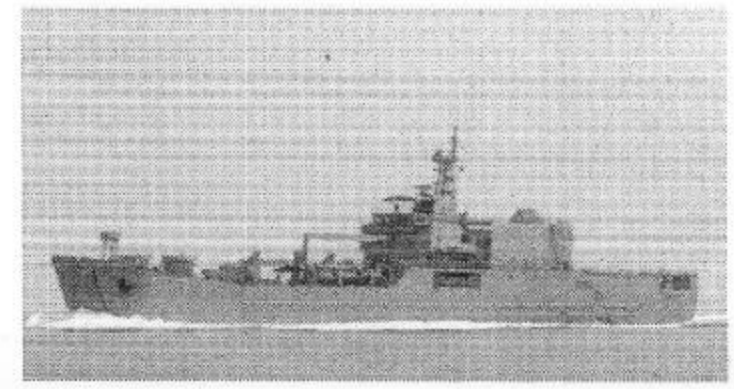
Specifications

System: Diesel
Main machinery: 2 SEMT-Pielstick 16 PA6 V 280, 9.41 MW (12,800 hp) sustained
Shafts: 2

FURTHER INFORMATION

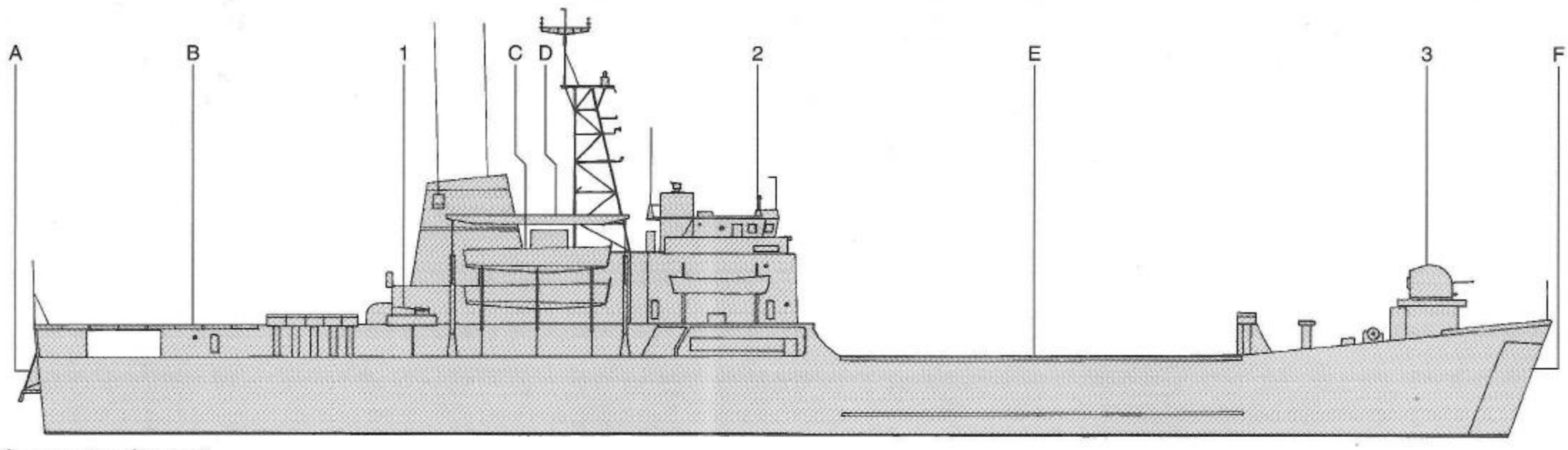
PROGRAMME

These vessels seem to be shrouded in an unusual degree of secrecy, and information has been minimal since the order for the first was placed in June 1990. The details given above are for the Hyundai HDL-4000 which has been advertised commercially, but the version built for the RoK Navy may well be different. Financial problems appear to have delayed the ships, but sea trials were reported to have started in late 1993 and two of the class were reported as having been commissioned by the end of 1994. Up to nine may be built if the intention is to replace the ageing ex-US Navy LSTs.



'Alligator' class LST of the RoK Navy

CAPANA (Alligator III)



Capana (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Flight deck (no hangar)* **C** *LCVP* **D** *Davit* **E** *Tank deck* **F** *Clamshell doors with internal ramp*

General 1 *Rheinmetall Rh-202 20 mm cannon* **2** *Navigation radar* **3** *OTOBREDA 40/70 twin cannon*

GENERAL SPECIFICATIONS

Country of origin: South Korea
Operator: Venezuela
Type: Alligator (LST)

Class: CAPANA

Built: 4
Active: 4

Displacement:
full load: 4,070 t

Dimensions
Length: 104.8 m (343.8 ft)
Beam: 15.4 m (50.5 ft)
Draught: 3 m (9.8 ft)

Speed: 14 kts
Range: 5,600 n miles at 11 kts

Complement: 117, including 13 officers

SHIPS

CAPANA (T 61)
Builder Korea Tacoma Marine, Chinhae, South Korea
Commissioned 24 Jul 1984

ESEQUIBO (T 62)
Builder Korea Tacoma Marine, Chinhae, South Korea
Commissioned 24 Jul 1984

GOAJIRA (T 63)
Builder Korea Tacoma Marine, Chinhae, South Korea
Commissioned 20 Nov 1984

LOS LLANOS (T 64)
Builder Korea Tacoma Marine, Chinhae, South Korea
Commissioned 20 Nov 1984

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops 202
- Cargo 1,600 tonnes

SHIP-SHORE LIFT

- 4 LCVPs on davits

AMPHIBIOUS FACILITIES

- Two clamshell, vertically hinged bow doors and bow ramp.
- Stern kedge anchor; no stern gate.
- 50 tonne tank turntable and an elevator between decks.

WEAPONS SYSTEMS

GUNS

OTOBREDA 40 mm L/70 Compact (Type 70)

One twin 40 mm turret is mounted on the forecastle.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13° to +85° at 60°/s
Rate of fire: 600 rds/min/mount
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 6 km (3.25 n miles)
anti-air: 4,000 m (2.2 n miles)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

Oerlikon 20 mm GAM-BO1

There are two single Oerlikon 20 mm cannon in GAM-BO1 mountings. The KAA is a single barrel, gas-operated, air-cooled, link-belt fed weapon with feeding from either side and the GAM is an unpowered light, compact mounting.

Specifications
KAA Gun
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,150 m/s (3,444-3,772 ft/s)
Range
anti-surface: 1.7 km
anti-air: 1,700 m (5,576 ft)
Rate of fire: 900 rds/min
Round weight: 320-345 g (11.28-12.16 oz)
Projectile: 110-125 g (3.87-4.19 oz)

GAM-BO1 Mounting
Elevation: −15 to +60°
Weight: 500 kg (1,102 lb) (loaded)

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Selenia NA 18/V electro-optic director
NA-18 is used to control the guns and consists of a TV camera, laser rangefinder and an infra-red camera.

RADAR

Navigation radar
There is a navigation radar; type unknown.

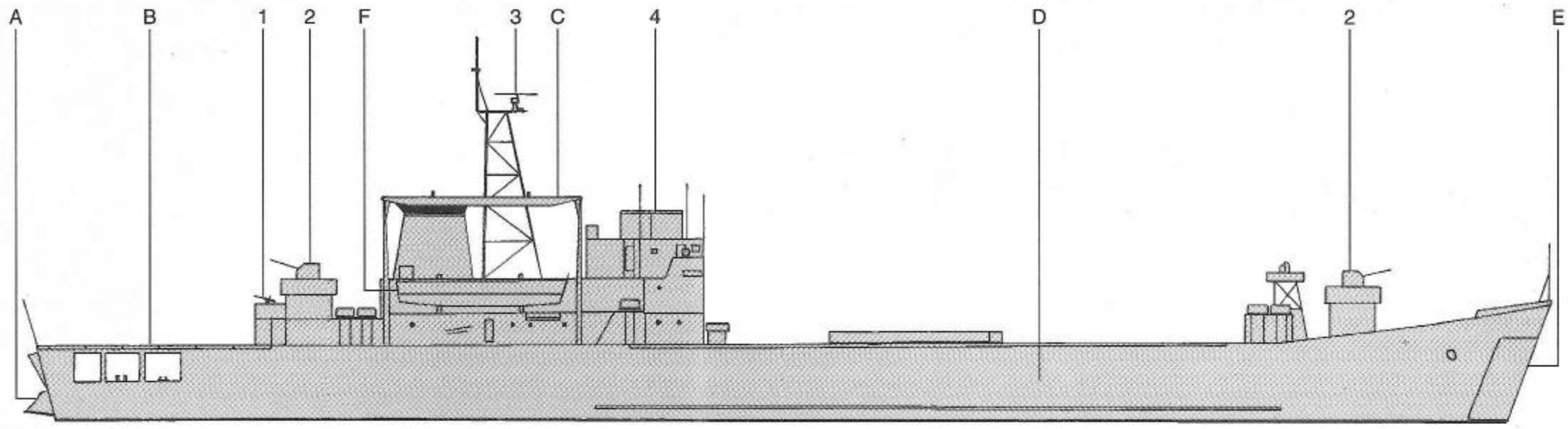
PROPULSION

Specifications
System: Diesel
Main machinery: 2 SEMT-Pielstick 16 PA6 V diesels, 5.04 MW (6,860 hp)
Shafts: 2

FURTHER INFORMATION

These ships are based on the Alligator design supplied to Indonesia and were all delivered in 1984. *Goajira* (T 63) was out of service from June 1987 to May 1993, following a serious fire.

TELUK SEMANGKA (Alligator)



Teluk Semangka (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Flight deck* **C** *Davits* **D** *Tank deck* **E** *Clamshell doors with internal ramp* **F** *LCVP (total four)*

General 1 *Rheinmetal RH-202 20 mm cannon* **2** *Bofors 40 mm/70* **3** *Surface search radar* **4** *Racal-Decca navigation radar*

GENERAL SPECIFICATIONS

Country of origin: South Korea
Operator: Indonesia
Type: Alligator (LST)

Class: TELUK SEMANGKA

Built: 6
Active: 6

Displacement:
full load: 3,750 t

Dimensions
Length: 100 m (328 ft)
Beam: 14.4 m (47.2 ft)
Draught: 4.2 m (13.8 ft)

Speed: 15 kts
Range: 7,500 n miles at 13 kts

Complement: 90, including 13 officers

SHIPS

TELUK SEMANGKA (512)
Builder Korea-Tacoma, Masan, South Korea
Commissioned 20 Jan 1981

TELUK PENJU (513)
Builder Korea-Tacoma, Masan, South Korea
Commissioned 20 Jan 1981

TELUK MANDAR (514)
Builder Korea-Tacoma, Masan, South Korea
Commissioned July 1981

TELUK SAMPIT (515)
Builder Korea-Tacoma, Masan, South Korea
Commissioned June 1981

TELUK BANTEN (516)
Builder Korea-Tacoma, Masan, South Korea
Commissioned May 1982

TELUK ENDE (517)
Builder Korea-Tacoma, Masan, South Korea
Commissioned 2 Sep 1982

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 1,800 tonnes, including 17 main battle tanks and 200 troops.
- If no tanks are carried, a marine battalion (500-600 men) can be embarked.

SHIP-SHORE LIFT

- Four LCVP mounted on davits.

AMPHIBIOUS FACILITIES

- Two, vertically-hinged, clamshell bow doors.
- 50 tonne capacity turntable on tank deck.
- Elevator to main deck.

Teluk Semangka *(512). The dimensions of these Korean-built ships — 100 m long, 14.4 m beam — are almost identical to those of the Second World War LSTs they were designed to replace, although the general design and machinery are obviously more up to date* (92 Wing RAAF)

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

Teluk Semangka, Teluk Penju, Teluk Mandar and *Teluk Sampit:* three Bofors 40 mm/60.
Teluk Banten and *Teluk Ende:* two Bofors 40 mm/60.

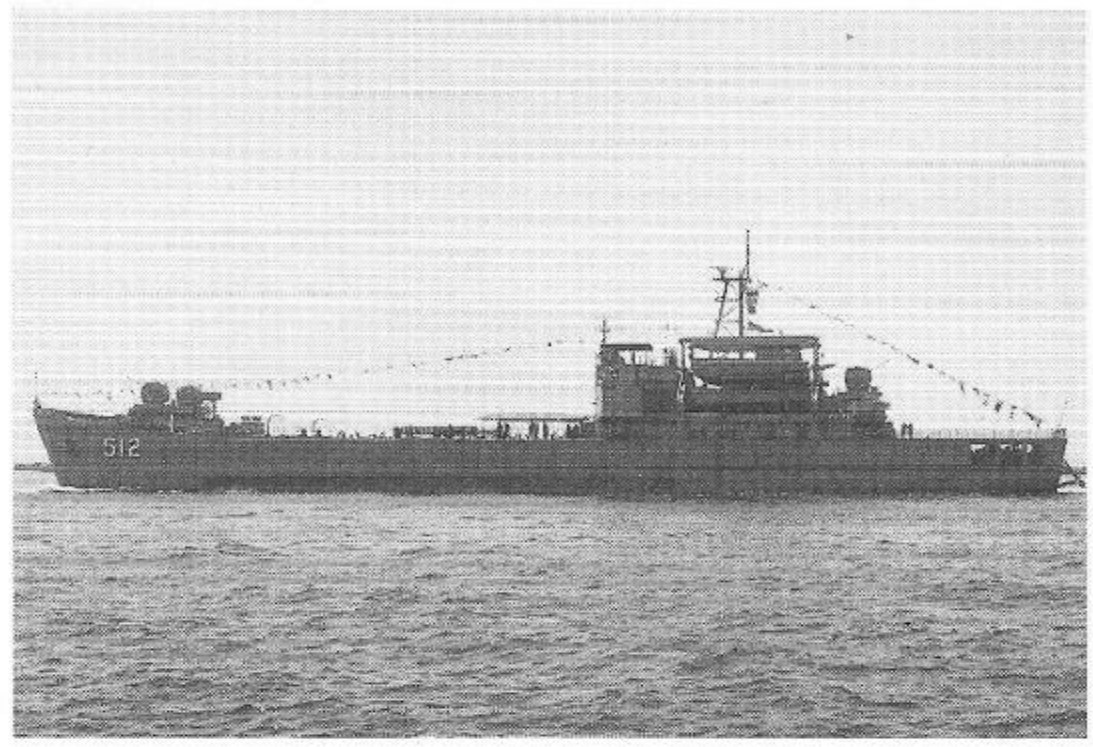
Specifications
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 - 1,025 m/s (3,280-3,362 ft/s)
Range:
anti-surface: 6.75 n miles (12.5 km)
anti-air: 6,900 m (22,632 ft)
Rate of fire: 300 rds/min (practical)
Ammunition: 2.21 kg (4.87 lb)

Rheinmetall 20 mm/85 multipurpose cannon

Two Rheinmetall 20 mm multipurpose cannon in manual mounts. The 85 calibre Rh 202 is 2.61 m (8.56 ft) long and is capable of single shot or automatic fire. Naval versions use either a conventional single belt feed in which rounds enter from the right and spent cartridges are ejected to the left, or the Type 2 two-way belt-feed mechanism.

Specifications
Gun: Rh 202
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,250 m/s (3,444-4,100 ft/s)
Rate of fire: 800-1,000 rds/min
Crew: 1-2
Range: 1 n mile (2 km)

Teluk Banten *(516) one of two of the six Indonesian ships completed as command ships. Two hangars have been built aft and the LCVPs moved onto the foredeck. Three Nurtanio-built Cougars can be embarked*



Teluk Semangka *(512) one of the original four with a flight deck (but no hangar) and LCVPs abaft the bridge* (H & L van Ginderen Collection)

COMMAND AND CONTROL SYSTEMS

RADARS

Surface search

Teluk Banten and *Teluk Ende* only. These two ships have a surface search, E/F-band radar with an antenna mounted on the bridge roof. The type is not known.

Navigation

All ships have a Racal-Decca I-band navigation radar; model not known.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 diesels, 5.04 MW (6,860 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

A total of six ships was built for the Indonesian Navy by Korea-Tacoma. The first four were ordered in 1979 and delivered in 1981, while the last two, to a slightly different design, were ordered in 1980 and delivered in 1982.

DESIGN

The first four are almost identical in concept, layout and size to the US Navy's wartime LST 1-1152 design, except for the addition of a small flight deck aft (but no hangar). One curious feature is that they have an elevator to transfer vehicles and stores between the tank and upper deck, as in the earlier US LSTs, as opposed to the ramp, which the Americans used in their later model LSTs. Also, in the first four, the landing craft are mounted in davits on either side of the stack.

The last two were built as command ships, but retaining their amphibious capability. They use the same hull, but the layout is altered to suit the new role. Thus, the superstructure has been moved forward to free space aft for a much larger flight deck and a hangar. The davits and LCVPs have been moved and are now forward of the bridge, and the stack has been deleted, to be replaced by two drowned exhausts. They also have only two 40 mm guns and have a surface search radar fitted above the bridge. Presumably, these two also have additional communications for their function as command ships.

Teluk Ende has also been observed with large red crosses on the hangar sides. The ship retained its armament and whether it constituted a hospital ship in accordance with International Red Cross and International Red Crescent rules is not clear.

HORMUZ 24

GENERAL SPECIFICATIONS

Country of origin: South Korea
Operator: Iran

Class: HORMUZ 24 (LST)

Purchased: 3
Active: 3

Displacement:
full load: 2,014 t

Dimensions
Length: 73.1 m (239.8 ft)
Beam: 14.2 m (46.6 ft)
Draught: 2.5 m (8.2 ft)

Speed: 12 kts

Complement: 30, plus 110 berths

SHIPS

FARSI (24)
SARDASHT (25)
SAB SAHEL (26)

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Nine tanks and 140 troops.
- Berths for 110 passengers in addition to crew.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Daihatsu 6DLM-22 diesel engines, 1.76 MW (2,400 hp (m))
Shafts: 2

FURTHER INFORMATION

STATUS

These are officially registered as merchant vessels and are under the control of the Iranian Ministry for Merchant Marine, which makes them *bona fide* merchant vessels. However, there are reports that they have been used for Pasdaran (revolutionary guards) activities, which might prejudice their civilian status. They could also be employed in support of military amphibious operations, but that is no different from, for example, British practice in employing merchant vessels as 'Ships Taken Up From Trade' (STUFT).

DESIGNATION

'Hormuz 24' is an internationally recognised reporting name for the class, equivalent to NATO reporting names for Russian equipment, and is used as the Iranian name is not known.

PROGRAMME

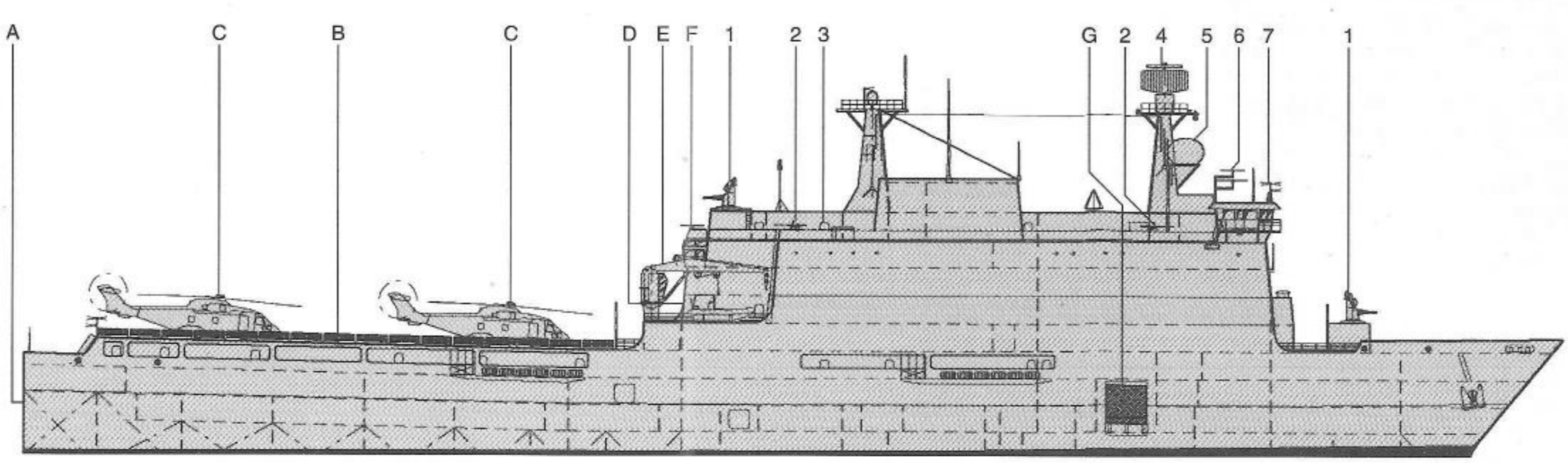
These ships were built in Korean yards at Inchon in the mid-1980s, with large bow doors.

DUTCH AMPHIBIOUS TRANSPORT SHIP (ATS)/SPANISH LANDING PLATFORM DOCK (LPD)

OVERVIEW

The Dutch/Spanish LPD programme started as a national project by the Netherlands, which has a long-standing requirement for an amphibious transport ship (ATS) to remove from its dependence on UK ships or merchant vessels. The staff requirement was formalised in 1988 and work was proceeding along national lines when the R Neth N became aware that the Spanish Navy was working on a similar LPD project and the two navies decided to pursue the project jointly, signing a memorandum of understanding (MoU) in March 1992. Progress was helped by the fact that the two navies were already co-operating successfully on an AOR programme. The common staff requirement was agreed in May 1992 and the joint ATS/LPD design was finalised at the end of 1993. The design reflects a high degree of commonality, but as in the AOR and LCF programmes this has not been taken to extremes. Thus, the two ships differ in their propulsion systems, garage deck arrangements and accommodation areas (to reflect national traditions and preferences), and in their CIWS, with the Dutch opting for Goalkeeper and the Spanish for Meroka. There will also doubtless be differences in command and control and other electronic systems.

It appears that the Dutch will build only one of these ships, but there is pressure in Spain for a second of the class, not least from shipyard unions concerned at a likely dearth of naval work once the present LPD is launched.



Dutch ATS/Spanish LPD (Ian Sturton)
Amphibious A *Stern gate to docking well* **B** *Flight deck* **C** *EH.101 or NFH-90 helicopters* **D** *Hangar* **E** *35 tonne crane* **F** *Carrier control approach (CCA) radar* **G** *Entry port*

General 1 *Signaal SGE-30 Goalkeeper CIWS* **2** *Oerlikon 20 mm cannon* **3** *SRBOC chaff/IR launcher* **4** *Signaal DA08 air/surface search radar* **5** *Satcom* **6** *Navigation radar* **7** *Signaal IRSCAN*

GENERAL SPECIFICATIONS

Countries of origin: Netherlands/Spain
Operators: Netherlands, Spain
Type: Amphibious Transport Ship (ATS)/Landing Platform Dock (LPD)

Class: ROTTERDAM/JUAN DE AUSTRIA

Active: 0
Building: 2

Displacement:
full load: 11,000 t (ATS); 12,250 t (LPD)

Dimensions
Length: 163 m (534.8 ft) oa; 142.2 m (466.5 ft) wl

Beam: 25 m (82 ft)
Draught: 5.8 m (19.03 ft)

Speed: 19 kts (ATS); 19.4 kts (LPD)
Range: 6,000 n miles at 12 kts

Complement: 128 crew, plus 611 marines

SHIPS

ROTTERDAM (L 800)

Builder	Royal Schelde, Merwede Shipyard, Netherlands
Laid down	23 Feb 1996
Launched	Jan 1997
Commissioned	Dec 1997

JUAN DE AUSTRIA (L51)

Builder	Bazan, Ferrol, Spain
Laid down	Apr 1996
Launched	Jun 1997
Commissioned	Apr 1998

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops 611 (41 officers, 156 petty officers, 414 enlisted men)
- Vehicles 170 armoured personnel carriers or 33 main battle tanks
- Endurance:

Passengers 611 — 30 days
Passengers 661 — 48 hours
Passengers 811 — 24 hours

SHIP-SHORE LIFT

- LCVP Mk 3: 6
- LCU Mk 9: 4
- LCM 8: 4

AMPHIBIOUS FACILITIES

- Garage capacity 900 m²
- General cargo 460 m²
- General stores (embarked force) 630 m²
- Ammunition (embarked force) 320 m²
- Additional 880m² for vehicles, if the dock is used.
- Additional 510 m² for vehicles, if hangar is used.
- Two cranes: 1 × 25 t; 1 × 2.5 t
- Stern ramp: 10.5 m (34.5 ft) long
- Side ramp: 4.5 m (14.76 ft) long
- Cargo elevators: 1 × 25 t; 1 × 7.5 t; 1 × 4 t
- Can carry up to 36 torpedoes and 300 sonobuoys.

AVIATION FACILITIES

Specifications
Flight deck: 56 × 25 m (184 × 82 ft)
Hangar: Accommodation for 4 heavy or 6 medium helicopters
Helicopters: 4 EH-101 or six NFH-90

HOSPITAL

- Pre-medication area.
- Operating theatre.
- Intensive care sickbay (10 beds).
- Laboratory.
- Dental facilities.
- Hospital ward for 100 patients.

WEAPONS SYSTEMS

GUNS

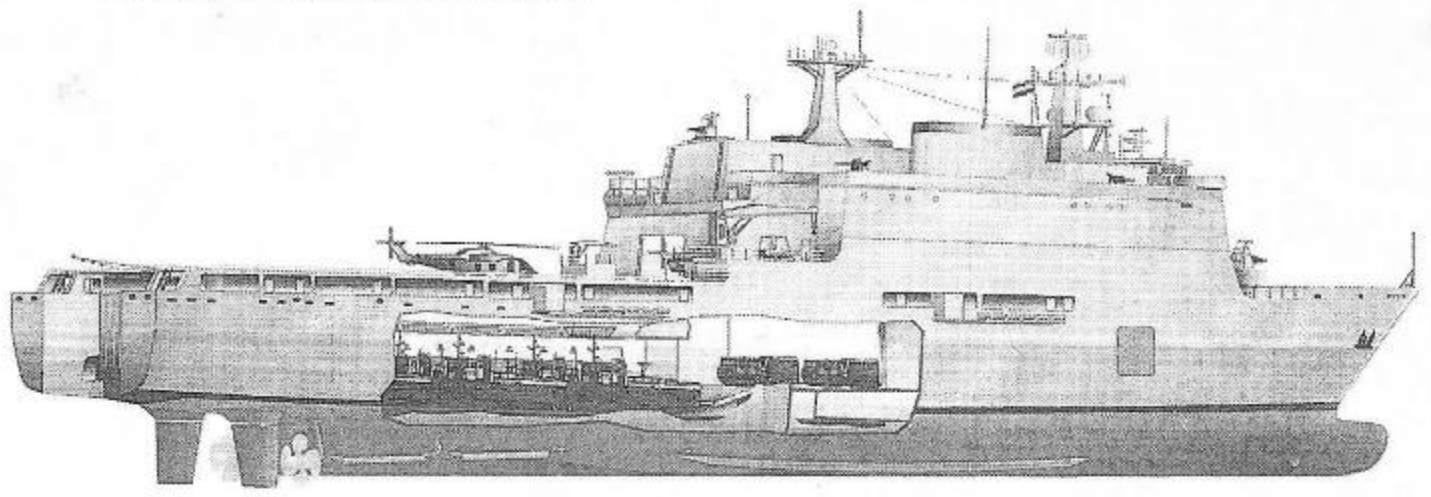
Signaal Goalkeeper 30 mm CIWS

Netherlands ATS only. Two Signaal/Hughes 30 mm 7-barrelled Gatling Goalkeeper close in weapons system will be mounted. Goalkeeper is an autonomous, fully automatic system, consisting of a General Electric Sea Vulcan 30 gun, I-band search radar, I/K-band tracking radar, TV camera, and ancillaries. The Sea Vulcan 30 is based upon the electrohydraulically-powered GAU-8/A 30 mm seven-barrel, Gatling gun, with each barrel firing once during each revolution of the barrel cluster. The gun is very reliable, with 33,000 mean rounds between stoppages. The mounting has an ammunition capacity of 1,190 rounds carried in a linkless system using a feed and storage drum, which is claimed to be sufficient for several target engagements before reloading is necessary. The warhead kill capability of Goalkeeper against anti-ship missiles is achieved by use of MPDS rounds which have high-density, tungsten-alloy penetrators. For 'soft' targets, HEI and TP types of ammunition can be used.

The I-band search radar uses a 2,050 × 280 mm linear array antenna with an integrated sidelobe suppression antenna. The antenna rotates at 60 rpm and has a horizontal beamwidth of 1.7° and a vertical beam width of 60°. The radar is powered by a water-cooled, synthesiser-driven, TWT transmitter with high output power for greater frequency and PRF flexibility in the face of ECM threats.

Specifications

Calibre: 30 mm
Muzzle velocity: 1,020 m/s (3,345 ft/s) (TP, HEI); 1,150 m/s (3,772 ft/s) (APDS)
Traverse: 360°
Elevation: −25 to +85°
Mounting weight: 6,800 kg (14,994 lb)
Crew: 0
Range: 200 m to 3 km (1.61 n miles)
Rate of fire: 4,200 rds/min
Ammunition: 369 g (13.01 oz) (TP, HEI, HEISD, API, MPDS)



Cutaway of the Dutch ATS. The twin rudders and bow thruster will give excellent manoeuvrability and it is stated that the six landing craft or two LCACs will be able to use the dock in Sea State 4 (Royal Schelde)

Manufacturers/Contractors

Hollandse Signaalapparaten BV, Hengelo, Netherlands (system/radar).
Hughes (gun).

Bazan Meroka CIWS

Spanish LPD only. Two Bazan Meroka Mod 2A/2B 12-barrelled 20 mm/120 close in weapons system (CIWS) will be mounted. This Spanish-designed weapon is unique in its configuration and operation. The weapon itself consists of 12 Oerlikon 20 mm KAA barrels and uses standard Oerlikon 20 mm ammunition, but these barrels are arranged in a single unit of two superimposed rows of 6 with a common breech-block. All operations, such as loading, feeding and unlocking, are carried out using compressed air from reservoirs on the mounting, which are recharged from an onboard compressor. Ammunition is brought to the barrels by two belt feeds, supplied by a hydraulically-powered, rotating, 72 round magazine.

Specifications

Calibre: 20 mm
Length of barrel: 120 calibres
Muzzle velocity: 1,215 m/s (3,985 ft/s)
Traverse: 360° at 90°/s
Elevation: −20 to +85°
Crew: 0
Range: 0.75 n miles (1.5 km)
Rate of fire: 2,700-3,600 rds/min
Ammunition: 337 g (11.88 oz) (TP-T, HEI, SAPHEI-T, AP-T); 310 g (10.93 oz) (APDS-T)

Manufacturer/Contractor

Fabrica de Artilleria de Bazan, Spain.

Oerlikon 20 mm

ATS and LPD. Four Oerlikon 20 mm guns will be mounted either side of the bridge superstructure.

Specifications

Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,738 ft/s)
Range:
surface target: 1.5 km
air target: 1,150 m (3,800 ft)
Rate of fire: 450 m/s (1,476 ft/s)
Round weight: 241 g (8.5 oz)
Projectile: 122 g (4.3 oz)
Elevation: −15 to +55°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Details of EW system have not been made public.

DECOYS

Four SRBOC chaff launchers

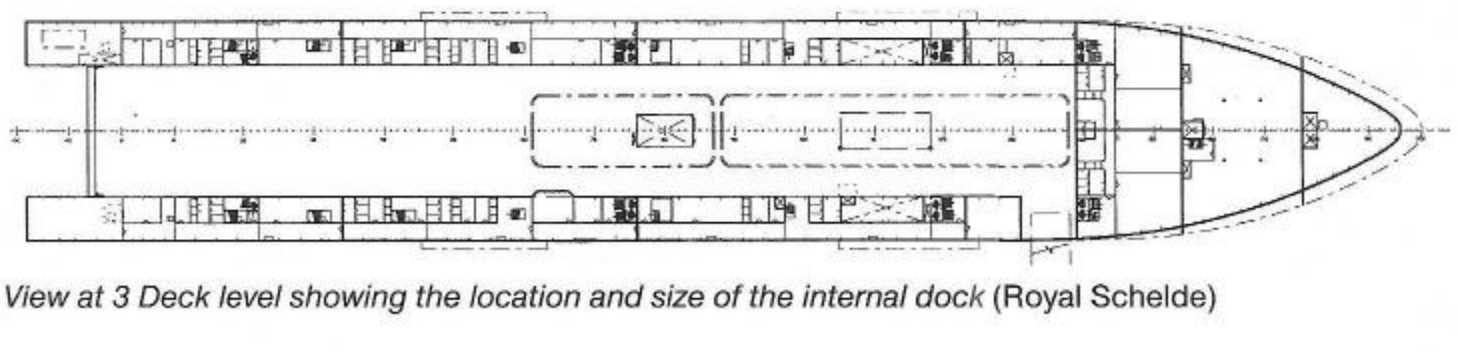
The Mk 36 SRBOC (Super Rapid Boom Offboard Countermeasures) system consists of launcher, launcher control, power supplies, ready service lockers and munitions. The Mk 137 launcher has six 130 mm fixed tubes arranged in parallel rows at angles of 45 and 60°. The firing circuits use electromagnetic induction to initiate the propelling charges in the cartridges. The prime cartridge is the Mk 182 Torch with chaff payload.

Specifications

Launcher dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Launcher weight: 173 kg (381.46 lb)
Mk 182 cartridge dimensions: 1,209 × 130 mm (47.59 × 5.11 in)
Cartridge weight: 22.7 kg (50.05 lb)

AN/SLQ-25 Nixie acoustic torpedo decoy system

The AN/SLQ-25 Nixie is a solid-state, modular design electro-acoustic countermeasures decoy system used to protect various classes of ships from acoustic homing torpedoes. It consists of a remote-control unit which can activate, deactivate and monitor the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming and recovering the towed bodies (which are stored on racks attached to the winch), a coaxial switching unit which selects the appropriate cable or load, and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body and either a deck edge tow chock or two fleet angle compensators (below-deck installations only).



View at 3 Deck level showing the location and size of the internal dock (Royal Schelde)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

No announcement has been made but combat data systems will be installed.

COMMUNICATIONS SYSTEMS

Datalinks

Link 11
Link 14
Satcom

WEAPONS CONTROL

Signaal IRSCAN Infra-red detector

Dutch LPD. It has been announced that this ship will carry the IRSCAN fast-reaction infra-red surveillance system, which has been under development by Signaal

since the mid-1980s, which is designed to detect both air and surface targets, which will be retrofitted into the Royal Netherlands Navy's Goalkeeper systems. IRSCAN is a modular, lightweight (336 kg), omnidirectional passive surveillance system which will be used in this application to detect and track targets in support of the Goalkeeper system. It consists of a stabilised sensor head, an air drier, an electronics cabinet and a control console all linked by fibre optic cable. The system can automatically track up to 32 targets, with a typical detection range of 6.5 n miles (12 km) against missiles and 8.1 n miles (15 km) against aircraft, and a typical reaction time is 2.5 seconds. The scanner has a 1,024 element staggered line array with CMT elements covering only the 8 to 12 μm range. The scanner has a scanning speed of 84 rpm and an elevation coverage of 14°.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADARS

Signaal DA08

Dutch ATS only. The DA08 is a high-power, coherent F-band radar for medium- to long-range surveillance and target indication to weapon control systems. The antenna is mounted on a lightweight hydraulically stabilised platform, providing considerable top weight reduction. The synthesiser-driven travelling wave tube transmitter provides for a great flexibility over a wide-band frequency, with pulse-to-pulse frequency agility. Together with the low sidelobe level of the antenna, the radar has a high performance in an electronic countermeasures polluted environment. Excellent clutter suppression is the result of the application of stabilisation, a dual beam antenna, dual receiver with a high dynamic range, quadrature digital Moving Target Indicator (MTI) or Fast Fourier Transform (FFT) processing, and circular polarisation.

Specifications

Beamwidth azimuth: 1.55°
Beamwidth elevation: Cosec² up to 40°
Rotation speed: 10/20 rpm
Processing: MTI
Stabilisation: Roll and pitch
Transmitter: F-band coherent (3-4 GHz) TWT system
Power output: 145 kW peak; 5 kW average
PRF: 500/1,000 Hz
Detection range (2 m² target): MTI version 185 km (115 n miles)
Resolution: Bearing 1.55°; range 90 m (295.2 ft)

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Kelvin Hughes ARPA

Dutch ATS only. A Kelvin Hughes ARPA will be used for surface search. It operates in the I-Band.

Navigation and CCA

Dutch ATS only. Two I-band sets, probably identical, will be used for navigation and carrier-controlled approach (CCA).

Spanish LPD
No details of the radar fit have yet been given.

PROPULSION

Dutch ATS only

Specifications

System: Diesel electric
Main machinery: 4 Stork-Werkspoor 12SW28 diesel generators, 14.6 MW sustained; 2 Holec electric motors, 12 MW (16,320 hp)
Shafts: 2, fixed pitch
Thruster: 1 bow thruster, 185 kW (252 hp)
Emergency power: 1—1,000 kW generator set

Spanish LPD only

Specifications

System: Diesel
Main machinery: 4 Bazan-MAN-B&W diesel engines, 8 MW
Shafts: 2
Thrusters: 2 bow thrusters (2 × 500 kW)
Auxiliary power: 4 1,500 kW diesel generators; one 400 kW emergency generator

FURTHER INFORMATION

PROGRAMME

Dutch ATS

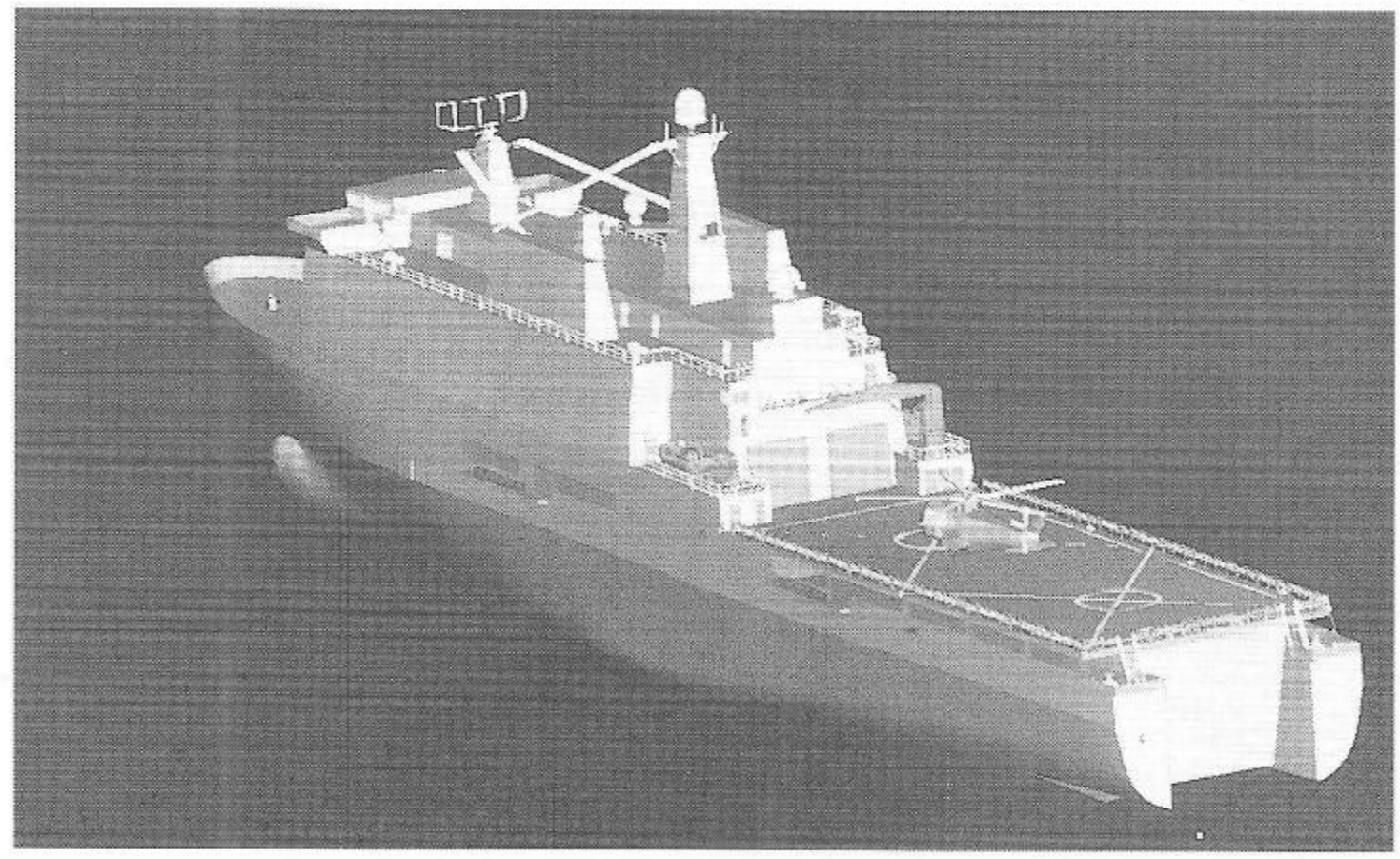
From the national point-of-view, the Dutch ATS is required to be an open ocean vessel, capable of operating anywhere in the world (except the Arctic) as part of a national or international task group, the latter either as part of the UK-NL Amphibious Force or some other NATO or ad hoc coalition. The ship is required to carry out its missions in sea-states up to 6 and to deploy and recover its landing craft up to Sea State 4.

Apart from amphibious operations, the ATS is required to be capable of operating as a helicopter carrier for ASW operations, as a support/ headquarters vessel for mine countermeasures operations, as well as acting as a general personnel or vehicle transport. In addition, in peacetime it is intended to be capable of carrying out search-and-rescue missions for environmental and disaster relief, which could include accommodating and evacuating refugees, provision of medical services and acting as a pollution control vessel. Finally, it is also expected to be capable of acting as a submarine rescue platform. It has a full range of naval and military command and control facilities, and has an NBCD citadel.

The design and procurement strategy is that the specification is based on the use of commercial standards (Lloyd's +100A1) and commercial equipment, except where military equipment is absolutely essential. The ship is being built to Lloyd's Register of Shipping rules and incorporates the latest IMO/SOLAS/MARPOL requirements, while overall quality control standards must meet ISO9001.

Spanish LPD

The name of this ship has been long rumoured but remains unconfirmed. The ship was authorised on 29 July 1994 and the second of class may be authorised in 1996/97. Ship will be able to transport a fully equipped battalion of marines and will be built to commercial standards with military command and control and NBCD facilities. As well as amphibious functions, the ship can also be used as general logistics support ship for both military and civil operations, including environmental and disaster relief.



Spanish LPD (Bazan)

PROPULSION

One of the major differences between the Dutch and Spanish versions of the ship, is the propulsion system, with the Dutch ship having diesel-electric propulsion. The Dutch analysis revealed that the ship will have a very varied operational profile. For amphibious operations it will be required to proceed at below 5 kts, but with a high auxiliary load, while in transit it will be required to maintain a speed of 12-15 kts for very long periods. Other elements requiring power include elevators, ramps, cranes a bow-thruster, while the 'hotel' requirements for some 700 people in conditions ranging from tropical to semi-arctic impose considerable loads.

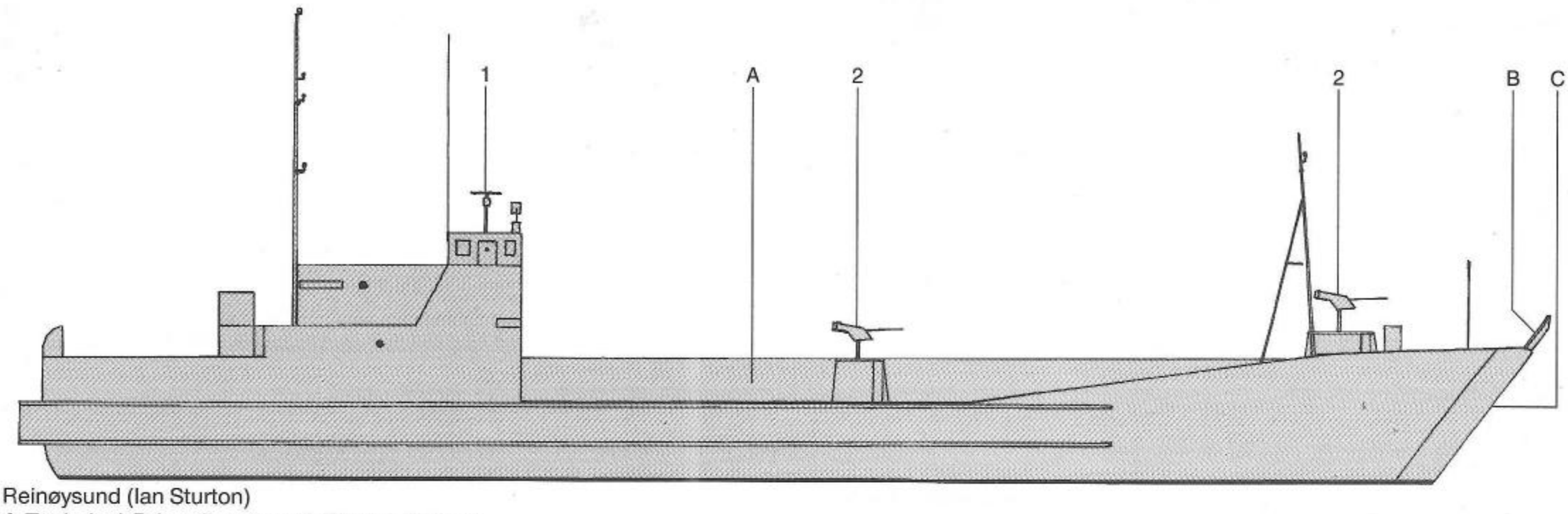
The choice eventually narrowed to two options. One was a diesel direct hybrid system, consisting of a diesel engine with a small electric motor added to each gearbox. The other was a diesel-electric system, using asynchronous motors, with speed control using a pulsewidth modulation convertor, and fixed-pitch propellers. The latter was eventually selected, partly on the grounds of its operational efficiency, but also because it offers a substantial reduction in through-life costs.

NBCD

For NBCD the ship is provided with an NBCD citadel, with a single decontamination centre, and a washdown system. Deep shelters are available and the ship is designed to operate for up to 24 hours in a 'closed' down condition.

A wet pressurised firemain is installed, subdivided into four sections. All accommodation areas will have a wet sprinkler system and the ammunition magazines will have a separate IMO standard sprinkler system. Machinery spaces and other hazardous areas will have a fixed foam system. Standard Royal Netherlands Navy portable firefighting and damage control equipment will be installed throughout the ship.

REINØYSUND



Reinøysund (Ian Sturton)
A *Tank deck* **B** *Landing ramp* **C** *Clamshell doors*

1 Navigation-radar **2** Rheinmetall Rh202 20 mm cannon

GENERAL SPECIFICATIONS

Operator: Norway

Class: REINØYSUND (LCT)

Built: 5
Active: 5

UNMODERNISED
Reinøysund (L 4502), Rotsund (L 4505)
Displacement:
full load: 604 t

Dimensions
Length: 52.1 m (171 ft)
Beam: 10.3 m (33.8 ft)
Draught: 1.8 m (5.9 ft)

MODERNISED
Sørøysund (L 4503), Maursund (L 4504), Tjeldsund (L 4506)
Displacement:
full load: 863 t

Dimensions
Length: 60.5 m (198.5 ft)
Beam: 10.3 m (33.8 ft)
Draught: 1.8 m (5.9 ft)

All
Speed: 11.5 kts
Complement: 10 (including two officers)

SHIPS

REINØYSUND (L 4502)
Builder Mjellem & Karlsen, Bergen, Norway
Commissioned Jan 1972

SØRØYSUND (L 4503)
Builder Mjellem & Karlsen, Bergen, Norway
Commissioned May 1972

MAURSUND (L 4504)
Builder Mjellem & Karlsen, Bergen, Norway
Commissioned Sep 1972

ROTSUND (L 4505)
Builder Mjellem & Karlsen, Bergen, Norway
Commissioned Nov 1972

TJELDSUND (L 4506)
Builder Mjellem & Karlsen, Bergen, Norway
Commissioned Feb 1973

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200
- Tanks: 7

WEAPONS SYSTEMS

GUNS

Rheinmetall 20 mm/85 multipurpose cannon

Three Rheinmetall 20 mm multipurpose cannon in manual mounts. The 85 calibre Rh 202 is 2.61 m long and is capable of single shot or automatic fire. Naval versions use either a conventional single belt feed in which rounds enter from the right and spent cartridges are ejected to the left, or the Type 2 two-way belt-feed mechanism.

Specifications
Gun — Rh 202
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,250 m/s (3,444-3,772 ft/s)
Rate of fire: 800-1,000 rds/min
Crew: 1-2
Range: 1 n mile (1.85 km)

COMMAND AND CONTROL SYSTEMS

RADAR

There is a navigation radar set with an antenna on the bridge roof. Type is unknown.

PROPULSION

Specifications
System: Diesel
Main machinery:
Unmodernised: *Reinøysund* (L 4502), *Rotsund* (L 4505). Two MTU MD diesels, 992 kW (1,350 hp)

Modernised: *Sørøysund* (L 4503), *Maursund* (L 4504), *Tjeldsund* (L 4506). Two Deutz MWM TBD 234 V12 diesels 992 kW (1,350 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

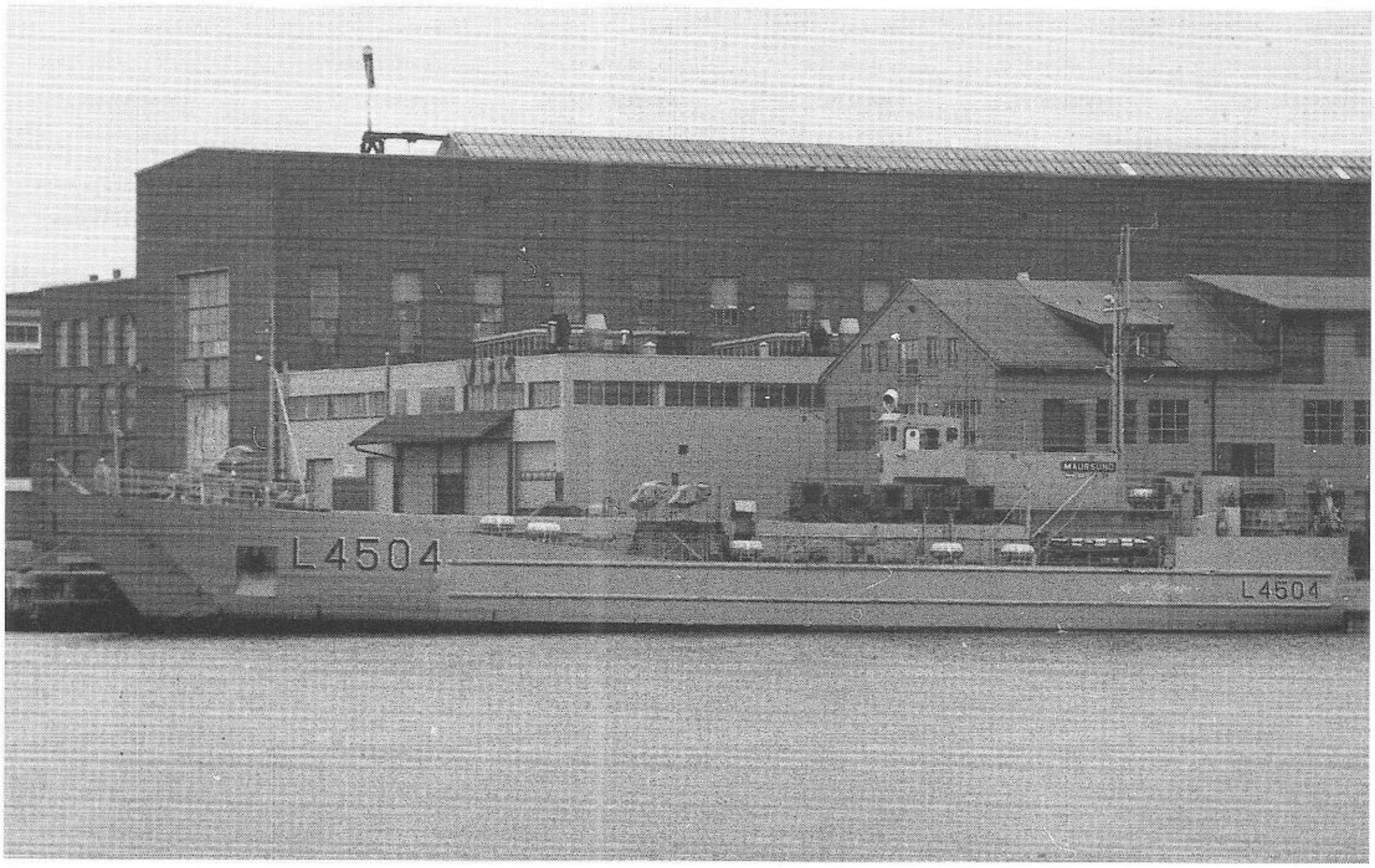
Two 'Kvalsund' class landing craft utility (LCU) were built for the Royal Norwegian Navy (R Nor N) in 1970. The five-strong 'Reinøysund' class was built slightly later, but to the same basic design. The 'Kvalsund' class was deleted in 1992, but the 'Reinøysund' class will remain in service until its replacements are completed, which is scheduled to be in about 1999.

DESIGN

These small LCUs which were built for the Royal Norwgian Navy have two clamshell, vertically-hinged doors, with a long, double-hinged, bow ramp protruding above them when closed. The superstructure is offset to starboard. The tank deck will hold seven Leopard tanks of the type operated by the Norwegian Army. These vessels have also been used as minelayers, and at one time had rails for 120 mines.

MODERNISATION

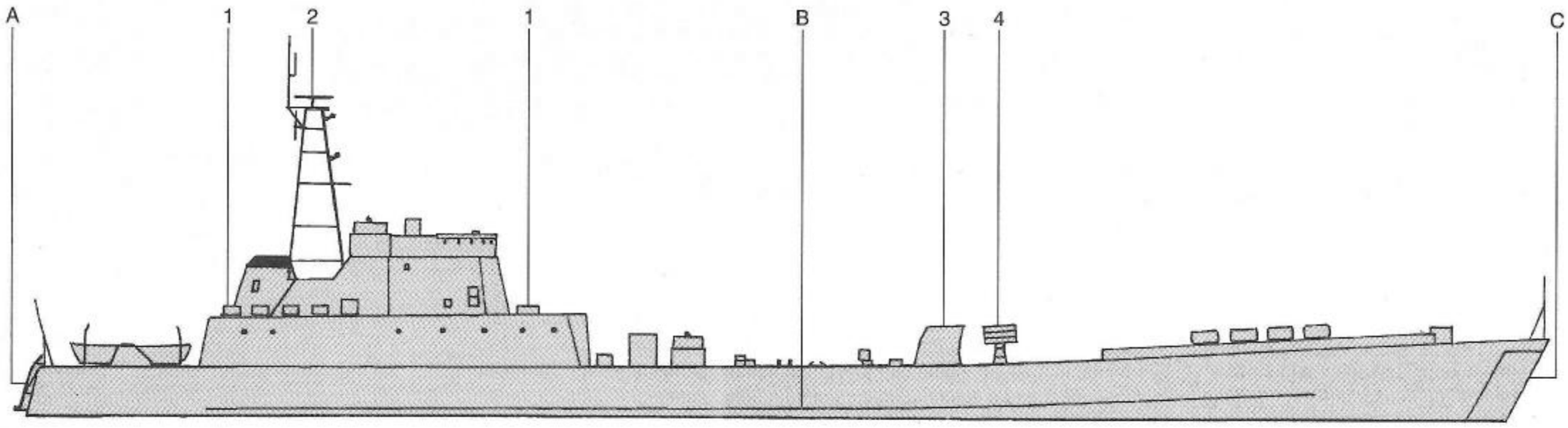
In 1995/96 three of the class were lengthened and given more modern engines. The remaining two are scheduled to receive a similar refit in 1996/97.



Maursund *(L 4504)*

POLNOCHNY

OVERVIEW



Polnochny A (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Tank deck* **C** *Clamshell bow doors with internal ramp*

General 1 *AK-230 30 mm CIWS* **2** *Strut Curve navigation radar* **3** *Rocket efflux deflection screen* **4** *BM-14 18-tube rocket launcher*

PROGRAMME

Some 86 of these landing ships were built at the Polnochny yard at Gdansk in Poland from 1963 onwards, most being supplied to the Russian fleet, from which many were later re-exported to third parties. 24 were also built for the Polish Navy. The numbers in the Russian fleet are reducing rapidly, while many others, both in the Russian and other fleets, are in varying states of disrepair, with spares being a problem for many users, although they will be seen on the world's oceans for many years to come.

DESIGN

There are four sub-types, all to the same basic design, although there are a number of differences, particularly in the length, and, as a result, the carrying capacity. Thus, the original design, Polnochny A was 73.0 m (239.5 ft) long, while the -B was 75.0 m (246.1 ft), the -C 81.3 m (266.7 ft), and the final (export-only) -D version 83.9 m (275.3 ft). There were other changes, also, with the convex forecastle shape and almost vertical stern in the Polnochny A giving way to a more weatherly concave shape, increased flare and a more acutely angled stern in later types. There are also minor variations in the stack, that in the Polonochny-B being much taller than in other variants. Polnochny-As and -Bs have pole masts, while -Cs and -Ds have lattice masts. Polnochny-Cs and -Ds also have a somewhat longer built-up section amidships. There are also variations in armament.

Alone in the class, the Polnochny-D has a helicopter deck forward of the superstructure, with a large rectangular hatch in it. This is too small for the helicopter to be lowered and appears to be used to raise stores from the upper deck, prior to loading in or under the helicopter.

The relatively small size and low freeboard suggest that these are essentially short range ships, designed for coastal operations. The clamshell bow doors are on lifting hinges which enable them to lift slightly and then draw back along the side of the bow. Inside, there is a long off-loading ramp. There is a large, sliding hatch in the forward end of the upper deck to enable stores to be loaded or unloaded by a dock-side crane direct into the tank deck. There is, however, no ramp to enable vehicles to access the upper deck from the tank deck.

DESIGNATION

The designation 'Polnochny' is the NATO reporting name, and is, in fact, the Polish name of the shipyard where the ships were built. Under the Polish system the four designs were allocated type numbers:

TABLE I: 'POLNOCHNY' CLASS - MAJOR CHARACTERISTICS

Specification	Polnochny A	Polnochny B	Polnochny C	Polnochny D
Displacement				
standard	762 t	772 t	1,137 t	
full load	812 t	847 t	1,168 t	1,325 t
Dimensions				
length	73.0 m (239.5 ft)	75.0 m (246.1 ft)	81.3 m (266.7)	83.9 m (275.3 ft)
beam	8.5 m (27.7 ft)	9.6 m (31.5 ft)	9.7 m (31.8 ft)	9.7 m (31.8 ft)
draught	1.8 m (5.8 ft)	2.3 m (7.5 ft)	2.4 m (7.9 ft)	2.4 (7.9 ft)
Speed	19 kts	19 kts	18 kts	15 kts
Range	1,000 n miles at 18 kts	1,000 n miles at 18 kts	2,600 n miles at 12 kts	2,900 n miles at 12 kts
Machinery	2x Kolomna Type 40-D diesels, 3.2MW (4,400 hp)	2x Kolomna Type 40-D diesels, 3.2MW (4,400 hp)	2x Kolomna Type 40-D diesels, 3.2MW (4,400 hp)	2x Kolomna Type 40-D diesels, 3.2MW (4,400 hp)
Flight deck	No	No	No	Yes
Complement	40-42	40-42	40-42	45

TABLE II: 'POLNOCHNY' CLASS - NUMBERS PRODUCED, CUSTOMERS, AND SURVIVING SHIPS

Country	Number acquired	Year	Type	Number in service	Remarks
Algeria	1*	1976	Polnochny B	1	
Angola	3*	1977-79	Polnochny B	3	Note 1
Azerbaijan	2*	1992	Polnochny B	2	Note 2
Bulgaria	2*	1986-87	Polnochny A	2	
Cuba	2*	1982	Polnochny B	1	
Egypt	3*	1974	Polnochny A	3	
Ethiopia	2*	1981 - 1 1983 - 1	Polnochny B	—	Scrapped - 1 Not known - 1
India	2**	1966	Polnochny A	—	Scrapped Project 770T
India	4**	1975-76	Polnochny C	4	
India	4**	1985 - 2 1986 - 2	Polnochny D 4		
Iraq	4**	1977-79	Polnochny D	0	Sunk - 3 In Iran - 1
Libya	4**	1977 - 2 1979 - 2	Polnochny D 3		Lost in fire - 1

Type 770 Polochny A
Type 770T Export version for India
Type 771 Polnochny B
Type 773 Polnochny C
Type 776 Polnochny D

The major characteristics of the four types are shown in Table I, and the details of operators and surviving ships in Table II.

A Polnochny A of the Polish Navy in the role for which the ship was built: landing armoured vehicles (in this case PT-76 reconnaissance tanks) across a beach. Some 90 of these capable vessels were built; all in Polish yards (Cenzin)

TABLE II cont.

Country	Number acquired	Year	Type	Number in service	Remarks
Poland	23***	1965-68	Polnochny A	—	1.Deleted 1991/92 2. See Note 4
	1***	1973	Polnochny C (modified)	1	Used as command ship
Russia	14*	1963-68	Polnochny A	4	
Russia	29*	1968-70	Polnochny B	12	
Russia	8*	1970-74	Polnochny C	6	
Somalia	1*	1976	Polonochny A	0	Note 3
Syria	3*	1984-85	Polnochny B	3	
Ukraine	1*	1994	Polnochny C	1	ex-Russian Navy
Vietnam	3*	1979-80	Polnochny B	3	
Yemen	3*	1973 - 1 1977 - 1 1979 - 1	Polnochny A	1	
TOTAL				**50**	

Notes:
* Built in Poland, supplied to the Russian Navy and later transferred to third parties.
** Built in Poland and exported direct.
*** Built in Poland for Polish Navy

1. Both are reported to be unserviceable.
2. Units of the Russian Caspian Fleet were transferred to Azerbaijan in 1992, including two Polnochny Bs. Russia resumed control in 1995 in order to ensure adequate maintenance and support, but the two ships are listed separately to reflect their actual ownership.
3. One Polnochny A was transferred from Russia to Somalia in December 1976. After the Somali revolution in 1991, all naval ships except the Polnochny and four 'Mol' class torpedo boats were sunk, but the survivors were ransacked, with every fixture and fitting removed. The fate of the Polnochny is not known, but it is unlikely to be serviceable.
4. At least two appear to remain in service, but as general transports.

POLNOCHNY A (Type 770)

GENERAL SPECIFICATIONS

Country of origin: Poland
Operators: see accompanying table
Type: Type 770

Class: POLNOCHNY A

Displacement:
standard: 762 t
full load: 812 t

Dimensions
Length: 73 m (239.5 ft)

	Bulgaria	Egypt	India	Poland	Russia	Somalia	Vietnam	Yemen	Totals
Purchased	2	3	2	23	14	1	1	1	**47**
Active (1 January 1997)	2	3	0	0	4	0	1	1	**11**

Beam: 8.5 m (27.9 ft)
Draught: 1.8 m (5.8 ft)

Speed: 19 kts
Range: 1,000 n miles at 18 kts

Complement: 40

SHIPS

Bulgaria

SIRIUS (701) (ex-Ivan Zagubanski)
ANTARES (702)

Egypt
301, 303, 305

Russia
Four ships (designation not known)

Vietnam
HQ 512

Yemen
SIRA (137)

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 180 Troops
- or 350 tonnes including up to six tanks or armoured personnel carriers.

SHIP-SHORE LIFT

- None

AMPHIBIOUS FACILITIES

- Two clamshell doors with lifting hinges.
- Tank deck 36.9 × 5.2 m (120 × 17 ft).
- Kedge anchor at stern.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 Grail (Strela-2M)

All Russian ships and some others, but not the Bulgarians, are armed with two SA-N-5 Grail quad launchers, each with 32 missiles. SA-N-5 is the NATO designation for the Russian Strela-2M (Strela = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and he partially pulls the trigger to activate the missile gyros, which are tame some four to six seconds to warm up. The operator uses stadia reference marks in his optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (91.84 ft/s) and spinning it up. Then, at a distance of 6 m (19.6 ft), the sustainer ignites and the trailing fins pop out.

The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg armour-piercing RDX warhead. In Strela 2M the (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has improved fragmentation uniformity.

According to a Polish source, the missile installation is designated Fasta 4M while the missiles are designated Strzala-2M and a total of 16 missiles are carried.

Specifications
(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 2.6 n miles (5.5 km)
Altitude: 18 - 4,500 m (60 - 15,000 ft)
Guidance: IR homing

Manufacturer/Contractor
Fakel, Russia.

GUNS

AK-230 30 mm/65 twin

These ships have two twin AK-230, remotely operated, twin barrel, automatic anti-aircraft guns, with one mounting before the bridge, the other at the after end of the superstructure. These are designed to engage air targets at heights of up to 4,000 m (13,120 ft) and are also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically-powered mounting consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system. Russian ammunition for this weapon consists of two rounds; BR-83 and OF-83D (see Specifications).

The fire-control radar is the I/J-band Rys (NATO = Drum Tilt) fire-control radar, whose maximum acquisition range is approximately 22 n miles (40 km).

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft/s)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb))
Crew: 2 (off mount)

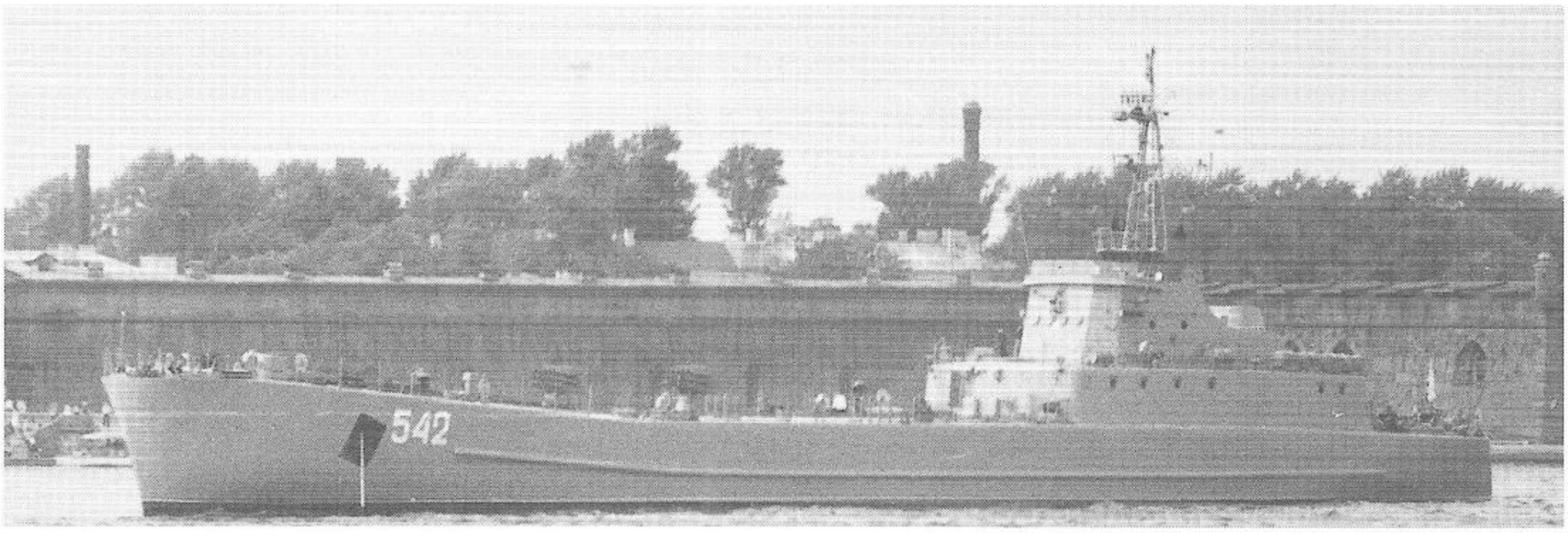
Ammunition
BR-83:
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.24 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D:
Type: High explosive
Weight (complete round): 1.40 kg (3.1 lb)
Projectile: 0.27 kg (0.59 lb)
Explosive: 30 g (A-XI-2) (1.05 oz)

BM-14 140 mm 18-tube rocket launchers

Two BM-14 rocket launchers are mounted on the upper deck. The BM-14 was developed specifically for the 'Polnochny' class and consists of 18 launch tubes in a framework fitted to an electrically-operated pintle mounting. The launch tubes are reloaded manually and like the land-based system it is likely to be able to traverse 200° and to elevate 0 to +52°. The launcher fires 139 mm (5.5 in) diameter unguided spin-stabilised M-14-OF rockets which have either HE-fragmentation, smoke or chemical warheads.

Specifications
Rockets
Diameter: 139.7 mm (5.5 in)
Length: 1.092 m (3.58 ft)
Weight:
round: 39.62 kg (87.35 lb)
warhead: 18.3-18.8 kg (40.3-41.45 lb)
Range: 400-9,810 m (437-10,730 yd)
Max velocity: 402 m/s (1,320 ft/s)



A Polnochny A of the (then) Soviet Navy. Note the almost vertical stern, concave shape to the forecastle and short superstructure (H & L van Ginderen Collection)

COMMAND AND CONTROL SYSTEMS

RADARS

Spin Trough

All except Egyptian ships. Spin Trough is a Russian-made, I-band, navigation radar.

Racal-Decca

Egyptian ships only. One Racal-Decca, I-band set for navigation.

Drum Tilt

All except Bulgarian ships. This is a pedestal-mounted fire-control radar providing acquisition and tracking functions only for the 30 mm guns. It is housed in a weatherproof container which is attached to the scanner assembly tilted at about 25°. Maximum acquisition range of aerial targets is approximately 22 n miles (41 km). Operating frequency is in the I-band.

AVIATION

None

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kolomna Type 40-D diesels, 3.2 MW (4,400 hp) sustained
Shafts: 2

FURTHER INFORMATION

Bulgaria
The Bulgarian ships were transferred from Russia in 1986/87 and are fitted with neither the SA-N-5 Grail surface-to-air missile system nor the Drum Tilt fire-control radar. Plans to convert them to minelayers have been shelved and both are now used as transports, based at Atiya. Bulgaria is reported to be planning drastic reductions to its naval fleet, which may well effect the future of these ships.

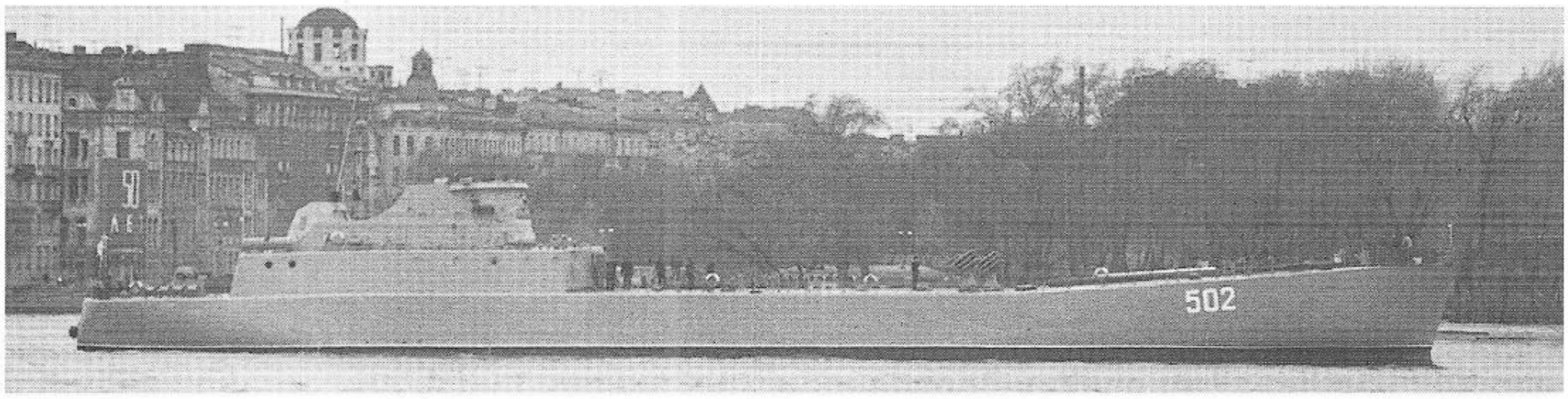
Egypt
The Egyptian ships were transferred from Russia in 1973/74. All were used to provide logistic support during the Gulf War in 1990/91. Some may carry SA-N-5 launchers.

Poland
Poland acquired 23 Polnochny-As for its own use, but none are now employed in the amphibious role. Most have been stricken, but at least two, *Goplo* (809) and *Gdynia* (810), are used as general transports.

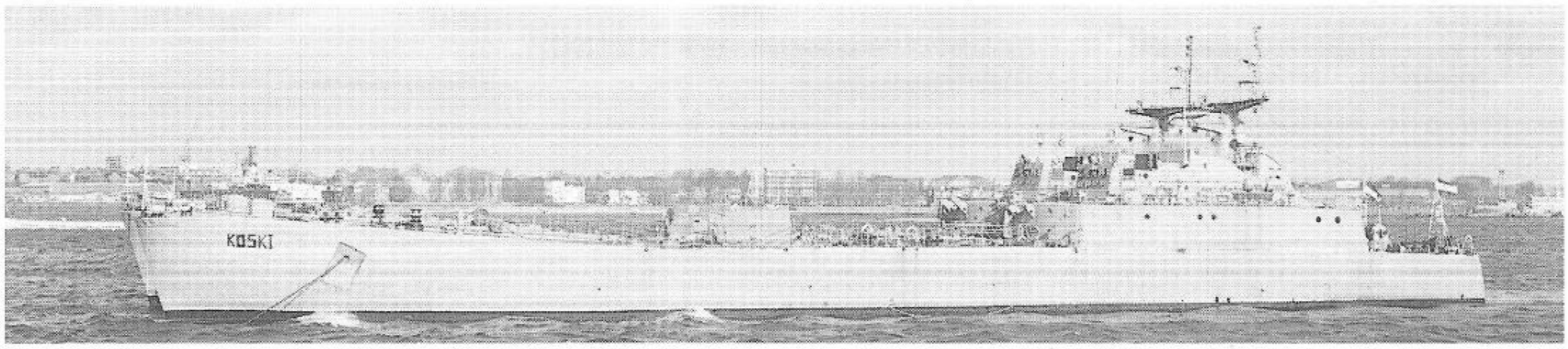
Russia
Many of the Russian Navy's Polnochnys have already been paid off, and some of the survivors are thought to be in doubtful condition. The four surviving Polnochny As are all in the Caspian Sea.

Vietnam
The Russian Navy transferred two Polnochny Bs to Vietnam, one in May 1979 the other February 1980, which was followed by the third — a Polnochny A — in November 1979.

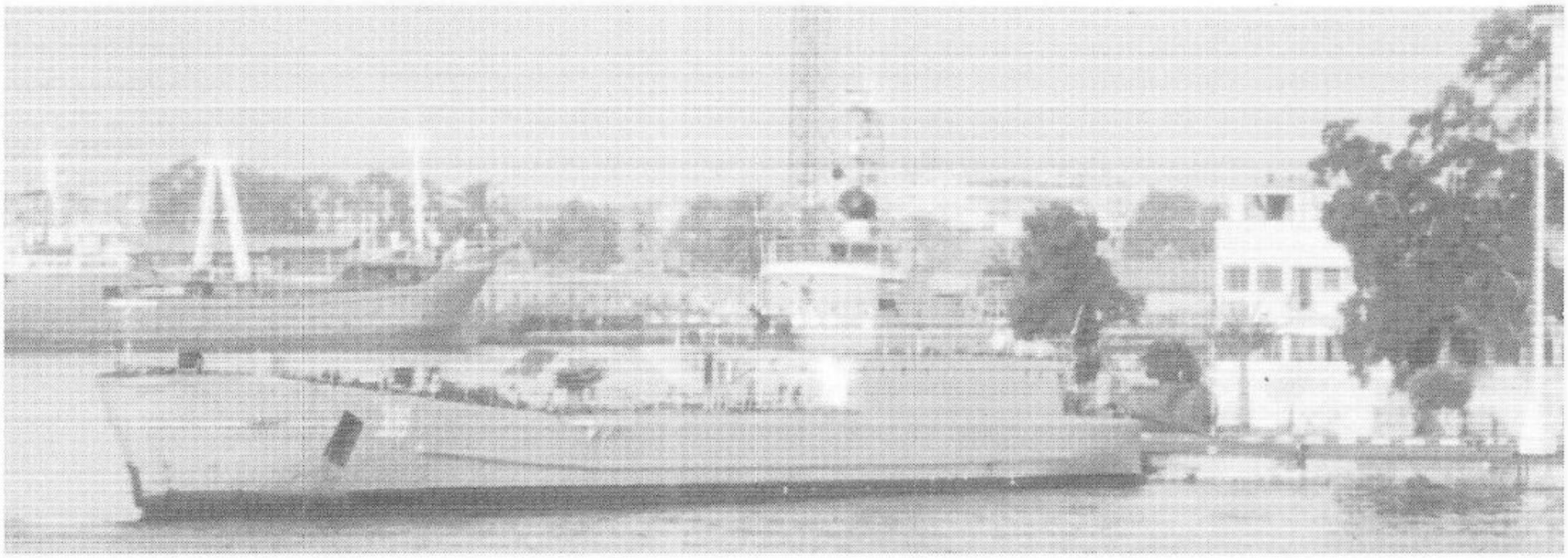
Yemen
Three Polnochnys were transferred from the Russian Navy to the People's Democratic Republic of South Yemen: two in August 1973 and one in July 1977. No 138 burned out in March 1986 and No 136 was unserviceable by 1993, but No 137 was reported still to be seaworthy in late 1995



Polnochny A of the Russian Navy (H & L van Ginderen Collection)



Two Polnochny As, photographed in 1990. These two ships are named Koski *and* Ranta *and fly the Honduran flag but no record can be found of their transfer* (H & L van Ginderen Collection)



Polnochny A 305 of the Egyptian Navy (H & L van Ginderen Collection)

POLNOCHNY B (Type 771)

GENERAL SPECIFICATIONS

Country of origin: Poland
Operators: Algeria, Cuba, Russia, Syria, Vietnam
Type: Type 771

Class: POLNOCHNY B

Displacement:
standard: 760 t
full load: 834 t

Dimensions
Length: 75 m (246.1 ft)

	Algeria	Angola	Azerbaijan	Cuba	Ethiopia	Russia	Syria	Vietnam	Totals
Purchased	1	3	2	2	2	29	3	3	**45**
Active	1	3	2	1(?)	1	12	3	3	**26**

Beam: 9.6 m (31.5 ft)
Draught: 2.3 m (7.5 ft)

Speed: 19 kts

Range: 1,000 n miles at 18 kts; 1,500 n miles at 15 kts

Complement: 40

SHIPS

Algeria

471

Cuba
690

Syria
1-114, 2-114, 3-114

(Other ship names/numbers not known).

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops 180
- or 350 tonnes including up to six tanks.

SHIP-SHORE LIFT

- None

AMPHIBIOUS FACILITIES

- Two clamshell doors with lifting hinges.
- Tank deck 45.7 × 5.2 m (150 × 17 ft)
- Kedge anchor at stern.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 Grail (Strela-2M)

All Russian Polnochny Bs and some others are armed with four SA-N-5 Grail quad launchers, each with 32 missiles. SA-N-5 is the NATO designation for the Russian Strela-2M (*Strela* = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and he partially pulls the trigger to activate the missile gyros, which are tame some four to six seconds to warm up. The operator uses stadia reference marks in his optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (91.84 ft/s) and spinning it up. Then, at a distance of 6 m (19.68 ft/s), the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.42 lb) armour-piercing RDX warhead. In Strela 2M the (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has improved fragmentation uniformity.

According to a Polish source, the missile installation is designated Fasta 4M while the missiles are designated Strzala-2M and a total of 16 missiles are carried.

Specifications

(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 5.5 km (2.6 n miles)
Altitude: 18 - 4,500 m (60 - 15,000 ft)
Guidance: IR homing

Manufacturer/Contractor

Fakel, Russia.

GUNS

AK-230 30 mm/65 twin

These ships have two twin AK-230, remotely operated, twin barrel, automatic anti-aircraft guns, one forward of the bridge, the other at the after end of the superstructure. This weapon is designed to engage air targets at heights of up to 4,000 m (13,120 ft) and is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically-powered mounting consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system. Russian ammunition for this weapon consists of two rounds; BR-83 and OF-83D (see Specifications).

The fire-control radar is the I/J-band Rys (NATO = Drum Tilt) fire-control radar, whose maximum acquisition range is approximately 40 km (22 n miles).

Specifications

NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,450 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,000 ft)
Rate of fire: 1,000 rds/min/gun
Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.24 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D:
Type: High explosive
Weight (complete round): 1.40 kg (3.09 lb)
Projectile: 0.27 kg (0.59 lb)
Explosive: 30 g (1.06 oz) (A-XI-2)

BM-14 140 mm 18-tube rocket launchers

Two BM-14 rocket launchers are mounted. The BM-14 was developed specifically for the 'Polnochny' class. The BM-14 consists of 18 launch tubes in a framework fitted to an electrically operated pintle mounting. The launch tubes are reloaded manually and like the land-based system it is likely to be able to traverse 200° and to elevate 0 to +52°.

The launcher fires 139 mm diameter unguided spin-stabilised M-14-OF rockets which weigh more than 39 kg (86 lb) and are 1.092 m long (3.58 ft). They can have either HE-fragmentation, smoke or chemical warheads.

Specifications

Rockets
Diameter: 139.7 mm (5.5 in)
Length: 1.092 m (3.58 ft)
Weight:
round: 39.62 kg (87.35 lb)
warhead: 18.3-18.8 kg (40.3-41.45 lb)
Range: 400-9,810 m (437-10,730 yd)
Max velocity: 402 m/s (1,320 ft/s)

COMMAND AND CONTROL SYSTEMS

RADARS

Don-2
Don-2 is a frequently found Russian navigation radar, originally introduced in the 1950s. It operates in the I-band.

Spin Trough
Cuban ship may have Spin Trough in place of Don-2.

Drum Tilt
This is a pedestal-mounted fire-control radar which probably provides acquisition and tracking functions only for 25 and 30 mm anti-aircraft guns. It is housed in a weatherproof container which is attached to the scanner assembly tilted at about 25°. Maximum acquisition range of aerial targets is approximately 41 km (25.47 miles). Operating frequency is in the I-band.

IFF
Square Head
High Pole B

AVIATION

None

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kolomna Type 40-D diesels, 3.2 MW (4,400 hp) sustained
Shafts: 2

FURTHER INFORMATION

Algeria
The ship was transferred from Russia in August 1976 and was originally numbered 555.

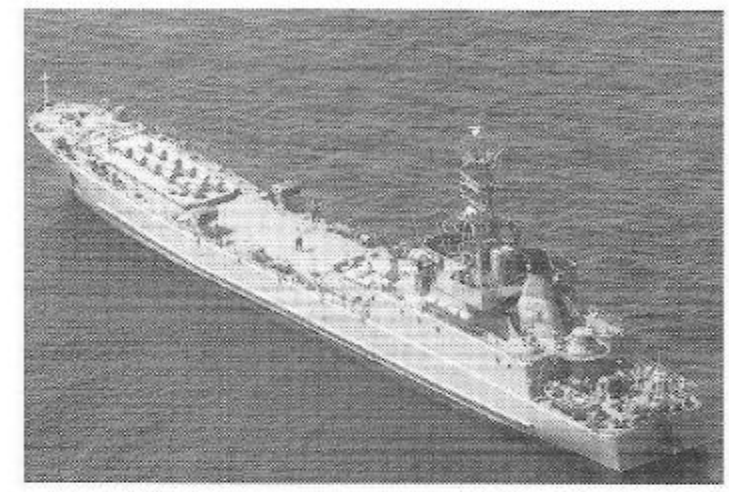
Cuba
The ship was transferred from Russia on 4 December 1982 and is reported to be currently non-operational, despite using a second of the class for spares.

Russia
Many of these ships have already been paid off, and some of the survivors are thought to be in doubtful condition.

Eight of the surviving Polnochny Bs are in the Caspian Sea and two of these are actually owned by Azerbaijan, though operated on that country's behalf by the Russian Navy.

Four of the Russian Navy's Type Bs were converted for mines countermeasures operations (LCMs), but all except one have been stricken.

Syria
The first ship was transferred from the Russian Navy in January 1984, followed by the second pair in February 1985. All three are operational and are based at Tartous.



Polnochny B. Note the tall, thin, tapering stack, kedge anchor at stern and BM-14 rocket launchers. No rocket efflux deflectors are fitted

POLNOCHNY C

GENERAL SPECIFICATIONS

Country of origin: Poland
Operators: See table below
Type: Type 773

Class: POLNOCHNY C
Displacement:
standard: 1,120 t
full load: 1,150 t

Dimensions
Length: 81.3 m (266.7 ft)
Beam: 9.7 m (31.8 ft)
Draught: 2.4 m (7.9 ft)

Speed: 18 kts
Range: 2,600 n miles at 12 kts

Complement: 40-45

	India	Russia	Ukraine	Totals
Purchased	4	8	1	**13**
Active	4	6	1	**11**

SHIPS

India

GHORPAD (L 14)
Builder Naval Shipyard, Gdynia, Poland
Commissioned in India Mar 1975

KESARI (L 15)
Builder Naval Shipyard, Gdynia, Poland
Commissioned in India Mar 1975

SHARDUL (L 16)
Builder Naval Shipyard, Gdynia, Poland
Commissioned in India Feb 1976

SHARABH (L 17)
Builder Naval Shipyard, Gdynia, Poland
Commissioned in India Feb 1976

Russia
Four ships, designation unknown.

Ukraine
One ship, designation unknown.

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops 160
- Eight tanks or armoured personnel carriers.
- 350 tonnes stores.

SHIP-SHORE LIFT

None

AMPHIBIOUS FACILITIES

- Two clamshell bow doors with ramp.
- Tank deck. 53.3 × 6.7 m (175 × 22 ft).
- Kedge anchor at stern.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 Grail (Strela-2M)

All Russian Polnochny Cs and some others are armed with four SA-N-5 Grail quad launchers, each with 32 missiles. SA-N-5 is the NATO designation for the Russian Strela-2M (*Strela* = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

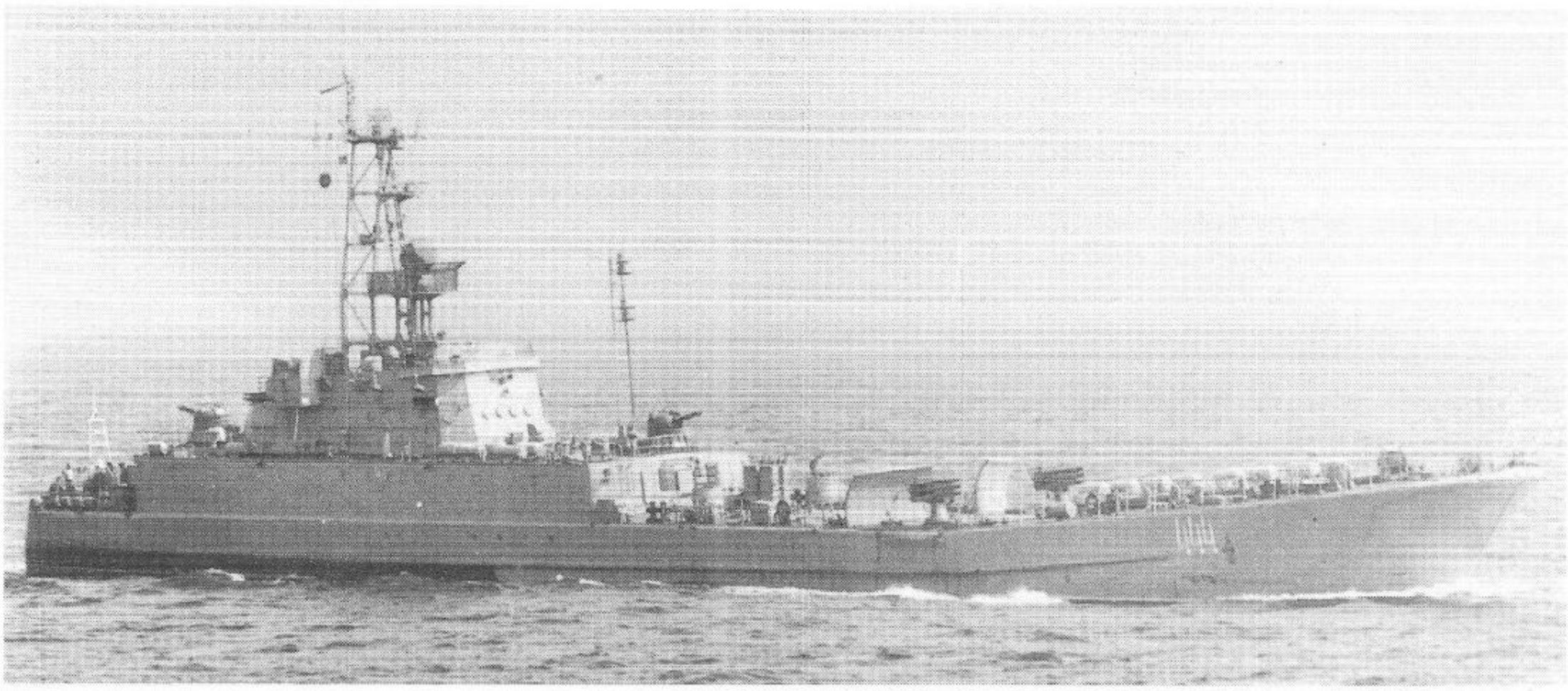
When the target is acquired the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and he partially pulls the trigger to activate the missile gyros, which take some four to six seconds to warm up. The operator uses stadia reference marks in his optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (91.8 ft/s) and spinning it up. Then, at a distance of 6 m (19.6 ft), the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M the (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has improved fragmentation uniformity.

According to a Polish source, the missile installation is designated Fasta 4M while the missiles are designated Strzala-2M and a total of 16 missiles are carried.

Specifications

(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg 21.98 lb)
Speed: Mach 1.7



Polnochny C. Note the angled bow, twin BM-14 rocket launchers and efflux deflector plates, AK-231 CIWS (one before, one abaft the bridge superstructure) and Drum Tilt fire-control radar on the bridge roof

Range: 5.5 km (2.6 n miles)
Altitude: 18-4,500 m (60-15,000 ft)
Guidance: IR homing

Manufacturer/Contractor
Fakel.

GUNS

AK-230 30 mm/65 twin
These ships have two twin AK-230, remotely operated, twin barrel, automatic anti-aircraft guns, which are designed to engage air targets at heights of up to 4,000 m. It is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically powered mounting is 1.46 m (4.78 ft) high, 3.11 m (10.2 ft) long and 2.1 m (6.88 ft) wide, and consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system. Russian ammunition for this weapon consists of two rounds; BR-83 and OF-83D (see Specifications).
The fire-control radar is the I/J-band Rys (NATO = Drum Tilt) fire-control radar, whose maximum acquisition range is approximately 40 km (22 n miles).

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.24 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D:
Type: High explosive
Weight (complete round): 1.40 kg (3.08 lb)
Projectile: 0.27 kg (0.59 lb)
Explosive: 30 g (1.05 oz) (A-XI-2)

BM-14 140 mm 18-tube rocket launchers
Two BM-14 rocket launchers are mounted. The BM-14 was developed specifically for the 'Polnochny' class. The BM-14 consists of 18 launch tubes in a framework fitted to an electrically-operated pintle mounting. The launch tubes are reloaded manually and like the land-based system it is likely to be able to traverse 200° and to elevate 0 to +52°.

The launcher fires 139 mm diameter unguided spin-stabilised M-14-OF rockets which weigh more than 39 kg (86 lb) and are 1.092 m long (3.58 ft). They can have either HE-fragmentation, smoke or chemical warheads which weigh 18.3 (40.35 lb) to 18.8 kg (41.44 lb).

Specifications
Rockets
Diameter: 139.7 mm (5.5 in)
Length: 1.092 m (3.58 ft)
Weight:
round: 39.62 kg (87.35 lb)
warhead: 18.3-18.8 kg (40.3-41.45 lb)
Range: 400-9,810 m (437-10,730 yd)
Max velocity: 402 m/s (1,320 ft/s)

COMMAND AND CONTROL SYSTEMS

RADARS

Don 2 or Radwar SRN-745
Don-2 is the standard Russian, I-band, navigational radar in use from the mid 1950s. The Radwar SRN 745 is a Polish-made equivalent.

Drum Tilt
Drum Tilt is a pedestal-mounted fire-control radar which probably provides acquisition and tracking functions only for 25 and 30 mm anti-aircraft guns. It is housed in a weatherproof container which is attached to the scanner assembly tilted at about 25°. Maximum acquisition range of aerial targets is approximately 41 km (25 miles). Operating frequency is in the I-band.

AVIATION

None

PROPULSION

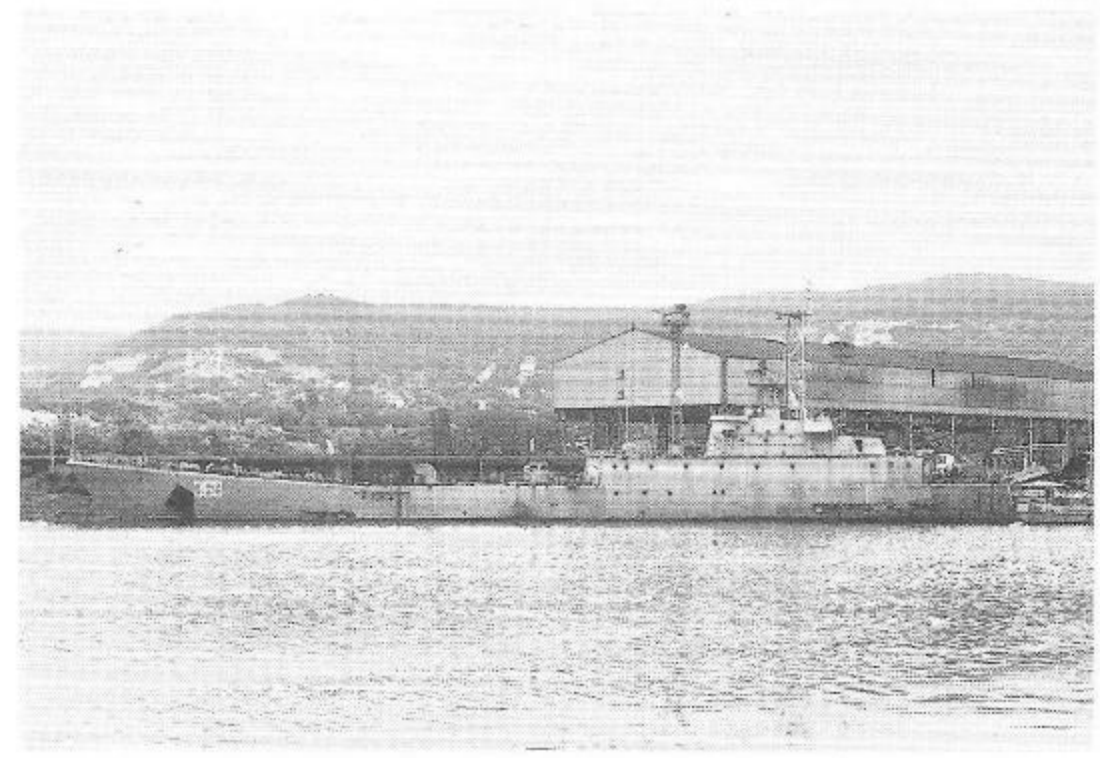
Specifications
System: Diesel
Main machinery: 2 Kolomna Type 40-D diesels, 3.2 MW (4,400 hp) sustained
Shafts: 2

FURTHER INFORMATION

India
India purchased four Polnochny Cs direct from the Polish shipyard rather than through transfers through the Russian Navy, as were most the Polnochnys which went to other countries. All the Polnochny Cs are still operational, though suffering for want of spares.

Ukraine
In the share-out of the Black Sea Fleet, the Ukrainian Navy received one Polnochny C in 1994. The ship is reported to have been laid up.

Polnochny C of the Russian Navy



Polnochny C (H & L van Ginderen Collection)

POLNOCHNY D

GENERAL SPECIFICATIONS

Country of origin: Poland
Operators: See table below
Type: Type 776

Class: POLNOCHNY D

Displacement:
full load: 1,325 t

Dimensions
Length: 83.9 m (275.3 ft)
Beam: 9.7 m (31.8 ft)
Draught: 2.4 m (7.9 ft)

Speed: 15 kts
Range: 2,900 n miles at 12 kts

Complement: 40-45

	India	Iraq	Libya	Totals
Purchased	4	3	4	**11**
Active	4	0	3	**7**

SHIPS

India

CHEETAH (L 18)
Builder Naval Shipyard, Gdynia, Poland
Commissioned in India Feb 1985

MAHISH (L 19)
Builder Naval Shipyard, Gdynia, Poland
Commissioned in India Jul 1985

GULDAR (L 21)
Builder Naval Shipyard, Gdynia, Poland
Commissioned in India Mar 1986

KUMBHIR (L 22)
Builder Naval Shipyard, Gdynia, Poland
Commissioned in India Nov 1986

Libya

IBN AL HADRAMI (112)
Builder Naval Shipyard, Gdynia, Poland
Transferred to Libya Nov 1977

IBN UMAYAA (116)
Builder Naval Shipyard, Gdynia, Poland
Transferred to Libya Jun 1978

IBN AL FARAT (118)
Builder Naval Shipyard, Gdynia, Poland
Transferred to Libya Jun 1978

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops 160
- Five main battle tanks, or four armoured personnel carriers, or five anti-aircraft guns, or eight trucks.
- 350 tonnes of stores.

AMPHIBIOUS FACILITIES

- Two clamshell bow doors with ramp.
- Tank deck. 53.3 × 6.7 m (175 × 22 ft).
- Kedge anchor at stern.

WEAPONS SYSTEMS

GUNS

AK-230 30 mm/65 twin

These ships have two twin AK-230, remotely operated, twin barrel, automatic anti-aircraft guns, which are designed to engage air targets at heights of up to 4,000 m (13,123 ft). It is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically powered mounting is 1.46 m (4.78 ft) high, 3.11 m (10.20 ft) long and 2.1 m (6.88 ft) wide, and consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system. Russian ammunition for this weapon consists of two rounds; BR-83 and OF-83D (see Specifications).

The fire-control radar is the I/J-band Rys (NATO = Drum Tilt) fire-control radar, whose maximum acquisition range is approximately 40 km (22 n miles).

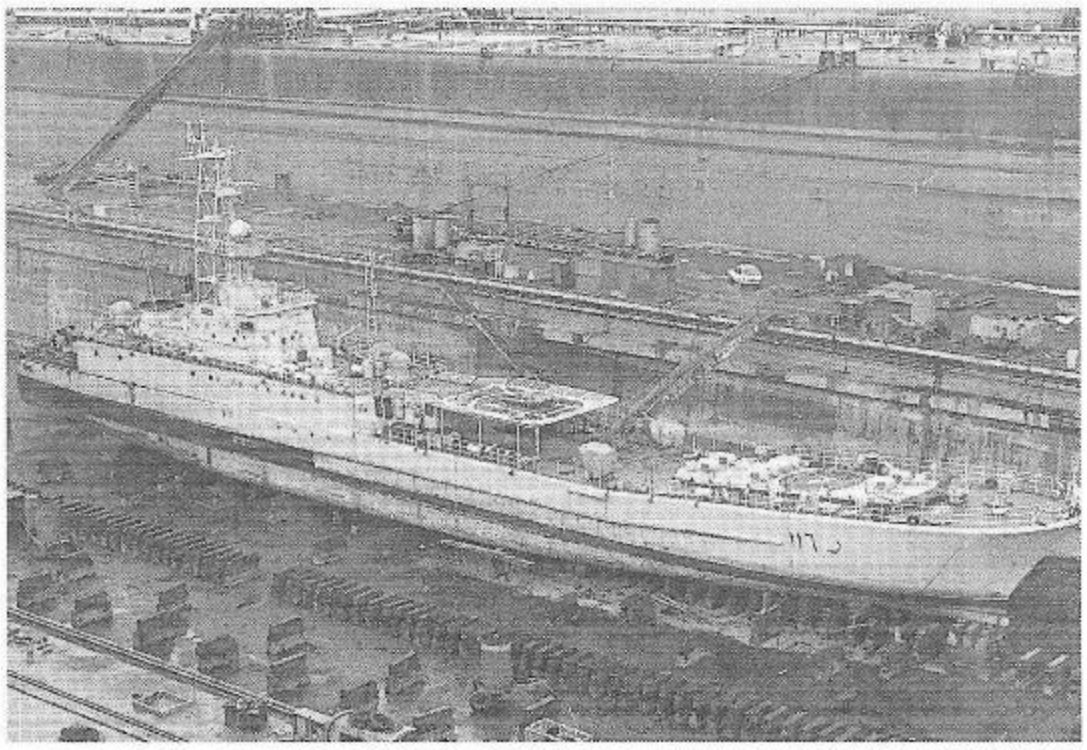
Specifications

NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,450 ft/s)

Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,000 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Crew: 2 (off mount)

Ammunition
BR-83:
Type: Armour-piercing tracer



Ibn Umayaa *(116) of the Libyan Navy in drydock in Malta*

Cheetah *(L 18) of the Indian Navy. The platform is used for a single light helicopter but there is no hangar* (92 Wing RAAF)

Weight (complete round): 1.47 kg (3.24 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D:
Type: High explosive
Weight (complete round): 1.40 kg (3.08 lb)
Projectile: 0.27 kg (0.59 lb)
Explosive: 30 g (10.58 oz) (A-XI-2)

BM-14 140 mm 18-tube rocket launchers

Two BM-14 rocket launchers are mounted. The BM-14 was developed specifically for the 'Polnochny' class. The BM-14 consists of 18 launch tubes in a framework fitted to an electrically-operated pintle mounting. The launch tubes are reloaded manually and like the land-based system it is likely to be able to traverse 200° and to elevate 0 to +52°.

The launcher fires 139 mm diameter unguided spin-stabilised M-14-OF rockets which weigh more than 39 kg (86 lb) and are 1.092 m (3.58 ft) long. They can have either HE-fragmentation, smoke or chemical warheads.

Specifications

Rockets
Diameter: 139.7 mm (5.5 in)
Length: 1.092 m (3.58 ft)
Weight:
round: 39.62 kg (87.35 lb)
warhead: 18.3-18.8 kg (40.3-41.45 lb)
Range: 400-9,810 m (437-10,730 yd)
Max velocity: 402 m/s (1,320 ft/s)

MINES

Up to 100 mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Don 2 or Radwar SRN-745

Don-2 is the standard Russian navigational radar in use from the mid 1950s. The Radwar SRN-745 is a Polish-made, I-band,
equivalent.

Drum Tilt in I-band

Drum Tilt is a pedestal-mounted fire-control radar which probably provides acquisition and tracking functions only for 25 and 30 mm anti-aircraft guns. It is housed in a weatherproof container which is attached to the scanner assembly tilted at about 25°. Maximum acquisition range of aerial targets is approximately 41 km (25 miles). Operating frequency is in the I-band.

AVIATION

Specifications

Flight deck: Forward of bridge
Hangar: None

Helicopters: Likely to be used by — India — Sea King, Kamov Ka-27/28s, or SA319B Chetak (Alouette III). Libya — SA319B Alouette III

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Kolomna Type 40-D diesels, 3.2 MW (4,400 hp) sustained
Shafts: 2

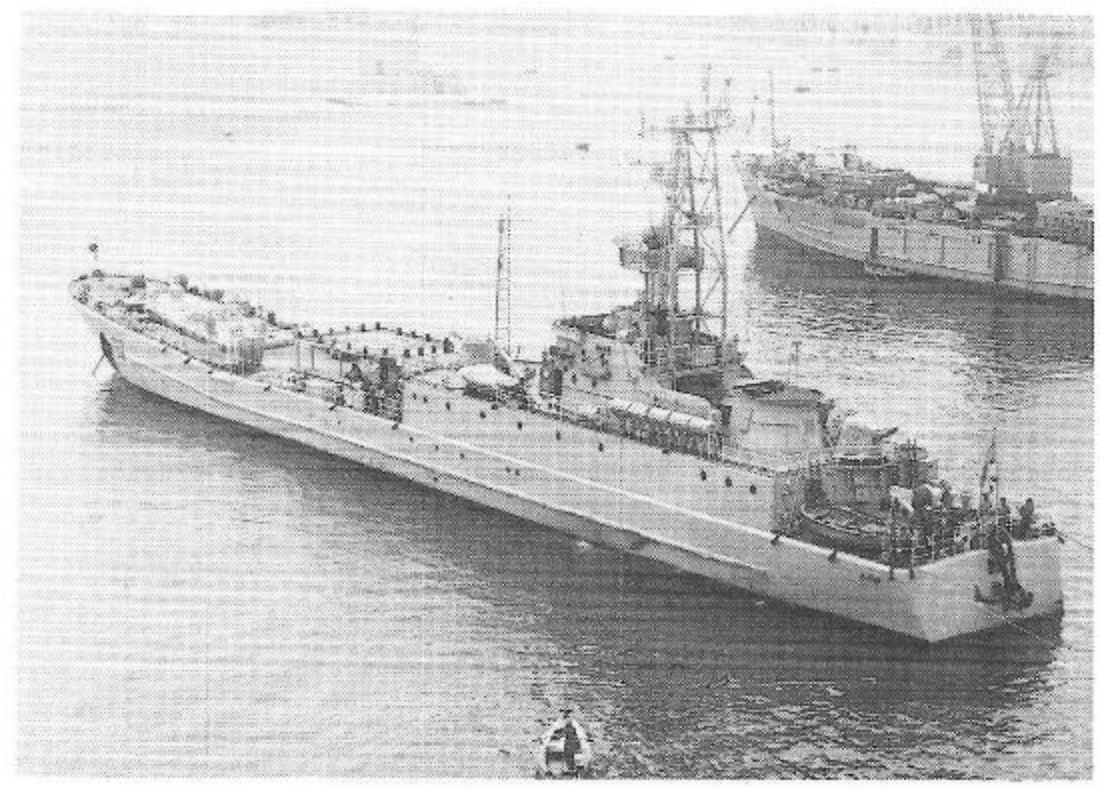
FURTHER INFORMATION

India
India purchased four Polnochny Ds direct from Poland. This version is generally similar to the Polnochny C, but is slightly longer, has a helicopter deck forward of the bridge, and different radars. All the Ds are still operational, although suffering for want of spares.

Iraq
Iraq took delivery of four Polnochny-Ds; two in 1977, one in 1978 and one in 1979. Of these, one was sunk in 1980 by an Iranian Harpoon anti-ship missile, two were sunk in 1991, and one defected to Iran in 1991 and, as far as is known, is still there, although it does not appear to have been absorbed into the Iranian Navy.

Libya
Four Polnochny-Ds were sold to Libya, but one, *Ibn al Qis* (113), was burned out during a landing exercise on 14 September 1978 and was a total loss. The operational status of these ships is now doubtful; all appear to be used for minelaying as well as amphibious work.

Ibn Al Farat *(118), a Polnochny D of the Libyan Navy. Note the large additional platform above the upper deck, the major characteristic of this version. Sensors include Drum Tilt (atop small tower on the bridge roof), with the Polish SRN-745 navigation radar above it and Square Head IFF interrogator at the mast head* (H & L van Ginderen Collection)



Ibn al Hadrami *(112). Note Kedge anchor and large winch on quarterdeck* (H & L van Ginderen Collection)

POLNOCHNY C (Modified)

GENERAL SPECIFICATIONS

Country of origin: Poland
Operator: Poland
Type: Type 776

Class: MODIFIED POLNOCHNY C

Built: 1
Active: 1

Displacement:
full load: 1,253 t

Dimensions
Length: 81.3 m (266.7 ft)
Beam: 9.7 m (31.8 ft)
Draught: 2.4 m (7.9 ft)

Speed: 18 kts
Range: 1,000 n miles at 18 kts; 2,600 n miles at 12 kts

Complement: 45 plus 54 flag staff

SHIPS

GRUNWALD (811)

Builder	Northern Shipyard, Gdansk, Poland	**Launched**	29 Sep 1972
		Commissioned	28 Apr 1973

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Military lift is much reduced, due to the conversion to the amphibious command role. It carries two light trucks in a small area behind the bow doors.

SHIP-SHORE LIFT

None

RAMPS, DECKS

- The bow doors still operate.
- The tank deck is almost totally used for operations centres and offices.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 Grail (Strela-2M)

SA-N-5 is the NATO designation for the Russian Strela-2M (*Strela* = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and he partially pulls the trigger to activate the missile gyros, which are tame some four to six seconds to warm up. The operator uses stadia reference marks in his optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (91.8 ft/s) and spinning it up. Then, at a distance of 6 m, the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M the (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has improved fragmentation uniformity.

According to a Polish source, the missile installation is designated Fasta 4M while the missiles are designated Strzala-2M and a total of 16 missiles are carried.

Specifications
(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 5.5 km (2.6 n miles)
Altitude: 18-4,500 m (60-15,000 ft)
Guidance: IR homing

Manufacturer/Contractor
Fakel, Russia.

Grunwald *(881) is a converted Polnochny C, used by the Polish Navy as a command and control ship for amphibious operations. It is the only Polnochy remaining in the Polish Navy* (H & L van Ginderen Collection)

GUNS

AK-230 30 mm/65 twin

There are two twin AK-230, remotely operated, twin barrel, automatic anti-aircraft guns, which are designed to engage air targets at heights of up to 4,000 m (13,123 ft). It is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). The electrically-powered mounting is 1.46 m (4.78 ft) high, 3.11 m (10.2 ft) long and 2.1 m (6.88 ft) wide, and consists of two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system. Russian ammunition for this weapon consists of two rounds; BR-83 and OF-83D (see Specifications).

The fire-control radar is the I/J-band Rys (NATO = Drum Tilt) fire-control radar, whose maximum acquisition range is approximately 40 km (22 n miles).

Specifications

NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,450 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,000 ft)
Rate of fire: 1,000 rds/min/gun
Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Crew: 2 (off mount)

Ammunition
BR-83:
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.24 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D:
Type: High explosive
Weight (complete round): 1.40 kg (3.08 lb)
Projectile: 0.27 kg (0.59 lb)
Explosive: 30 g (1.05 oz) (A-XI-2)

ROCKET LAUNCHERS

BM-14 140 mm 18-tube rocket launchers

Two BM-14 rocket launchers are mounted. The BM-14 was developed specifically for the 'Polnochny' class. The BM-14 consists of 18 launch tubes in a framework fitted to an electrically-operated pintle mounting. The launch tubes are reloaded manually and like the land-based system it is likely to be able to traverse 200° and to elevate 0 to +52°.

The launcher fires 139 mm diameter unguided spin-stabilised M-14-OF rockets which weigh more than 39 kg (87.35 lb) and are 1.092 m (3.58 ft) long. They can have either HE-fragmentation, smoke or chemical warheads.

Specifications

Rockets
Diameter: 139.7 mm (5.5 in)
Length: 1.092 m (3.58 ft)
Weight:
round: 39.62 kg (87.35 lb)
warhead: 18.3-18.8 kg (40.3-41.45 lb)
Range: 400-9,810 m (437-10,730 yd)
Max velocity: 402 m/s (1,320 ft/s)

COMMAND AND CONTROL SYSTEMS

RADARS

SRN (?)

There is one Polish-made, I-band, navigation radar.

Drum Tilt (MR-104)

Drum Tilt is a pedestal-mounted fire-control radar which probably provides acquisition and tracking functions only for 25 and 30 mm anti-aircraft guns. It is housed in a weatherproof container which is attached to the scanner assembly tilted at about 25°. Maximum acquisition range of aerial targets is approximately 41 km (25 miles). Operating frequency is in the I-band.

IFF

Square Head
High Pole

AVIATION

None

PROPULSION

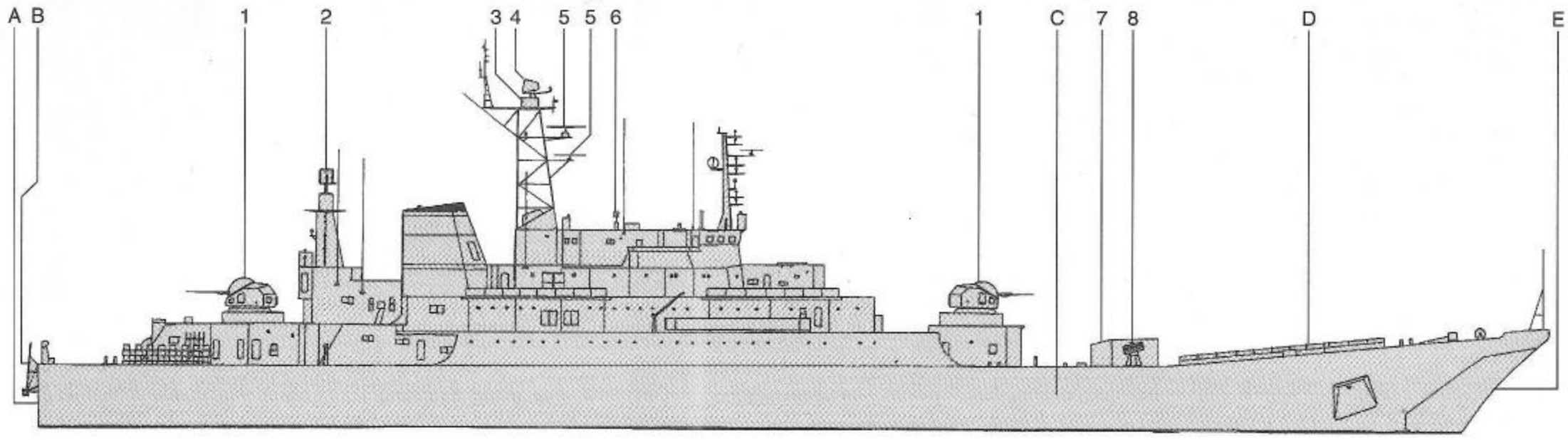
Specifications

System: Diesel
Main machinery: 2 Kolomna Type 40-D diesels, 3.2 MW (4,400 hp) sustained
Shafts: 2

FURTHER INFORMATION

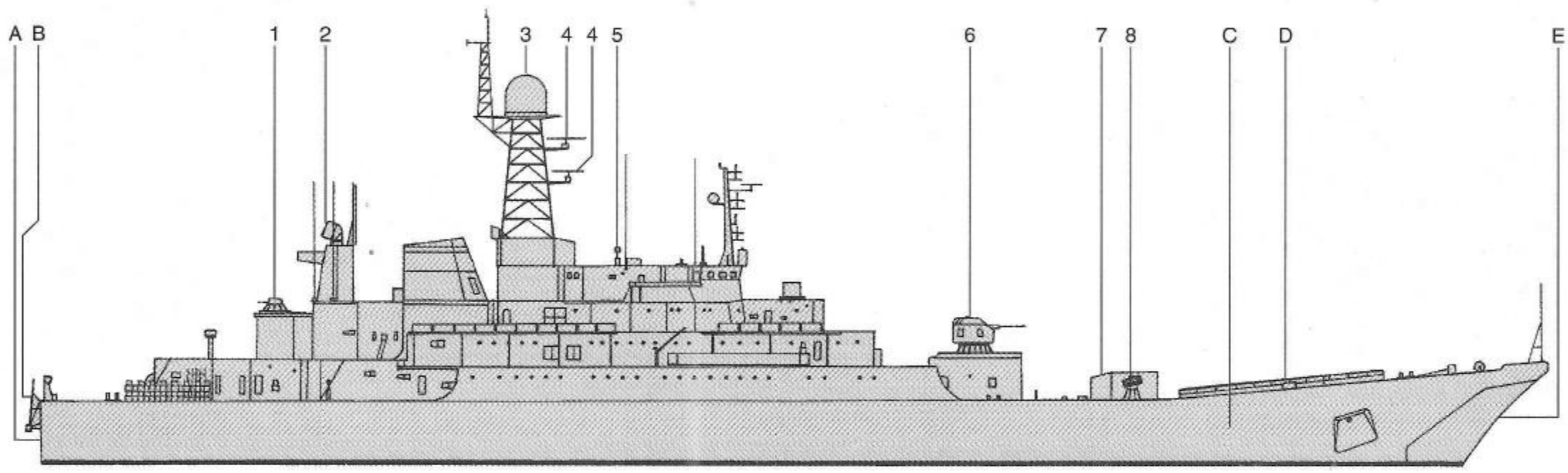
Having built all the Polnochnys and at one time operated 23 Polnochny As, the only one of the class now remaining in Polish service is the *Grunwald*. This is a Polnochny C, which has been substantially modified to produce an amphibious command and control ship, which has been achieved by converting the tank deck into a command centre, and installing the necessary staff facilities and communications equipment.

ROPUCHA I/II



Ropucha I (Ian Sturton)
Amphibious A *Stern door (also used for minelaying - 92 mines)* **B** *Kedge anchor* **C** *Tank deck* **D** *Cargo hatch* **E** *Bow doors with internal ramp*

General 1 *Twin 57 mm/80 automatic gun* **2** *Muff Cob fire control (for 57 mm guns)* **3** *Square Head IFF (two)* **4** *Strut Curve air/surface search radar* **5** *Don 2 or Nayada navigation radar* **6** *Squeeze Box electro-optic director* **7** *Deflector plate (removable)* **8** *BM-21 rocket launcher*



Ropucha II (Ian Sturton)
Amphibious A *Stern door (also used for minelaying — 92 mines)* **B** *Kedge anchor* **C** *Tank deck* **D** *Cargo hatch* **E** *Bow doors with internal ramp*

General 1 *AK-630 30 mm six barrel CIWS* **2** *Bass Tilt fire-control radar (for AK-630)* **3** *Cross Dome air/surface search radar* **4** *Don 2 or Nayada navigation radar* **5** *Squeeze Box electro-optic director* **6** *76 mm/60 automatic gun* **7** *Deflector plate (removable)* **8** *BM-21 rocket launcher*

GENERAL SPECIFICATION

Country of origin: Poland
Operators: Russia, Yemen
Type: Type 775, Type 775M

Class: ROPUCHA I and II

Russian designation: *Bolshoy Desantny Korabl* (BDK) (large landing ship)

Built: 28
Active:
Russia: Ropucha I: 17; Ropucha II: 3
Yemen: Ropucha I: 1

Displacement:
standard: 2,200 t
full load: 4,080 t

Dimensions
Length: 112.5 m (369.1 ft)
Beam: 15 m (49.2 ft)
Draught: 3.7 m (12.1 ft)

Speed: 17.5 kts
Range: 3,500 n miles at 16 kts; 6,000 n miles at 12 kts

Complement: 77 including seven officers

SHIPS

Russia
ALEKSANDR SHABALIN, KONSTANTIN OLSHANSKIY, TSESAR KUNIKOV, BOBRUISK, plus 16 others

Yemen
139

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 10 main battle tanks, plus 190 troops
- or 24 armoured fighting vehicles plus 170 troops.

SHIP-SHORE LIFT

- No landing craft are carried.

AMPHIBIOUS FACILITIES

- There are two, vertically-hinged, clamshell bow doors.
- The upper deck cannot be used for vehicles.
- There is a large, sliding hatch cover inset in the upper deck through which vehicles and heavy cargo can be loaded/unloaded by a dockside crane direct into the tank deck. (There is no on-board crane).

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 Grail (Strela-2M)

A number of these ships, but not all, are armed with four SA-N-5 Grail quad launchers, each with 32 missiles. SA-N-5 is the NATO designation for the Russian Strela-2M (*Strela* = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and he partially pulls the trigger to activate the missile gyros, which are tame some four to six seconds to warm up. The operator uses stadia reference marks in his optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (91.84 ft/s) and spinning it up. Then, at a distance of 6 m (19.68 ft), the sustainer ignites and the trailing fins pop out.

Specifications

(Strela 2)
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 5.5 km (2.6 n miles)
Altitude: 18 - 4,500 m (60 - 15,000 ft)
Guidance: IR homing

Manufacturer/Contractor

Fakel, Russia.

GUNS

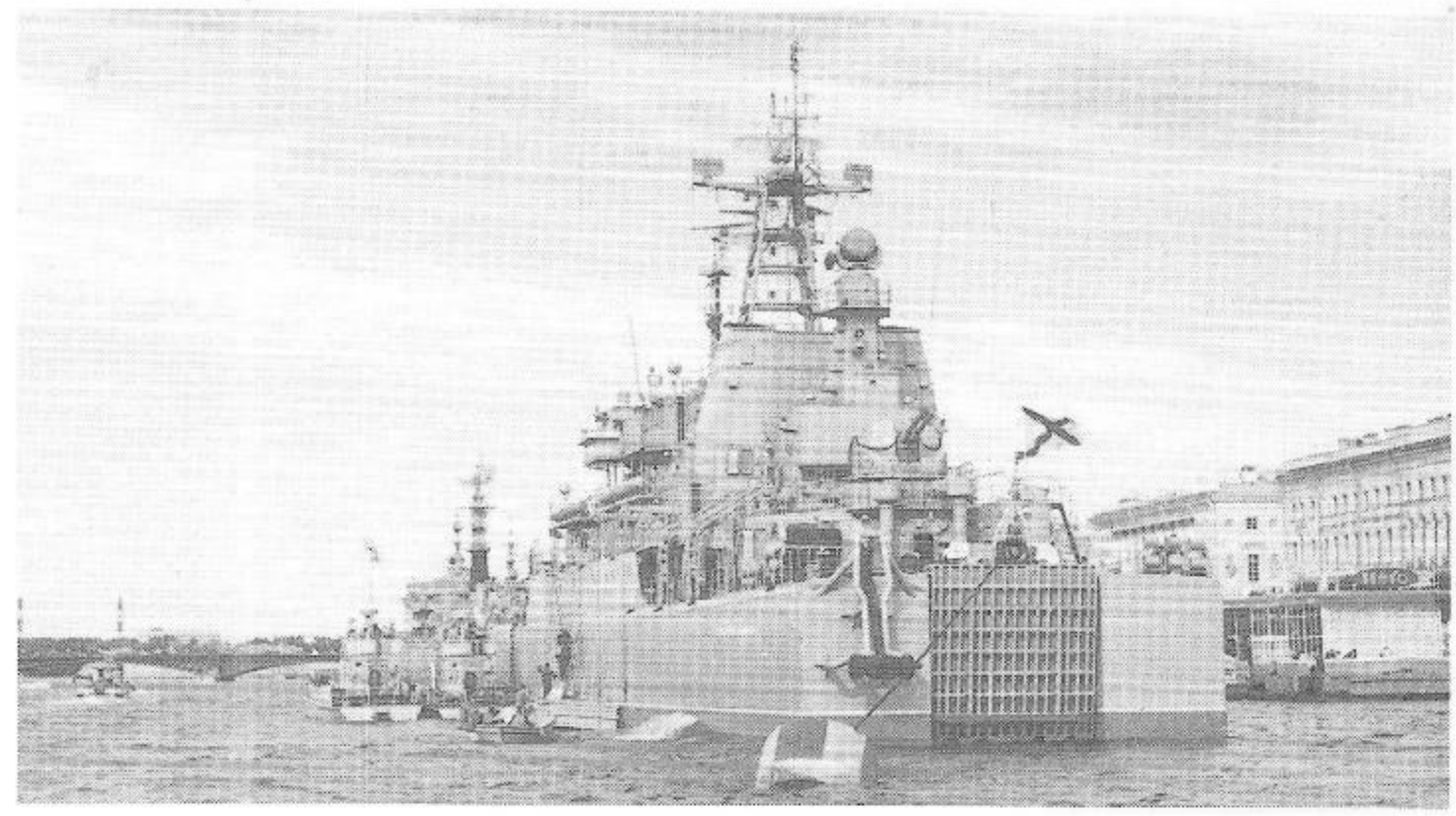
57 mm twin L/75 (ZIF-72/AK 725)

Ropucha I only. There are two twin 57 mm L/75 mountings: one is before the bridge, the other at the after end of the superstructure. This Russian weapon was designed for prolonged air defence engagements, but can also be used against seaborne and land targets. The 4.57 m (14.98 ft) long barrels are water-cooled and the mounting consists of the elevating mass with two automatic weapons and the cradle, the rotating structure for the elevating mass with gun drives, firing system and other elements, all on a slip ring with two arrays of ball-bearings.

There are two operators in the fire-control station, which is associated with the 'Muff Cob' fire-control system. 'Muff Cob' has its antenna in a 1 m wide, weatherproof mounting suspended from a trunnion-yoke carried on a traversing mounting. The radar is supplemented by an electro-optic sensor. The height of the mounting is about 3 m (9.84 ft) and the H-band radar can probably tilt from −10 to +50° as with the gun mounting. The mounting is controlled from the compartment housing the radar display system. Remote laying is controlled through a servo follower drive which ensures smooth slew rate changes at all speeds. Manual operation of the mounting is confined to maintenance and repair functions.

Specifications

Length of barrel: 75 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Traverse: ±200°
Elevation: −10 to +85°
Range:
anti-surface: 3.25 n miles (6 km)
anti-air: 6,000 m (19,680 ft)
Rate of fire: 120 rds/min/barrel
Projectile weight: 6.61 kg (14.6 lb)



Russian Navy Ropucha I class, Aleksandr Shabalin. *Masthead sensors are Strut Curve air/surface search radar with two Square Head IFF at yard-arms. Further aft is Muff Cob atop a small tower, below which is one of the two twin 57 mm mounts. The two cylindrical devices are air vents from the tank deck below. On the transom are the stern door and the housing for a large Kedge anchor*

AK-726 76 mm (3 in)/59 mounting

Ropucha II only. Ropucha II has one single 76 mm turret before the bridge, replacing one of the twin 57 mm mountings in the Ropucha I.

Specifications

Calibre: 100 mm (3.9 in)
Length of barrel: 59 calibres
Muzzle velocity: 880 m/s (2,886 ft/s)
Traverse: 200° at 30°/s
Elevation: −10 to +85° at 20°/s
Weight of projectile: 15.6 kg (34.39 lb)
Rate of fire: 60 rds/min
Range
anti-surface: 8 n miles (15 km)

30 mm AK-630 close in weapon system

Ropucha II only. There are two AK-630 close in weapon system (CIWS) turrets on either side of the after superstructure, replacing the twin 57 mm turret in the Ropucha I. This multibarrel, high volume-of-fire gun system, has a separate fire-control radar and a below-deck control station with remote optical and/or electro-optical sensor. It fires five types of fire mission: against anti-ship missiles, aircraft, small surface vessels, drifting mines, and unprotected shore targets. The weapon consists of six water-cooled barrels, using the Gatling-principle with a fixed breech-block and revolving barrels. The magazine contains 2,000 rounds of HE-I and HE-T ammunition. The gun fires bursts of up to 400 rounds, during which both the barrel and the breech-block are cooled, with used cartridges and links being ejected into a bin below the elevating mass. The mounting is unusual in having an ignition system for burning off gun gases accumulating within it during firing.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Muzzle velocity: 890 m/s (2.919 ft/s)
Traverse: 360° (depending on location of turret) at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire-control: 4,000 m (13,123 ft)
electro-optic fire-control: 5,000 m (16,400 ft)
Rate of fire: 4,000-5,000 rds/min
Ammunition:
round: 1.224 kg (2.69 lb)
projectile weight:
UOF-84: 384 g (0.13 oz)
UOR-84: 388 g (13.68 oz)

BM-21 122 mm 20-barrelled rocket launchers

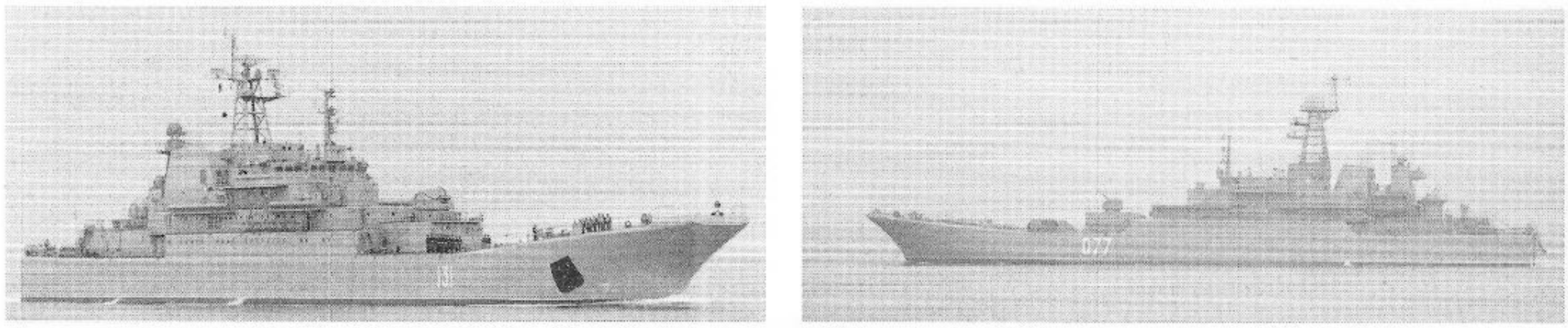
All ships are fitted for two BM-21 122 mm 20-barrelled rocket launchers, but only occasionally are ships seen at sea with the weapons mounted and the blast deflection screens fitted. These weapons are intended for use immediately before an amphibious assault and consist of two clusters, each of 10 tubes, on either side of an electrically operated mounting which holds the training and elevation gears. They are reloaded automatically from a below-deck magazine. The mounting can traverse 360° and elevate from 0 to +55°.

Specifications

Rockets
M-21-OF (9M22U)
Diameter: 122 mm (4.8 in)
Length: 3.226 m (10.58 ft)
Weight: 77.5 kg (170.8 lb)
Range: 500-20,380 m (1,640-66,846 ft)
Warhead weight: 19.3-19.4 kg (42.55-42.77 lb)
Max velocity: 690 m/s (2,263 ft/s)

MINES

As with many LSTs, the Ropchas have a secondary minelaying capability and can carry up to 92 contact type mines. While being employed as a minelayer the ship would not normally be used to carry troops or vehicles.



Ropucha I (left) and Ropucha II (right). The differences between the two types include the main radar (Ropucha I — Strut Curve; Ropucha II — Cross Dome) and weapons (Ropucha I — two twin 57 mm; Ropucha II — one 76 mm, two AK-630 CIWS) (Left picture: H & L van Ginderen Collection)

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Squeeze Box electro-optic director
Two Squeeze Box. Squeeze Box is the NATO reporting name for an electro-optic sensor used with fire-control radars in shore bombardment operations.

Other sensors
Two other sensors, believed to have a weapons control function, are Hood Wink and Odd Box

RADARS

Strut Curve
Ropucha I only. Strut Curve is a medium-range, general purpose, air- and surface search radar, operating in the F-band. An elliptical lattice reflector is used, illuminated by a horn feed carried by a boom projecting from the lower edge of the scanner. Somewhat unusually for Russian naval radars, Strut Curve has no balance vanes behind the reflector. Range against a 2 m² aircraft target at medium altitude is about 60 n miles (111 km) with a likely maximum range of 150 n miles (278 km).

Cross Dome
Ropucha II. Cross Dome replaces Strut Curve in the Ropucha II. It is an F-band, air- and surface-search radar.

Don 2 or Nayada
Two I-band navigation radars are carried: Don 2 and Nayada. The latter has one of the longest ranges of any Russian navigation radar, up to 65 n miles (119 km).

Muff Cob fire-control radar
Ropucha I only. Muff Cob fire-control radar is similar in general appearance to the Drum Tilt fire-control radar, but the former has provision for elevation motion, being supported by a trunnion yoke carried on the traversing mounting. The operating frequency is in H-band. Some drawings of Muff Cob show what appears to be an on-mount TV or optical tracking subsystem, but this has not been confirmed. In all the installations of Muff Cob studied, this radar is employed for gunfire control purposes only. One radar director usually controls one or two gun mountings.

Bass Tilt fire-control radar
Ropucha II only. Bass Tilt resembles and Muff Cob in general appearance and broad functional purpose, but is more modern, having entered service in the mid-1970s. It is used for the radar direction of small or medium calibre anti-aircraft guns, and is mounted on a pedestal, with the 1.2 m (3.93 ft) diameter, drum-shaped radome inclined at an angle of approximately 45°. The director is 2 m (6.56 ft) high and 1.45 m (4.75 ft) long. The radar is linked to a ballistic computer and each director controls one or two gun mountings.

IFF
Two High Pole A or Salt Pot A

SONARS

Mouse Tail VDS
Some are believed to carry Moose Tail VDS.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Zgoda-Sulzer 16ZVB40/48 diesels, 14.14 MW (19,230 hp) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

Together with the much larger 'Ivan Rogov' class LPDs, these sophisticated and well-designed LSLs, were an important element of the (then) Soviet Navy's efforts to achieve a global capability. The Russian type name is *Bolshoy Desantny Korabl* (BDK) (large landing ship) and 28 were built at the Gdansk Northern Shipyard in Poland for the Russian Navy, plus one for Yemen. None went to the Polish Navy.

DESIGN

The 'Ropucha' class is of classic LST design, but with a certain elegance of line lacking in most other amphibious ships. The ship has clamshell bow doors, a stern gate, and a tank deck running the full length of the hull for ro-ro operation. They also have a greater payload in relation to their size than almost any other LST. There are no aviation facilities.

There are two known variants, designated Ropucha I (Russian Type 775) and Ropucha II (Type 755M). The differences are, however, confined to the armament, fire-control systems and the main radar. Ropucha I has two twin 57 mm turrets and Muff Cob, while Ropucha II has one 76 mm, two 30 mm CIWS and Drum Tilt.

PRODUCTION

The class was built in three batches. There were 25 in the first batch, with the third batch of just three ships designated as a separate sub-class, the Ropucha II (Type 775M). In practice, there appear to have been some minor variations between individual ships throughout the class.

Batch I, built from 1974 to 1978, consisted of 12 ships, one of which was sold to what was then South Yemen (now Yemen) in 1979. This remains the only Ropucha outside the Russian Navy. A second batch of 10 was built between 1980 and 1988, with the three Ropucha IIs following between 1987, when the first was laid down and January 1992, when the last was commissioned. Four, possibly five, of the class have so far been scrapped, though it is thought that others are in a poor state of repair.

NUMBERS/NAMES

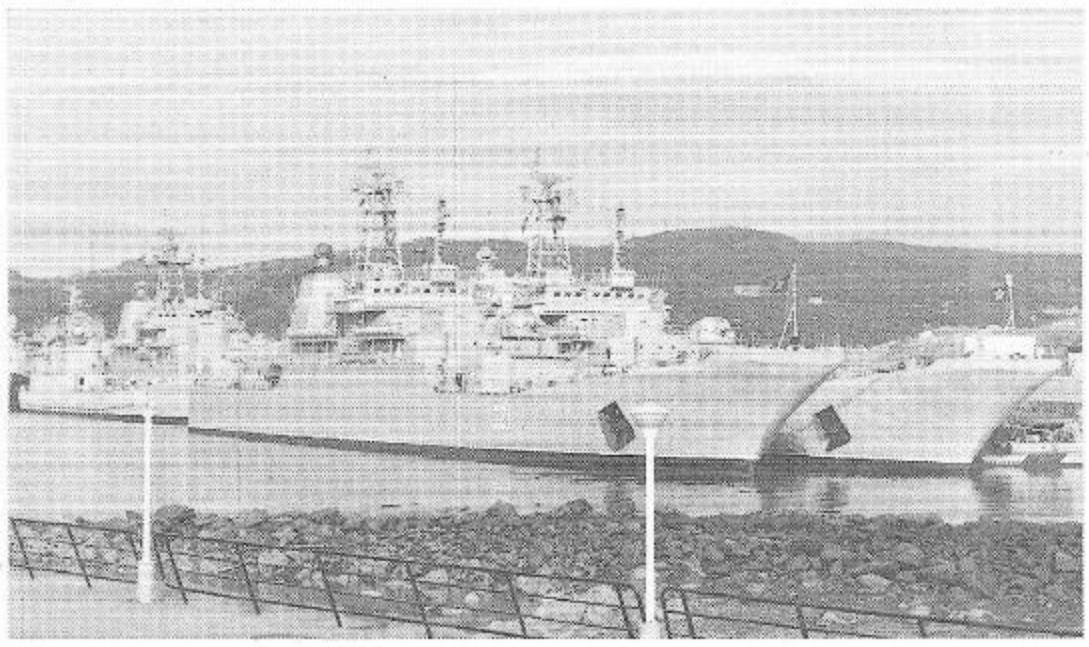
It appears that only four ships have names, but all have pennant numbers prefixed by the type abbreviation, BDK.

DEPLOYMENT

Seven are attached to the Northern fleet, five are in the Baltic, five in the Black Sea and three in the Pacific. The deleted vessels, which were in poor repair, were in the Pacific fleet.

YEMEN

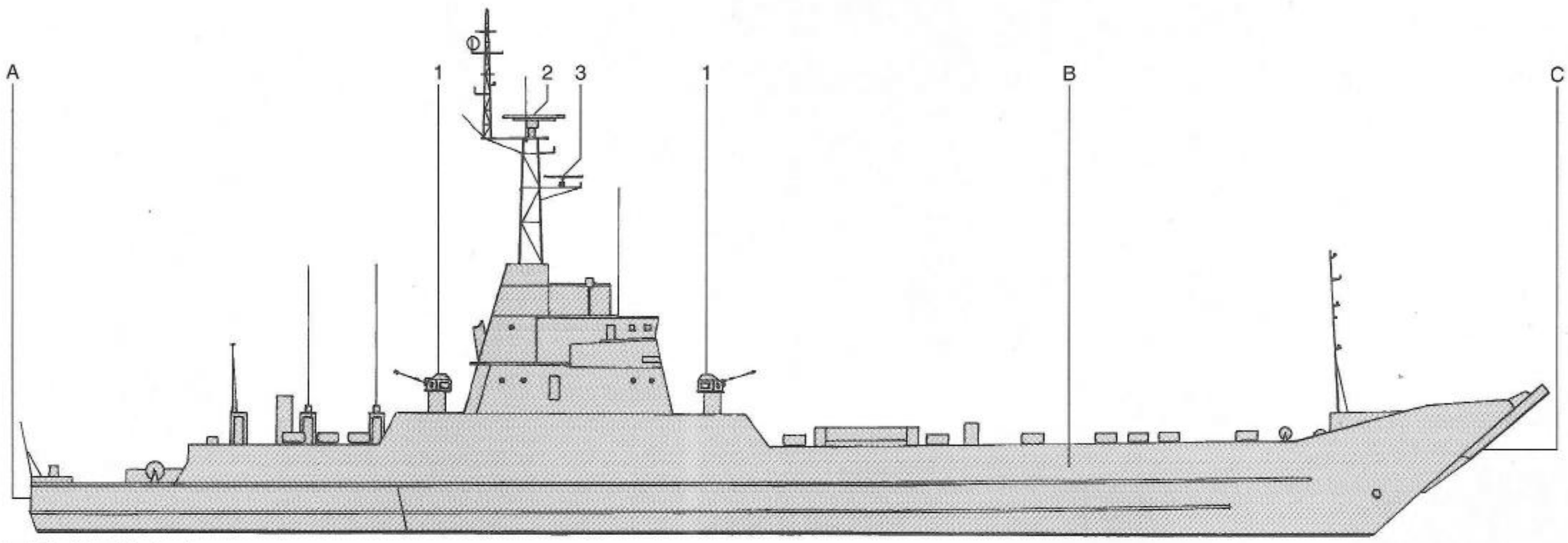
One standard Ropucha I was supplied to Yemen in 1979, where it was given the pennant number, 139. It returned to the Baltic in 1991 for a refit and returned to Yemen in 1993. It remains the only Ropucha in service outside the Russian Navy.



Three Ropucha Is and a Polnochny C in a north Russian port

Ropucha I (US Navy)

LUBLIN



Lublin (Ian Sturton)
Amphibious A *Stern gate and ramp (also used for minelaying)* **B** *Tank deck* **C** *Articulated bow ramp*

General 1 *Wrobel II combined twin 23 mm gun/SA-N-5 missile launcher* **2** *SRN-7453 surface search radar* **3** *SRN-443XTA navigation radar*

GENERAL SPECIFICATIONS

Operator: Poland
Type: Type 767 (LCT/ML)

Class: LUBLIN

Built: 5
Active: 5

Displacement:
standard: 1,210 t
full load: 1,745 t

Dimensions
Length: 95.8 m (314.3 ft)
Beam: 10.8 m (35.4 ft)
Draught: 2.38 m (7.81 ft)

Speed: 16.5 kts
Range: 1,400 n miles at 16 kts

Complement: 37, including five officers

SHIPS

LUBLIN (821)	
Builder	Northern Shipyard, Gdansk, Poland
Laid down	8 Dec 1987
Launched	12 Jul 1988
Commissioned	12 Oct 1989

GNIEZNO (822)	
Builder	Northern Shipyard, Gdansk, Poland
Laid down	8 Jun 1988
Launched	27 Dec 1988
Commissioned	23 Feb 1990

KRAKOW (823)	
Builder	Northern Shipyard, Gdansk, Poland
Laid down	18 Aug 1988
Launched	7 Mar 1989
Commissioned	27 Jun 1990

POZNAN (824)	
Builder	Northern Shipyard, Gdansk, Poland
Laid down	22 May 1989
Launched	5 Jan 1990
Commissioned	8 Mar 1991

TORUN (825)	
Builder	Northern Shipyard, Gdansk, Poland
Laid down	21 Aug 1989
Launched	8 Jun 1990
Commissioned	24 May 1991

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 135 plus equipment
- Armoured vehicles: nine 45 tonne main battle tanks (for example, T-72, T-80, T-55), amphibious tanks (PT-76), or armoured personnel carriers (Topas, MT-LB).
- Wheeled vehicles: 17 (for example, BRDM-2 armoured cars)

AMPHIBIOUS FACILITIES

- The bow includes a flat, telescopic ramp of unusual design.
- The stern includes a folding ramp.
- The tank deck extends the full length of the ship.

WEAPONS SYSTEMS

GUNS

Wrobel II: combined twin ZU-23-2MR 23 mm gun/SA-N-5 missiles

Four Wrobel II systems are mounted, which are a combination of twin 23 mm gun mountings with surface-to-air missiles. Wrobel II consists of a ZU-23-2MR 23 mm gun mounting with SA-7B Grail Mod 1 (Russian and Polish designation Strela 2M) short-range surface-to-air missiles. The mounting consists of the gunner's cabin, which is enclosed in transparent plastic, with elevation and training gears, two 23 mm guns, two launcher-containers for missiles, a night-sight and an optional GP-02MR tachometric sight. The rear part of the cabin contains the spent round ejection system and a ventilation system. The missile launchers are fitted above the cabin.

Wrobel II is not linked to the ship's fire-control system and the operator receives oral instructions for engaging the target. Targets are engaged using either the missile alone or both weapons in combination. The missiles can engage targets at altitudes of 50 to 2,300 m (164-7,546 ft) at elevation angles of 20-60°. For attacks on oncoming targets they can be used at distances up to 1.5 n miles (2.8 km) and for retreating targets at distances up to 2.25 n miles (4.2 km).

'Lublin' class tank-landing ship/minelayer (MoD Bonn)

The guns, which have a practical firing rate of 400 rds/min, can engage targets at angles up to 90°. They can engage air targets below 2.3 km (7,544 ft) and surface targets up to 1 n mile (2 km).

Specifications

Weapons: 23 mm gun; Grail (Strela 2M) missile
Traverse: 360°
Elevation: −10 to +90° (gun); +20 to +60° (missile)
Rate of fire: 400 rds/min
Range: 2.25 n miles (4.2 km) (missile); 1 n mile (2 km) (gun)
Altitude: 2,300 m (7,544 ft)

DEPTH CHARGES

There are nine throwers for counter-mining depth charges. This is designated the LWD-100/5,000 Sosna system

MINES

Between 50 and 134 mines can be carried, depending on type, which are mounted on two mine rails and laid over the stern gate.

ELECTRONIC WARFARE SYSTEMS

DECOYS

Two Derkacz 12-tube chaff launchers.

RADARS

SRN-7453 Nogat
SRN-7453 is a surface search radar. It operates in the I-band.

SRN-443XTA
SRN-443XTA is an I-band navigation radar.

PROPULSION

Specifications

System: Diesel
Main machinery: 3 Cegielski-Sulzer 6ATL25D diesels, 3.96 MW (5,390 hp) at 1,000 rpm
Shafts: 3
Auxiliary power: 3 Wola 250 kVA generators.

FURTHER INFORMATION

PROGRAMME

Having produced large numbers of 'Polnochny' and 'Ropucha' class vessels for the Russian and other navies, Poland designed an unusual type of LST for its own navy. Five were built at the Northern Shipyard in Gdansk, being commissioned between 1989 and 1991.

DESIGN

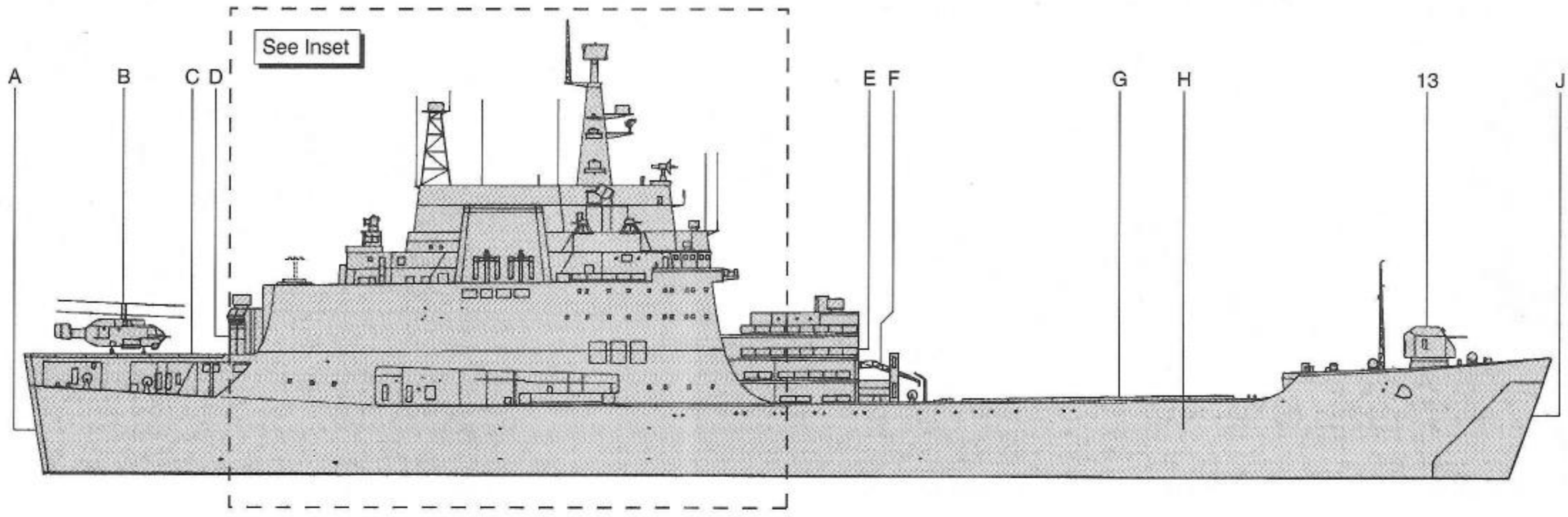
The ship is a modern design of combined landing ship and minelayer, with a through deck from bow to stern, with folding ramps at either end and a stern anchor. The bottom hinge of the bow ramp is raised as far clear of the water as possible, enabling the hull to present a reasonably streamlined shape to the water. The consequence is that the depth forward is slightly greater than with a normal flat bow, so that the ramp has to be telescopic to enable vehicles to land.

The ships also have a pressurised 'citadel' for nuclear, biological and chemical warfare defence, and an upper deck washdown system. In weapon systems, the 'Lublin' class is the first to be equipped with the novel Polish-designed, gun and missile combination, the Wrobel II.

DEPLOYMENT

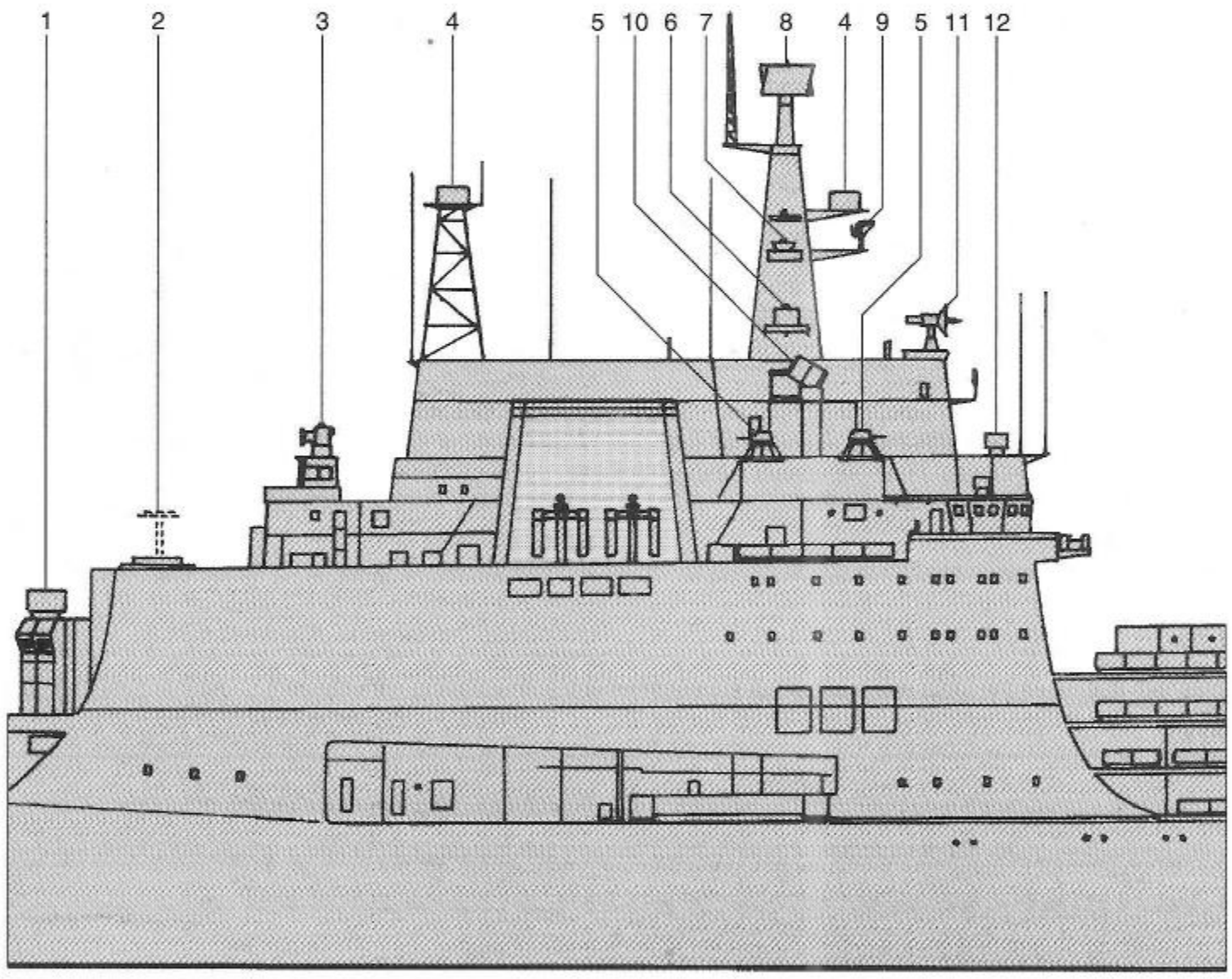
All five ships are based at Swinoujscie (Swinemunde), Poland's westernmost base on the Baltic, where they form the 8th Squadron of the 2nd Transport and Mining Division *(Dywizjon Okretow Transportowo-Minowych)*.

IVAN ROGOV (TYPE 1174)



Ivan Rogov (Ian Sturton)
Amphibious A *Stern gate to docking well* **B** *Kamov Ka-29 Helix B helicopters (four)* **C** *Aft flight deck* **D** *Hangar* **E** *Hangar* **F** *Crane* **G** *Forward flight deck/vehicle deck* **H** *Tank deck* **J** *Clamshell doors with internal, articulated ramp*

General 1-12 *See inset* **13** *AK-726 twin 76 mm/6 gun*



1 *Fly Screen carrier-control approach radar* **2** *SA-N-4 Gecko twin-arm launcher* **3** *Pop Group fire control (for SA-N-4)* **4** *Round House TACAN* **5** *AK-630 30 mm CIWS (total four)* **6** *Bell Shroud radar intercept* **7** *Bell Squat jammers* **8** *Top Plate A (Head Net C on others) air/surface search radar* **9** *Palm Frond navigation radar (three)* **10** *Bass Tilt fire-control radar (for AK-630)* **11** *Owl Screech fire-control radar (for 76 mm gun)* **12** *Squeeze Box electro-optic director (two)*

GENERAL SPECIFICATIONS

Operator: Russia
Type: Type 1174
National designation: *Bolshoy Desantny Korabl* (BDK) (LPD)

Class: IVAN ROGOV

Built: 3
Active: 3

Displacement:
standard: 8,738 t
full load: 14,102 t

Dimensions
Length: 158 m (518.2 ft)
Beam: 24.5 m (80.2 ft)
Draught: 6.5 m (21.2 ft) (8.5 m (27.8 ft) flooded)

Speed: 25 kts
Range: 4,000 n miles at 18 kts; 12,500 n miles at 14 kts

Complement: 205

SHIPS

IVAN ROGOV (120)
Builder Yantar, Kaliningrad, Russia
Launched Jul 1977
Commissioned 1978

ALEKSANDR NIKOLAEV
Builder Yantar, Kaliningrad, Russia
Launched Apr 1982
Commissioned Dec 1982

MITROFAN MOSKALENKO
Builder Yantar, Kaliningrad, Russia
Launched Jul 1989
Commissioned Dec 1989

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 522 (one naval infantry battalion)
- Tanks: 20 (or equivalent weight of armoured personnel carriers and trucks).
- Cargo: 1,600 tonnes

SHIP-SHORE LIFT

- 3 'Lebed' class ACVs (docking bay)
- 6 'Serna' class LCM (docking bay)

AVIATION FACILITIES

Specifications
Flight deck: 2 flight decks. 1 aft, 1 on foredeck
Hangar: The hangar is in the superstructure. Helicopters can enter the hangar from both front and rear
Helicopters: 4 Ka-29 Helix B

AMPHIBIOUS FACILITIES

- Bow ramp with beaching capacity leads directly from tank deck.
- Tank deck measures 61 × 13.7 m (200 × 45 ft)
- Stern doors open into docking bay.
- Docking bay measures 76.2 × 13.7 m (250 × 45 ft)

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-4 short-range missile system

There is one SA-N-4 launcher at the after end of the superstructure, with a magazine holding 20 missiles. The twin-rail launcher lies beneath a hinged flat cover plate, emerging to launch its missiles and retracting to reload. This is likely to result in a low rate of fire which must be slowed even further by the need to close the magazine cover before firing. Below the launcher are four revolving drums each with five missiles while the electromechanical and hydraulic machinery is below that. On launch, the booster burns for 2 seconds allowing the radar to gather the missile at a range of 0.75 n miles (1.5 km), following which the sustainer burns for 15 seconds. Command and control is via the Pop Group system (see Command and Control Systems).

Specifications
Length: 3.1 m (10.17 ft)
Diameter: 21 cm (8.27 in)
Wing span: 64 cm (25.2 in)
Weight: 130 kg (286.6 lb)
Speed: Mach 2.5
Warhead: 50 kg (110 lb) HE
Range: 0.75-8 n miles (1.5-15 km)
Height: 9-3,000 m (30-10,000 ft)
Guidance: Semi-active radar homing

SA-N-5 Grail (Strela-2M)

There are two SA-N-5 Grail quad launchers, each with 32 missiles. SA-N-5 is the NATO designation for the Russian Strela-2M (Strela = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired the operator selects a missile and then activates the thermal battery. When the seeker acquires the target, the operator receives an audio signal and he partially pulls the trigger to activate the missile gyros, which take some four to six seconds to warm up. The operator uses stadia reference marks in his optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spinning it up. Then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has improved fragmentation uniformity.

According to a Polish source, the missile installation is designated Fasta 4M while the missiles are designated Strela-2M and a total of 16 missiles is carried.

Specifications
Strela 2
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 2.6 n miles (5.5 km)
Altitude: 18-4,500 m (60-15,000 ft)
Guidance: IR homing

Manufacturer/Contractor
Fakel.

GUNS

76 mm/59 AK-726 twin mounting

There is one twin 76 mm turret on the forecastle. Production of the AK-726 radar-controlled automatic 76 mm gun system began around 1960; the aim was for a multipurpose weapon for air defence, surface engagement and shore bombardment. The AK-726 has two barrels and requires a five-man crew within the turret. It is used in this class with the conical scan fire-control radar, Owl Screech.

Specifications
Calibre: 76 mm
Length of barrel: 59 calibres
Muzzle velocity: 980 m/s (3,215 ft/s)
Traverse: 360° at 36°/s
Elevation: −7 to +85° at 32°/s
Ammunition (total): 16 kg (35 lb)
Rate of fire: 90 rds/min
Range:
anti-surface: 8 n miles (15 km)
anti-air: 10,000 m (32,810 ft) max

Third of class, Mitrofan Moskalenko. *As so often in the Cold War, Russian designers took a completely new look at the design of ships for particular tasks and the 'Ivan Rogov' class was unlike anything produced previously for amphibious warfare. The ship can transport a battalion group of marines and deliver them by landing craft, ACV, helicopter or directly over a suitable beach. Note the Top Plate A air/surface search radar at the masthead*

BM-21 multiple rocket launcher

One BM-21 is mounted on the foredeck. Naval BM-21s are to be used immediately before an amphibious assault and consist of two clusters, each of 20 tubes, on either side of an electrically operated mounting which holds training and elevation gears. They are reloaded automatically from a below-deck magazine. The mounting is about 2 m (6.5 ft) high and 2 m (6.5 ft) long and can traverse 360° and elevate from 0 to +55°. The standard missile for these weapons is the M-21-OF spin- and fin-stabilised rocket which comes in 3.226 (10.6) and 2.87 m (9.4 ft) lengths and can carry high explosive fragmentation, smoke, incendiary or chemical warheads.

Mitrofan Moskalenko (H & L van Ginderen Collection)

Specifications

Rockets	M-21-OF (9M22U)	M-21-OF (9M22M)
Diameter	122 mm	122 mm
Length	3.226 m (10.6 ft)	2.87 m (9.4 ft)
Weight	77.5 kg (171 lb)	66 kg (145.5 lb)
Range	500-20,380 m (1,640-66,867 ft)	500-20,000 m (1,640-65,620 ft)
Warhead weight	19.3-19.4 kg (42.5-42.8 lb)	18.4 kg (40.6 lb)
Max velocity	690 m/s (2,264 ft/s)	700 m/s (2,296 ft/s)

30 mm/65 AK 630 close in weapon systems

Four 30 mm/65 AK 630 close in weapon systems, two port and two starboard, outboard of the mainmast and one deck down. AK-630 is a multibarrel high volume of fire gun system with separate fire-control radar and a below-deck control station, with remote optical and/or electro-optical sensor. The gun is the water-cooled six-barrel AO-18 which fires 1.224 kg (2.7 lb) rounds with 0.39 kg (0.86 lb) projectiles. The AK 630 system includes the radar detector, Bass Tilt.

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Muzzle velocity: 890 m/s (2,920 ft/s)
Traverse: 360° at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range: 4,000 m (13,124 ft) with radar fire control; 5,000 m (16,405 ft) with electro-optic fire control
Rate of fire: 4,000-5,000 rds/min

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Bell Shroud, Bell Squat

The ESM/ECM suite consists of two Bell Shroud intercept systems and two Bell Squat jammers. Bell Shroud is basically a Watch Dog B system with two extra pairs of receiver antennas to cover higher frequencies in the radar spectrum. Bell Shroud is the standard intercept system used on destroyers and frigates of the Russian Navy, and is used in conjunction with Bell Squat as the standard intercept/jamming system. Bell Squat was derived from the earlier Top Hat with the frequency bands increased to cover K-band. Two types of ECM system are in use, Bell Squat A which uses barrage jamming, and Bell Squat B which employs deception jamming.

DECOYS

PK-10

The PK-10 system consists of four KT-216 launchers, a control console and three types of munition. The launcher is a 10-barrel unit, with the 120 mm barrels fixed at about 45°, and is able to rotate. The control console is of a relatively simple design. The munitions are all for seduction purposes. The SR-50 is a chaff round with a payload of 11 kg (24.2 lb). The SOM-50 is a heat-seeker/laser-guided missile seduction round with 7.3 kg (16 lb) payload while the SK.50 is a combined round with 9.1 kg (20 lb) of payload.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Squeeze Box electro-optic director

There are two Squeeze Box. Squeeze Box is the NATO reporting name for an electro-optic sensor used with fire-control radars in shore bombardment operations.

RADARS

Head Net C

***Ivan Rogov* and *Aleksandr Nikolaev* only.** Head Net C is an E/F-band, 3D radar with two Head Net A scanners, one which has aperture (its span dimension) tilted from the horizontal by approximately 30°, thus displacing the resulting fan-shaped elevation beam by the same amount from the vertical. This beam, in combination with the vertical beam produced by the companion scanner, provides the means for height-finding by the so-called 'V-beam technique'. The Head Net series has been one of the most widely fitted of the numerous radars employed on major Russian warships, and appears to be of fairly conventional construction. It has a large (about 6 × 1.5 m) (19.7 × 4.9 ft) elliptical paraboloid reflector of open lattice construction. The scanner mounting is distinctive, with a tall, thin, conical profile and a domed top. Detection range on aircraft at medium altitude is of the order of 60-70 n miles (111-130 km).

Top Plate A

***Mitrofan Moskalenko* only.** Top Plate is a true 3D system employing back to back antennas and operating in D/E-bands. A version of Top Plate, known as *Fregat-Mae* is being offered for export. The system weighs 7.5 tonnes (of which 2.2 tonnes is contributed by the single antenna array), draws 30 kW of power and is available with peak elevations of 45 or 55°.

Don Kay/Palm Frond

Two navigation radars, either Don Kay or Palm Frond. Some 16 types of Russian shipboard navigation/short-range surface search radars have been identified to date, all operating in the band 9,400 to 9,600 MHz. The new Palm Frond equipment has been replacing the Don series since 1985.

Owl Screech

Owl Screech is the fire-control radar for the 76 mm guns. It has a circular dish scanner, behind which are fairly bulky housings containing the transmitter and receiver, together with the turning and stabilisation gear. The complete radar is pedestal mounted. The 2.3 m (7.5 ft) diameter scanner has a central feed supported by a four-leg structure. Feed arrangements could incorporate a rotating dipole to provide a conical scan search pattern. Dish diameter is approximately 2 m (6.5 ft). Operating frequency is in the H/I-band for both types.

Bass Tilt

Bass Tilt is the fire-control radar for the 30 mm CIWS. It is mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (3.9 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.5 ft) high and 1.45 m (4.8 ft) long. The radar is linked to a ballistic computer and each director controls one or two gun mountings.

Pop Group

Pop Group is the NATO reporting name for the fire-control radar group associated with the SA-N-4 surface-to-air missile system. The NATO reporting name was assigned because the launcher for this missile system 'pops up' from a silo-type housing preparatory to launching. Pop Group has two antennas for radar functions, with a third for the transmission of command signals to the missile. The arrangement consists of a cube-shaped container with sides of about 2.2 m (7.2 ft), in which is probably housed the bulk of the electronics (transmitter/receiver units), power supplies, and turning gear, and on the top of this is a trainable radar head assembly. The latter unit has a parabolic antenna of about 2 m (6.5 ft) aperture for target search and which rotates independently of the rest of the radar head. On the front face of the head are two circular arrays for target tracking and missile guidance. The system operates in the G/J-bands. It appears probable that the Pop Group radar is a monopulse frequency-agile system.

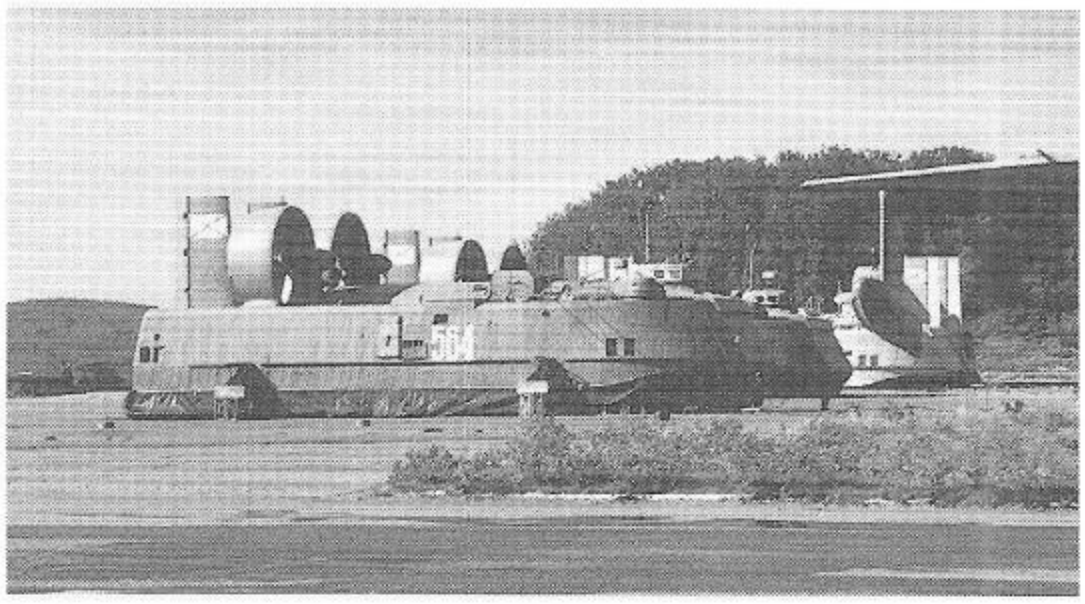
Fly Screen/Fly Spike
Fly Screen and Fly Spike are I-band carrier-controlled approach (CCA) radars.

IFF
Salt Pot B.

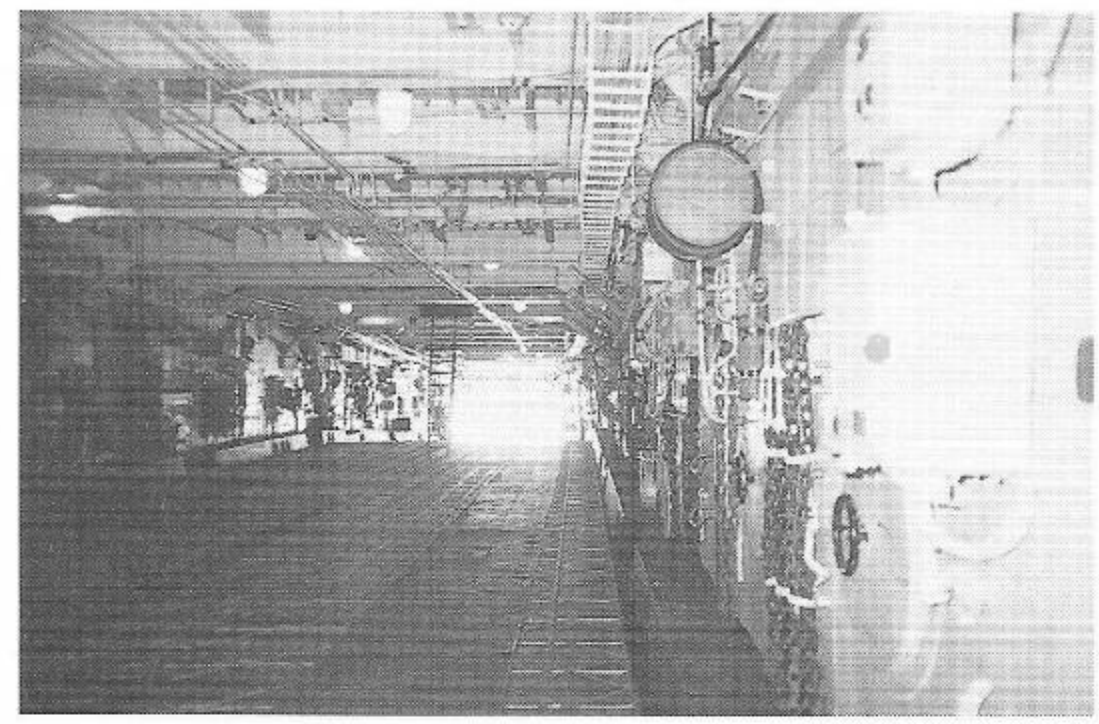
Round House
There are two Round House TACAN arrays. One is on a small platform on the forward side of the foremast, the other is atop its own dedicated lattice tower at the after end of the superstructure.

SONAR

Mouse Tail
Mouse Tail variable depth sonar has been seen streamed from the stern door on *Mitrofan Moskalenko*. This may have been a trial, as the ship has no ASW weapons.



The 'Ivan Rogov' class is designed to carry two of the 'Lebed' class air-cushion vehicles. With a footprint of 24.4 × 12.2 m (80.1 × 36.7 ft) these ACVs can carry two tracked vehicles, 40 tonnes of cargo or 120 troops. They have a range of 100 n miles at 50 knots



Interior of 'Lebed' class ACV

PROPULSION

Specifications
System: Gas turbine
Main machinery: 2 M8E gas turbines, 29.4 MW (39,998 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These were the largest and most impressive amphibious warfare ships ever built for the (then) Soviet Navy and indicated the intention to produce an amphibious force with a global capability. Until these ships appeared, the largest vessels in the Soviet amphibious fleet had been the 'Ropucha' class LSTs, displacing some 4,080 t, which followed traditional LST design. The 'Ivan Rogov' class, however, combined good helicopter facilities with a docking well for LCMs and a bow door for landing on a beach. NATO observers were also impressed with the speed of these vessels: virtually equal to anything the US had achieved, and a big step forward from previous Soviet amphibious designs.

DESIGN

These are, by a very large margin, the largest amphibious warfare ships ever designed to deliver troops direct onto a beach. They have a flat bottom and, despite a large bulb at the foot of the stern, are capable of beaching and landing troops, trucks and tanks over an articulated ramp. Finding beaches with the necessary gradients to accept such a long ship with a draught of 6.5 m (21.2 ft) could, however, be a major limitation on its use in this role.

They are able to carry a complete naval infantry (marine) battalion group, complete with 10 amphibious tanks (PT-76), 30 armoured personnel carriers (BMP), trucks and guns. These can be landed directly onto a beach, by helicopter, landing craft and air-cushion vehicles, or onto a jetty.

As always with Russian ships of the 1970s and 1980s they possess a substantial armament, with the usual SAMs and guns being augmented by a single BM-22 rocket launcher.

Soviet planners and designers did not overlook the question of command and control, either, which is always a very complex business in amphibious operations. Thus, space has been allocated to the naval and amphibious force command centres and there is evidence of an extensive communications fit.

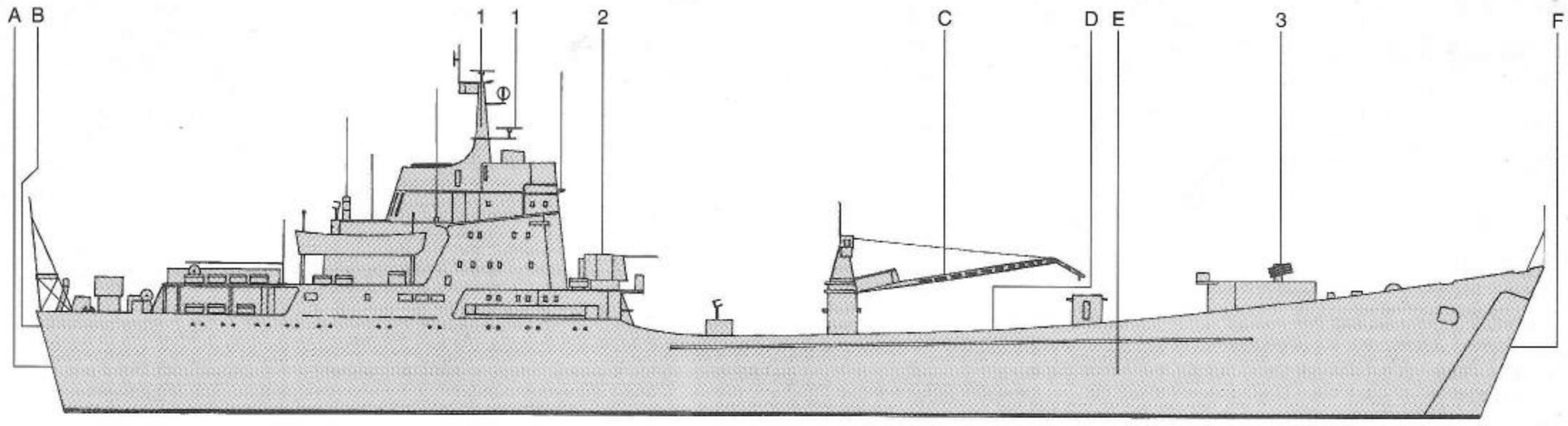
Aviation facilities include two flight decks, one on the stern, the other on the foredeck.

DEPLOYMENT

The first two are in the Pacific Fleet and *Mitrofan Moskalenko* is with the Northern Fleet. Two of the three now appear to be in a poor state along with many other ships of the Russian Navy.

'Serna' class has replaced the previous 'Ondatra' class LCMs. Using an 'air-lubrication' system it is capable of speeds up to 30 knots and can carry up to 90 troops, tracked or wheeled vehicles or cargo of up to 45 tonnes in weight. Loading and unloading is via a bow ramp. Power is provided by two M503A-3 diesels (3,300 hp at 1,900 rpm) and two DGR1A-16/1500 diesel-generators (each 16 kW) (Russvoorzhenie)

ALLIGATOR (TAPIR) CLASS 1171



Alligator (III) *(Russia)* (Ian Sturton)
Amphibious A *Stern ramp* **B** *Kedge anchor* **C** *15 tonne crane* **D** *Cargo hatch* **E** *Tank deck* **F** *Clamshell bow doors with internal ramp*

General 1 *Don 2 surface search/navigation radar* **2** *ZIF-31B twin 57 mm mount* **3** *BM-21 rocket launcher*

GENERAL SPECIFICATIONS

Country of origin: Russia
Operators: Russia, Ukraine
Type: Type 1171
National designation: *Bolshoy Desantny Korabl* (BDK) (large landing ship)

Class: ALLIGATOR (TAPIR)

Built: 14
Active: Russia — 7; Ukraine — 1

Displacement:
standard: 3,400 t
full load: 4,700 t

Dimensions
Length: 113 m (370.7 ft)

Beam: 15.5 m (50.8 ft)
Draught: 4.5 m (14.7 ft)

Speed: 18 kts
Range: 10,000 n miles at 15 kts

Complement: 100

SHIPS

Russia

Type One — **VORONEZHSKY KOMSOMOLETS (BDK 10)**

Type Two — **SERGEY LAZO (BDK 66)**
NIKOLAY OBVEKOV (BDK 69)

Type Three — **ALEKSANDR TORTSEV**
DONETSKY SHAKHTER

Type Four — **NIKOLAY FILCHENKOV**
NIKOLAY VILKOV

Ukraine

Type Three — **ILYA AZAROV** (U 400)

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 300 plus
- Tanks: 20
- Armoured personnel carriers: 40
- Total payload:
  Normal operations: 1,700 tonnes
  Beaching: 600 tonnes

SHIP-SHORE LIFT

- No landing craft are carried, but amphibious APCs can be used.

AMPHIBIOUS FACILITIES

- Clamshell bow doors and internal ramp.
- Stern door and ramp.
- Tank deck 91 m (300 ft) long and approximately 12 m (40 ft) wide.
- Large hatches enable tanks and vehicles to be loaded/unloaded by dockside cranes.
- Onboard cranes; all ships have one 15 tonne crane, some have an additional 5 tonne crane.

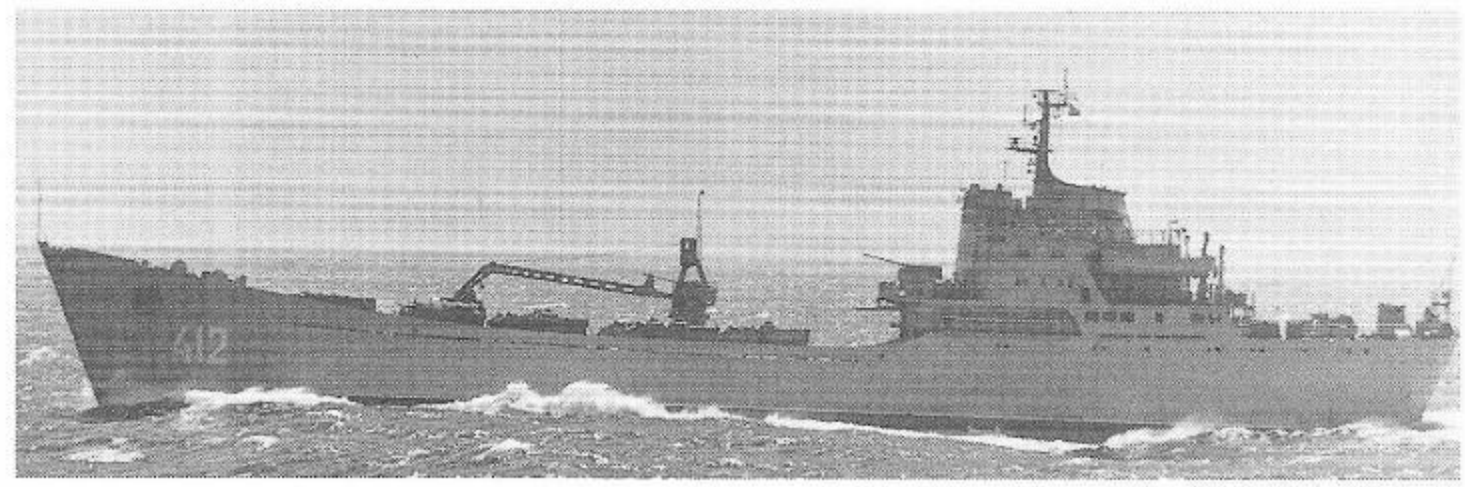
WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 Grail (Strela-2M)

There are two SA-N-5 Grail quad launchers, each with 32 missiles. SA-N-5 is the NATO designation for the Russian Strela-2M (*Strela* = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired, the operator selects a missile and then activates the thermal battery. When the seeker acquires the target, the operator receives an audio signal and partially pulls the trigger to activate the missile gyros, which take some four to six seconds to warm up. The operator uses stadia reference marks in his optical sight to compute the lead angle to the target, then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spinning it up. Then, at a distance of 6 m (19.7 ft), the sustainer ignites and the trailing fins pop out.



Alligator Type 2. The first large amphibious warfare ships to be completed for the Russian Navy, these ships were essentially freighters with a roll-on/roll-off capability. Note the 15 tonne capacity crane, and the trucks and armoured personnel carriers on the upper deck. Sole armament is the twin 57 mm mount before the bridge (US Navy)

Specifications
Strela 2
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)

Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 2.6 n miles (5.5 km)
Altitude: 18-4,500 m (60-15,000 ft)
Guidance: IR homing

Manufacturer/Contractor
Fakel, Russia.

GUNS

Twin 57 mm/70 (ZIF-31B)
There is one twin 57 mm/70 is an open mount on a platform immediately before the bridge. This Russian weapon was designed for prolonged air defence engagements, but can also be used against seaborne and land targets. The 4.57 m (15.6 ft) long barrels are water-cooled and the mounting consists of the elevating mass with two automatic weapons and the cradle, the rotating structure for the elevating mass with gun drives, firing system and other elements, all on a slip ring with two arrays of ball-bearings.

Specifications
Length of barrel: 70 calibres
Muzzle velocity: 1,020 m/s (3,346 ft/s)
Traverse: ±200°
Elevation: −10 to +90°
Range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,500 m (14,800 ft)
Rate of fire: 120 rds/min/barrel
Projectile weight: 6.61 kg (14.6 lb)

2-M-3 25 mm/60
Type Four only. Four in two twin mountings. The 2-M-3 consists of two guns installed one above the other in separate cradles and on their sides so that they are fed from the side. The 1.5 m (4.9 ft) long, air-cooled barrels have a flash suppressor at one end and an exposed spring recuperator wrapped around the barrel near the breech. The mounting weighs 1.735 tonnes and it has two on-mount operators and five loader-carriers.

Specifications
Calibre: 25 mm
Length of barrel: 60 calibres
Traverse: 360° at 25°/s
Elevation: −10 to +85° at 15°/s
Rates of fire: 450 rds/min/barrel
Projectile: 0.28 kg (0.61 lb) HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-surface: 2,800 m (9,186 ft)

BM-21 multiple rocket launcher
Types Three and Four only. One BM-21 is mounted on the roof of a small deckhouse on the foredeck. BM-21s are designed for use immediately before an amphibious assault and consist of two clusters, each of 20 tubes, on either side of an electrically operated mounting which holds training and elevation gears. They are reloaded automatically from a below-deck magazine. The mounting is about 2 m (6.5 ft) high and 2 m (6.5 ft) long and can traverse 360° and elevate from 0 to +55°. The standard missile for these weapons is the M-21-OF spin- and fin-stabilised rocket which comes in 3.226 (10.6) and 2.87 m (9.4 ft) lengths and can carry high explosive fragmentation, smoke, incendiary or chemical warheads.

Specifications

Rockets	M-21-OF (9M22U)	M-21-OF (9M22M)
Diameter	122 mm	122 mm
Length	3.226 m (10.6 ft)	2.87 m (9.4 ft)
Weight	77.5 kg (171 lb)	66 kg (145.5 lb)
Range	500-20,380 m (1,640-66,867 ft)	500-20,000 m (1,640-65,620 ft)
Warhead weight	19.3-19.4 kg (42.5-42.8 lb)	18.4 kg (40.6 lb)
Max velocity	690 m/s (2,264 ft/s)	700 m/s (2,296 ft/s)

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Squeeze Box optronic director
Types Three and Four only. Squeeze Box is the NATO codename for an electro-optic sensor used with fire-control radars in shore bombardment operations.

RADAR

Navigation radars
Type One has one Don-2 and one Spin Trough. Others have two Don 2.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 diesels, 6.6 MW (9,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

Fourteen of these LSTs were built at the Yantar yard at Kaliningrad on the Baltic between the mid-1960s and the mid-1970s; six have been deleted in recent years and one of the eight survivors has gone to the Ukraine Navy rather than the Russian Navy.

DESIGN

The design is that of a conventional freighter with large clamshell doors, a long tank deck, superstructure and machinery aft, and a stern door and ramp. They have a particularly high freeboard. Within the class, there are four types, distinguished by different crane arrangements, structures and armaments:

Type One (four built) has two cranes, whereas the other three types carried just one. One survives.
Type Two (two built) is the basic design. Both survive.
Type Three (six built) has a raised bridge structure and an extra forward deckhouse to accommodate the shore bombardment rocket launchers. Three survive.
Type Four (two built) has a similar structure to Type Three, but with an additional two twin 25 mm gun mountings on the centreline aft of the bridge superstructure. Both ships survive.

The Alligators' primary role is as a tank carrier, with a tank deck 91 m (300 ft) long, which stretches across the whole width of the ship. In the 1970s and 1980s, they operated worldwide, usually with Naval Infantry units on board, but since the end of the Cold War they have been more confined to local waters.

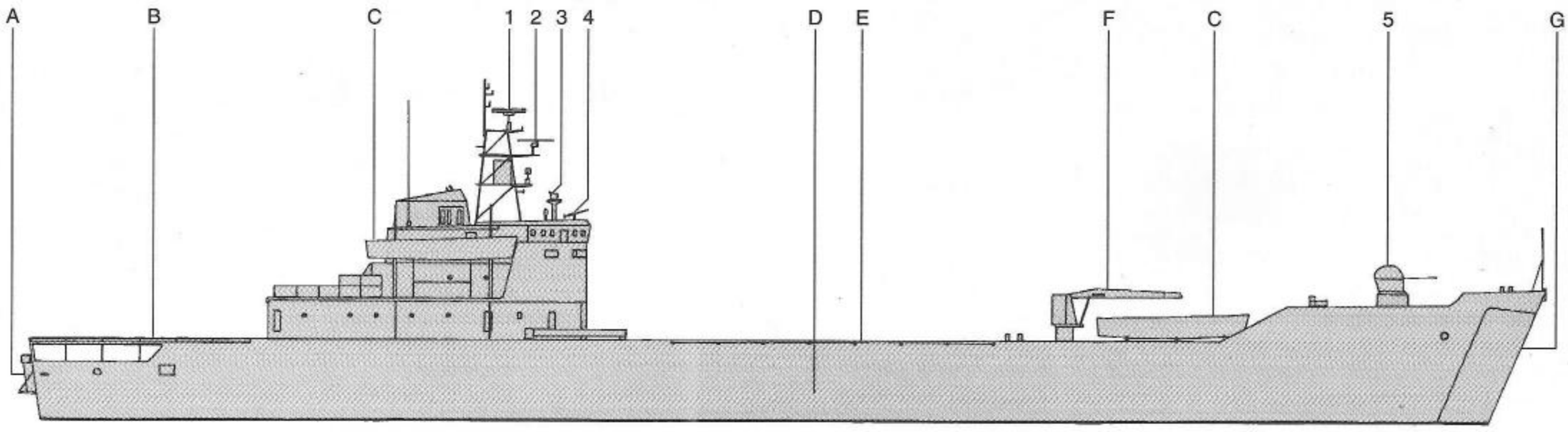
DEPLOYMENT

Two of the survivors are in the Black Sea, three in the Pacific Fleet, one in the Northern Fleet and one in the Baltic. A further Type Three belongs to Ukraine.

Alligator Type 2 (US Navy)

Nikolay Vilkov, *an Alligator Type 4. Note the deckhouse forward with BM-21 rocket launcher and deflector screen, and the two 25 mm/8 mounts on new platforms aft of the stack* (92 Wing RAAF)

SICHANG (PS 700 Mod)



Sichang *(PS 700 Mod)* (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Flight deck* **C** *LCVP* **D** *Tank deck* **E** *Forward flight deck* **F** *Crane* **G** *Clamshell doors with internal ramp*

General 1 *Radar (type not known)* **2** *Racal-Decca 1226 navigation radar* **3** *BAe Sea Archer Mk 1A electro-optic director* **4** *M2HB 12.7 mm heavy machine gun* **5** *Bofors 40 mm/70 cannon*

GENERAL SPECIFICATIONS

Country of origin: France
Operator: Thailand
Type: PS 700 (Mod) (LST)

Class: SICHANG

Active: 2
Proposed: 1

Displacement:
standard: 3,540 t
full load: 4,235 t

Dimensions
Length:
***Sichang* (721):** 103 m (337.92 ft)
***Surin* (722):** 112.5 m (369.1 ft)
Beam: 15.7 m (51.5 ft)

Draught: 3.5 m (11.5 ft)

Speed: 16 kts
Range: 7,000 n miles at 12 kts

Complement: 129

SHIPS

SICHANG (721)

Builder	Ital Thai, Bangkok, Thailand
Launched	14 Apr 1987
Commissioned	9 Oct 1987

SURIN (722)

Builder	Bangkok Dock Co Ltd, Bangkok, Thailand
Launched	12 Apr 1988
Commissioned	16 Dec 1988

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops 348
- Tanks 14 tanks (each 50 tonnes) or 12 armoured personnel carriers
- Cargo 850 t

SHIP-SHORE LIFT

- 3 LCVPs
- 1 LCPL

- These landing craft are carried at the forward end of the upper deck and lifted in/out of the water by crane.

AVIATION FACILITIES

Specifications
Flight deck: 2 flight decks, 1 aft, the second on the foredeck
Hangar: None
Helicopters: 2 Bell 212

AMPHIBIOUS FACILITIES

- Clamshell bow doors.
- Vehicle ramp is 17 m (55.8 ft) long.
- Beaching draught is 2.88 m (9.45 ft).
- Crane on foredeck for landing craft.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/70

One Bofors 40 mm L/70 automatic cannon is mounted on the forecastle. This is used for both air defence and for fire support during the run in to a beach. The barrel is of monobloc construction with a flash suppressor at the end and it is 2.8 m (9.2 ft) long and weighs 163 kg (359.4 lb). A recoil spring is wrapped around the end of the barrel. The barrel is inserted into the cylindrical section in the front of the breech rings by a threaded mounting.

Specifications
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Range: 6.75 n miles (12.5 km), 8,700 m.
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (13,124 ft)
Rate of fire: 300 rds/min
Ammunition: 2.4 kg (5.3 lb) (HCHE, PFHE), 2.5 kg (5.5 lb) (HE-T)

Oerlikon 20 mm in GAM-C01 mounting

One Oerlikon 20 mm cannon in a GAM-C01 mounting.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,773 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

Mounting
Elevation: −15 to +90°
Total weight: 497 kg (1,096 lb) (including shield)

M2HB 12.7 mm machine guns

Two M2HB 12.7 mm machine guns are carried. The M2HB is a selective short recoil automatic operation weapon with a 1,143 mm long barrel and eight

right-hand grooves turning once every 381 mm. The weapon uses 110-round belts.

Specifications
M2HB
Calibre: 12.7 mm
Barrel: 90 calibres
Gun weight: 38.1 kg (84.0 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

81 mm mortar
As with other French amphibious warship designs, these ships carry one 81 mm mortar for use during the run in to amphibious landings. Typical range for such a weapon is 1.94 n miles (3.6 km), firing a 4.05-4.15 kg (8.9-9.1 lb) bomb at a rate of approximately 10 rds/min.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

British Aerospace Sea Archer Mk 1A electro-optic directors
Two British Aerospace Sea Archer Mk 1A electro-optic directors provide complete integration of a TV subsystem with below-decks control by joystick, giving an improved surveillance capability and the option of manned or unmanned director on deck. The system consists of two basic elements: the MSI-Defence Systems Optical Fire Director (OFD) with a combination of electro-optic tracking sensors and a laser rangefinder; and a gun control console containing a predictor operator control panel and system communications. The system is capable of three modes of gunfire control: air defence, surface, naval gunfire support. The Thai ships have the Mod 1 version which includes a thermal imager and autotrack capabilities.

Specifications
Traverse: 360°
Elevation: -20 to +70°
Laser: Nd:YAG
Beamwidth: 2 mrad
Repetition rate: 20 Hz

Manufacturer/Contractor
British Aerospace Systems and Equipment Ltd, UK.

RADAR

Racal-Decca 1226
The Type 1226 is part of the Solid State series and uses a 30 cm (11.8 in) PPI (Plan Position Indicator) display. It operates in the I-band, has 20 kW output and is equipped with a 1.83 m (6.0 ft) antenna.

Specifications
Type 1226
Role: Surface search
Frequency: I-band
Range: 48 n miles (89 km)
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 20V 1163 TB82 diesels, 8.1 MW (11,000 hp) (see 'Further Information' below)
Shafts: 2
Propellers: Controllable pitch

FURTHER INFORMATION

PROGRAMME

These ships were built under licence to the French Chantier du Nord (Normed) 'PS 700' design by Ital Thai in Bangkok, Thailand, with technical assistance from the Korea-Tacoma company. They are the largest naval ships yet built in Thailand, the task for the Bangkok yard being made even more difficult when it was decided that, since the ship could not accommodate a full infantry battalion, the hull had to be extended after the launch.

At one time a total of six was planned, but so far only two have been completed, while the third has not yet been laid down, the order still being 'under consideration' in 1996.

DESIGN

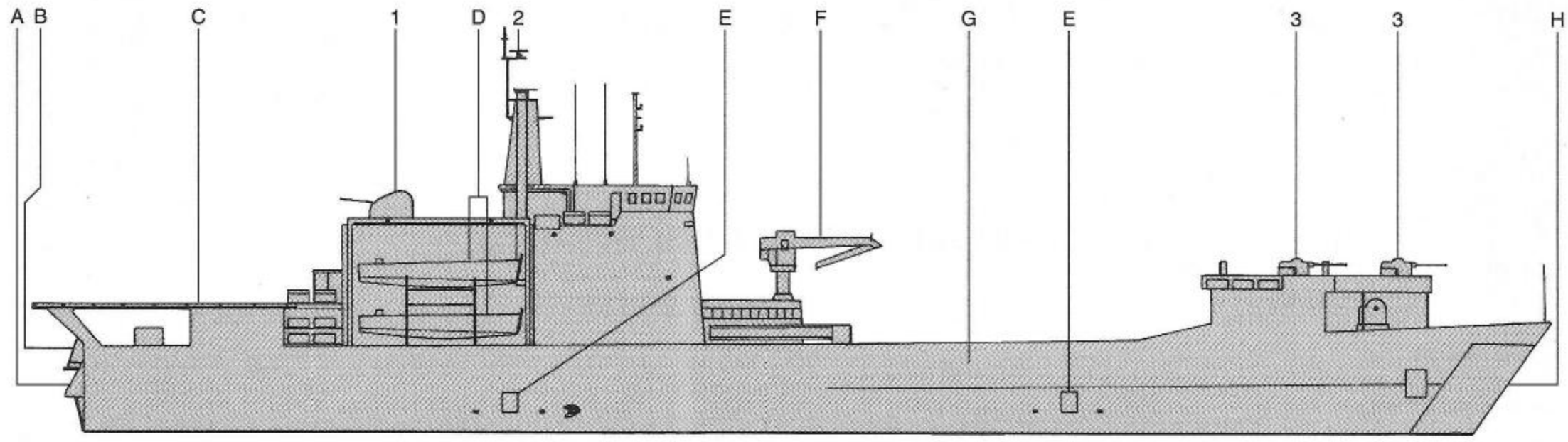
A conventional LST design, with clamshell bow doors, a long tank deck and superstructure aft. There is a large flight deck aft and a second flight deck on the foredeck. The hull of the first of class had to be extended by the insertion of a 6 m (19.68 ft) plug after the launch.

The second ship, *Surin* (722) incorporates a number of changes. It is 9.5 m (31.2 ft) longer than (the lengthened) *Sichang* (721) and the flight deck aft is one deck level higher. There are also reports that *Surin* (722) may have different engines, possibly MWM.

Sichang *(721)* (Royal Thai Navy)

Surin *(722). Note that the flight deck is one deck level higher than in* Sichang *(721)* (Royal Thai Navy)

OSMAN GAZI



Osman Gazi (Ian Sturton)
Amphibious A *Mine launching chute (probable)* **B** *Kedge anchor* **C** *Flight deck* **D** *LCVPs (total four)* **E** *Mine loading ports (probable)* **F** *Cranes (two)* **G** *Tank deck* **H** *Clamshell bow doors with ramp*

General 1 *Oerlikon twin 35 mm/90* **2** *Racal-Decca Type 1226* **3** *Bofors 40 mm/70 (three)*

GENERAL SPECIFICATIONS

Operator: Turkey

Class: OSMAN GAZI (LST)

Built: 1
Active: 1

Displacement:
full load: 3,773 t

Dimensions
Length: 105 m (344.5 ft)
Beam: 16.1 m (52.8 ft)
Draught: 4.8 m (15.7 ft)

Speed: 17 kts
Range: 4,000 n miles at 15 kts

SHIPS

OSMAN GAZI (N^L 125)
Builder Taşkizak Yard, Istanbul, Turkey
Laid down 7 Jul 1989
Launched 20 Jul 1990
Commissioned 27 Jul 1994

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 900
- Tanks: 15

SHIP-SHORE LIFT

- LCVP: four in davits on either side of superstructure.

AVIATION FACILITIES

Specifications
Flight deck: Large flight deck aft
Hangar: None
Helicopters: 1 Agusta AB 212ASW

AMPHIBIOUS FACILITIES

- Clamshell bow doors, with internal ramp.
- Crane immediately before bridge.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/70 cannon

There are three Bofors 40 mm L/70 automatic cannon on the forecastle, which are used for both air defence and for fire support during the run in to a beach. The barrel is of monobloc construction with a flash suppressor at the end and it is 2.8 m (9.2 ft) long and weighs 163 kg (359 lb). The rifling consists of 16 grooves with a 1 in 46 to 1 in 27 calibres twist extending 2.42 m (8.0 ft). A recoil spring is wrapped around the end of the barrel. The barrel is inserted into the cylindrical section in the front of the breech rings by a threaded mounting.

Specifications
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Range: 6.75 n miles (12.5 km), 8,700 m

Osman Gazi *(N^L 125). The two ports in the side are open, and the minelaying chutes can be seen in the transom* (H & L van Ginderen Collection)

Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (13,124 ft)
Rate of fire: 300 rds/min
Ammunition: 2.4 kg (5.3 lb) (HCHE, PFHE), 2.5 kg (5.5 lb) (HE-T)

Oerlikon 20 mm/90 in GDM-A mounting

There is one twin Oerlikon 20 mm cannon in a GDM-A mount atop the superstructure, abaft the stack.

Specifications
Gun
Calibre: 35 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,175 m/s (3,855 ft/s)
Range:
anti-surface: 2.7 n miles (5 km)
anti-air: 4,500 m (14,764 ft)
Rate of fire: 550 rds/min/barrel
Ammunition: 1.56 kg (3.4 lb)

Mounting (GDM-A)
Loaded weight: 6.52 t
Traverse: 360° at 120°/s
Elevation: −15 to +85° at 100°/s
Crew: 1 gunner, 2 loaders

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca

There is one Racal-Decca, I-band, navigation radar; actual model is unknown.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 12V 1163 TB73 diesels, 6.47 MW (8,800 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

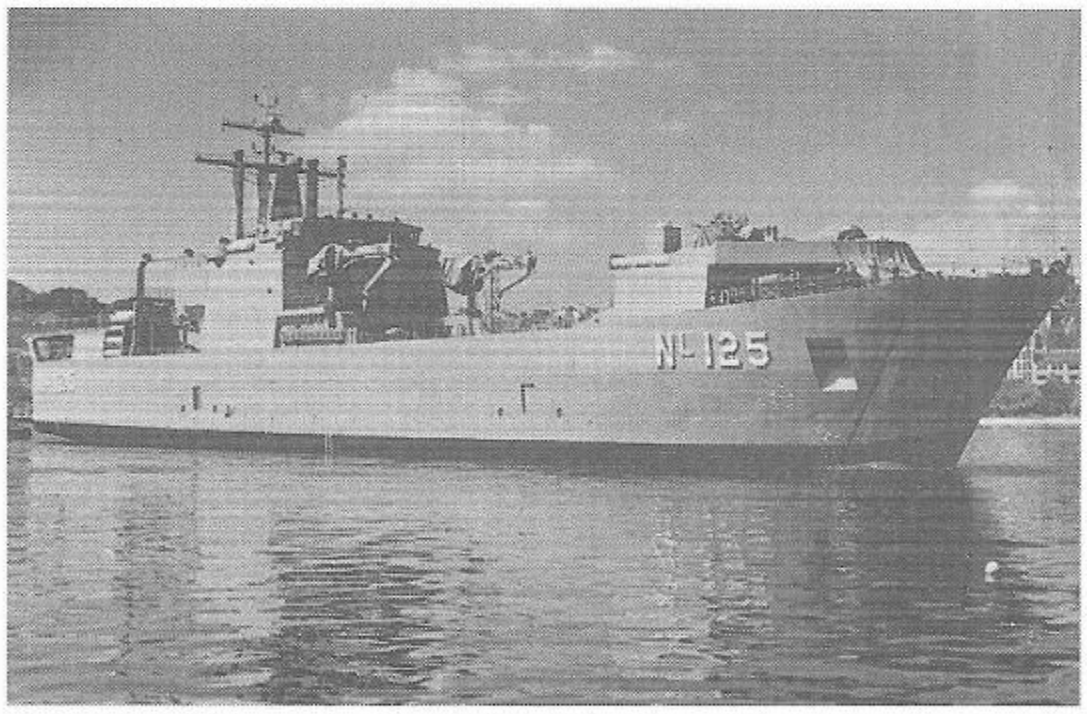
Osman Gazi (N^L 125) is the latest amphibious warfare ship in a series of one- or two-ship classes for the Turkish Navy. It was originally announced that there would be at least two ships in this class, but the second was cancelled in 1991 and *Osman Gazi* remains the only ship in its class. The ship took a full four years between launch and completion — an unusually long time.

DESIGN

The ship is a tank landing ship of approximately the same size as the two 40-year-old former US Navy 'Terrebonne Parish' class LSTs still operated by the Turkish Navy. The design has full nuclear, biological and chemical defence (NBCD) protection. It also has a support weapons co-ordination centre for amphibious task forces.

Although this ship is not normally listed as a minelayer, *Osman Gazi* has two ports on either side normally associated with loading mines and what appears to be a large chute in the starboard side of the transom. It therefore appears probable that it is a minelayer.

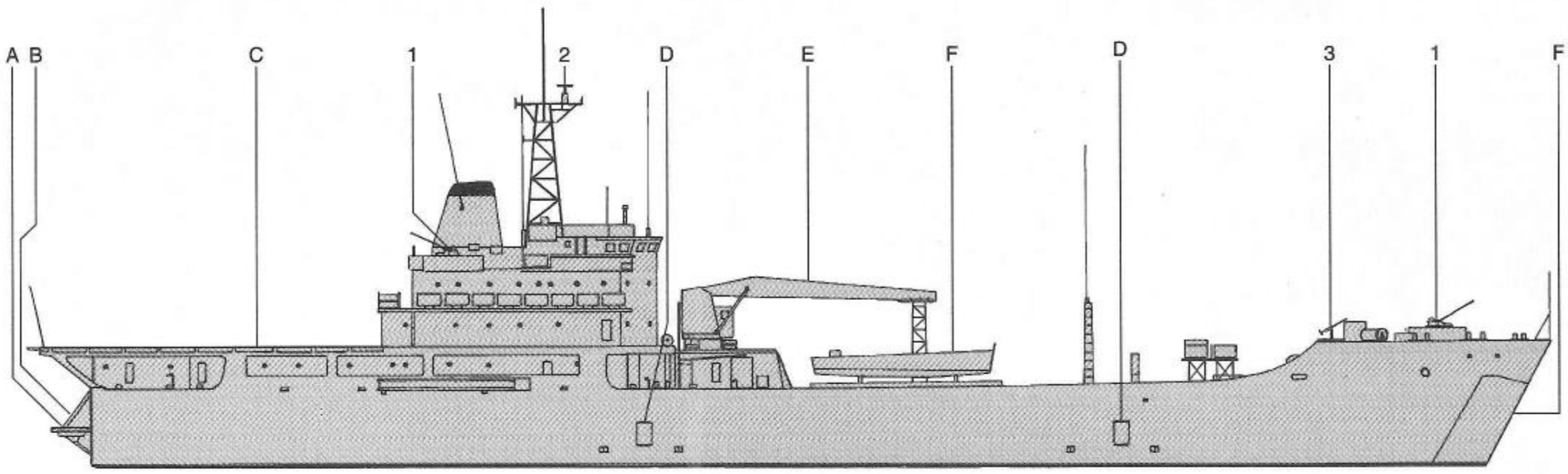
Also noteworthy are two large cranes on the foredeck.



Osman Gazi *(N^L 125) prior to completion. Note the unusual gantry over the forward part of the tank deck and the two cranes* (Turkish Navy)

Osman Gazi *(N^L 125)* (H & L van Ginderen Collection)

SARUÇABEY



Karamürselbey *(Turkey)* (Ian Sturton)
Amphibious A *Minelaying port (two)* **B** *Kedge anchor* **C** *Flight deck* **D** *Mine entry port/troop disembarkation* **E** *Crane* **F** *Clamshell doors with internal ramp*

General 1 *Bofors 40 mm/70 (three)* **2** *Racal-Decca Type 1226 navigation radar* **3** *Oerlikon 20 mm cannon*

GENERAL SPECIFICATIONS

Operator: Turkey

Class: SARUÇABEY (LST/ML)

Built: 2
Active: 2

Displacement:
full load: 2,600 t

Dimensions
Length: 92 m (301.8 ft)

Beam: 14 m (45.9 ft)
Draught: 2.3 m (7.5 ft)

Speed: 14 kts

SHIPS

SARUÇABEY (N^L 123)

Builder	Taskizak Naval Yard, Istanbul, Turkey
Launched	30 Jul 1981
Commissioned	17 Jul 1984

KARAMÜRSELBEY (N^L 124)

Builder	Taskizak Naval Yard, Istanbul, Turkey
Launched	26 Jul 1984
Commissioned	19 Jun 1987

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 600
- Tanks: 11 tanks, 12 Jeeps

SHIP-SHORE LIFT

- Two LCVPs carried on foredeck

AVIATION FACILITIES

Specifications
Flight deck: Large flight deck aft
Hangar: None
Helicopter: 1 Agusta AB 212

AMPHIBIOUS FACILITIES

- Clamshell doors and internal vehicle ramp.
- Crane on foredeck immediately forward of the bridge.
- Kedge anchor.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/70 cannon

There are three Bofors 40 mm L/70 automatic cannon which are used for both air defence and for fire support during the run in to a beach. The barrel is of monobloc construction with a flash suppressor at the end and it is 2.8 m (9.2 ft) long and weighs 163 kg (359 lb). The rifling consists of 16 grooves with a 1 in 46 to 1 in 27 calibres twist extending 2.42 m (8.0 ft). A recoil spring is wrapped around the end of the barrel. The barrel is inserted into the cylindrical section in the front of the breech rings by a threaded mounting. The mounting for the Moroccan Batrals not known.

Specifications
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Range: 6.75 n miles (12.5 km), 8,700 m.
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (13,124 ft)
Rate of fire: 300 rds/min
Ammunition: 2.4 kg (5.3 lb) (HCHE, PFHE), 2.5 kg (5.5 lb) (HE-T)

Oerlikon 20 mm/90 in GDM-A mounting

There are two twin Oerlikon 20 mm cannon. The two mounts are atop the superstructure, abaft the stack.

Specifications
Gun
Calibre: 35 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,175 m/s (3,855 ft/s)
Range:
anti-surface: 2.7 n miles (5 km)
anti-air: 4,500 m (14,764 ft)
Rate of fire: 550 rds/min/barrel
Ammunition: 1.56 kg (3.4 lb)

Mounting (GDM-A)
Loaded weight: 6.52 t
Traverse: 360° at 120°/s
Elevation: −15 to +85° at 100°/s
Crew: 1 gunner, 2 loaders

MINES

150 mines can be carried in lieu of amphibious lift. They are laid through ports in the transom.

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca 1226

The Type 1226 is part of the Solid State series and uses a 30 cm PPI (Plan Position Indicator) display. It operates in the I-band, has 20 kW output and is equipped with a 1.83 m (6.0 ft) antenna.

Specifications
Type 1226
Role: Surface search
Frequency: I-band
Range: 48 n miles (89 km)
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 3 diesels, 3.2 MW (4,320 hp)
Shafts: 3

FURTHER INFORMATION

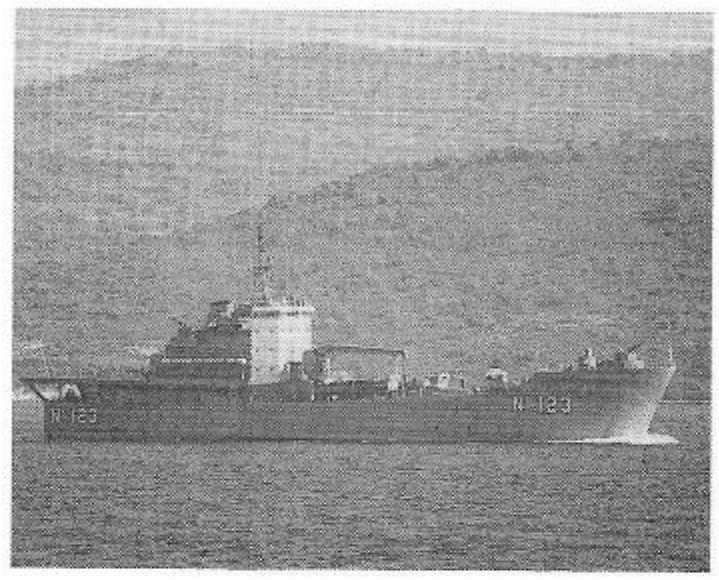
PROGRAMME

A two-ship class of LSTs which represents a major advance on the 'Çakabey' class. As with other Turkish amphibious vessel types, there are fewer of these ships than had initially been intended; the original plan was to build five but, in the event, only two were completed, being commissioned in 1984 and 1985, respectively.

DESIGN

This is essentially an enlarged and much improved version of the Çakabey dual-purpose minelayer/landing ship design. There is a proper helicopter deck aft, a raised forecastle, and the superstructure is somewhat larger. There is also a large articulated crane amidships to handle the LCVPs.

There are two large ports on each side on the tank deck. These are basically intended for embarking the mines, but are also used as embarkation/disembarkation ports for troops.



Saruçabey (N^{L} 123) belongs to the second two-ship class landing ships/minelayers built in Turkey.

ÇAKABEY

GENERAL SPECIFICATIONS

Operator: Turkey

Class: ÇAKABEY (LSM/ML)

Built: 1
Active: 1

Displacement:
full load: 1,600 t

Dimensions
Length: 77.3 m (253.5 ft)

Beam: 12 m (39.4 ft)
Draught: 2.3 m (7.5 ft)

Speed: 14 kts

SHIPS

ÇAKABEY (N^L 122)
Builder Taşkizak Naval Yard, Istanbul, Turkey
Launched 30 Jun 1977
Commissioned 30 Jan 1983

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 400
- Tanks: Nine tanks; 10 Jeeps

SHIP-SHORE LIFT

- 2 LCVPs, carried on davits either side of the superstructure.

AVIATION FACILITIES

Specifications

Flight deck: There is a small flight deck aft and helicopters can also land on the foredeck.
Hangar: None
Helicopter: 1 Agusta AB 212ASW

AMPHIBIOUS FACILITIES

- Clamshell bow doors, with internal ramp.
- Two cranes on foredeck, one at either end.
- Kedge anchor

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60 in Mk 1 twin mountings

Four Bofors 40 mm/60 in two Mk 1 twin mountings. The Mk 1 mounting is power-driven on a stand and base ring with twin water-cooled Mk 1 and Mk 2 guns which are 243 mm apart. A steel platform is attached to the rear of the weapon's base. Both the gun-layer (pointer) and trainer have optical ring sights, and manual elevation and training gear. The mounting has no provision for ammunition storage but a shield is usually provided. The mounting uses 3 or 5 HP elevation and training motors and the muzzle arc radius is 231 cm (90 in) while the working circle radius is 213 cm (84 in).

Specifications

Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s) (new gun); 850 m/s (2,789 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,639 ft)
Rate of fire: 80 rds/min (practical), 160 rds/min (cyclic)
Ammunition: 2.21 kg (4.9 lb)

Mounting
Weight, empty: 4.45-6.76 t
Traverse: 360° at 30°/s
Elevation: −15 to +85/90° at 24°/s
Crew: 4

Oerlikon 20 mm in twin Mk 24 mountings

Four Oerlikon 20 mm in two twin Mk 24 mountings. The two mounts are on the forecastle.

Specifications

Gun
Calibre: 35 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,175 m/s (3,855 ft/s)
Range:
anti-surface: 2.7 n miles (5 km)
anti-air: 4,500 m (14,764 ft)
Rate of fire: 550 rds/min/barrel
Ammunition: 1.56 kg (3.4 lb)

US Mk 24 mounting
Traverse: 360°
Elevation: −15 to +90°
Weight: 481-649 kg (1,060-1,431 lb) (unloaded)

MINES

150 mines can be carried and laid in lieu of the amphibious load.

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca Type 1226

The Type 1226 is part of the Solid State series and uses a 30 cm PPI (Plan Position Indicator) display. It operates in the I-band, has 20 kW output and is equipped with a 1.83 m (6.0 ft) antenna.

Specifications

Type 1226
Role: Surface search
Frequency: I-band
Range: 48 n miles (89 km)
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm

Manufacturer/Contractor

Racal-Decca, UK.

PROPULSION

Specifications

System: Diesel
Main machinery: 3 diesels, 3.2 MW (4,320 hp)
Shafts: 3

FURTHER INFORMATION

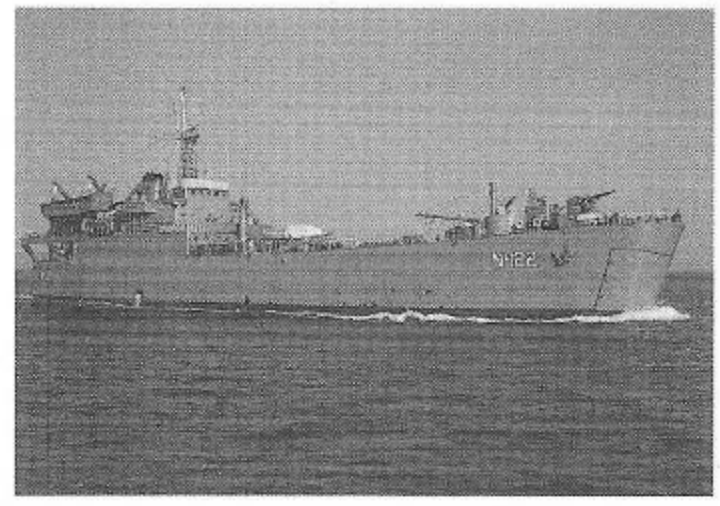
PROGRAMME

The first of several classes of Turkish-designed and built combined minelayers and amphibious warfare vessels. The original intention was to build four of the class but, in the event, only one was completed and two of a larger version, the 'Saruçabey' class, were built instead.

DESIGN

This is a dual-purpose tank landing ship and minelayer design, with bow doors. There are two landing spots for helicopters: one on the foredeck, the other on a platform aft.

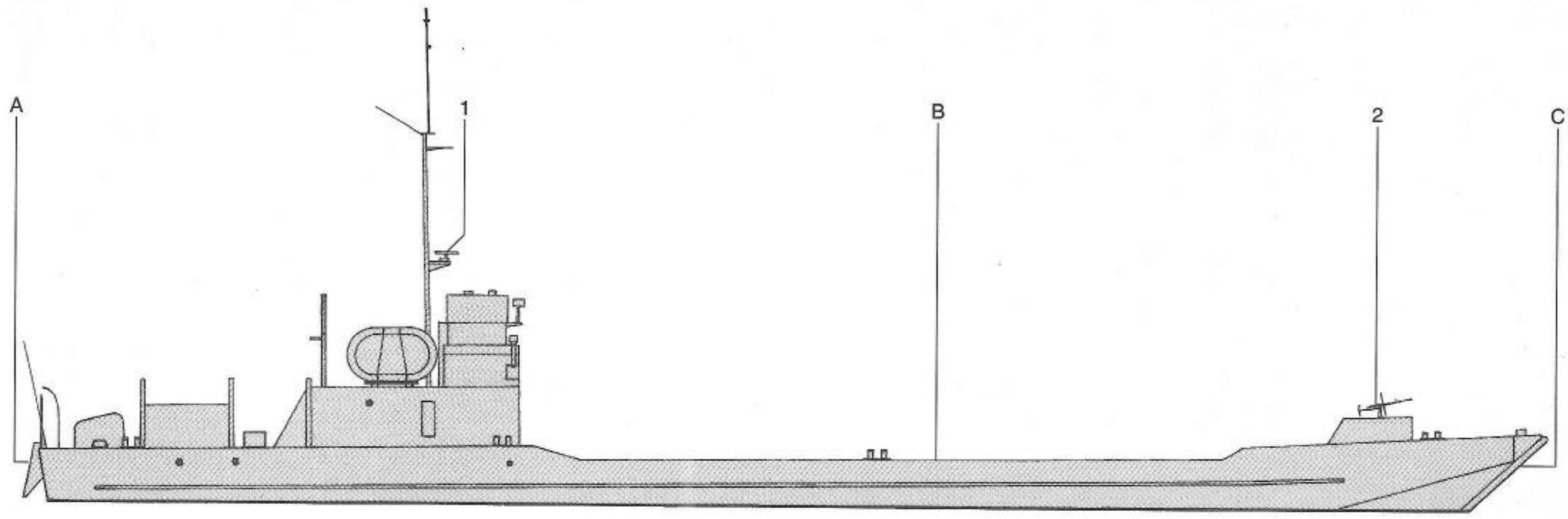
An unusual feature is the side disembarkation ports, two on each side, leading directly onto the tank deck. These are for loading the mines and their use by troops is an incidental advantage.



Çakabey *(N[L] 122) the first combined landing ship/minelayer to be built in Turkey* (Turkish Navy)

Çakabey *(N[L] 122). Note the open mineloading ports in the ship's side and the minelaying ports in the transom* (H & L van Ginderen Collection)

TURKISH TYPE LCT



Libya *Turkish type LCT* (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Tank deck* **C** *Bow ramp*

General 1 *Navigation radar* **2** *Oerlikon twin 20 mm cannon*

GENERAL SPECIFICATIONS

Country of origin: Turkey
Operators: Turkey, Libya.

Class: TURKISH LCT

Built: 31
Active:
Turkey: 28
Libya: 3 (see 'Further Information')

Displacement:
standard: 280 t
full load: 600 t

Dimensions
Length:
Ç119-Ç138 and Libyan craft: 56 m (183.7 ft)
Ç139-Ç150: 59.6 m (195.5 ft)
Beam: 11.6 m (38 ft)
Draught: 3.2 m (10.5 ft)

Speed: 8.5 kts
Range: 600 n miles at 8 kts

Complement: 17 including one officer

SHIPS

Turkey

Ç119	Ç121	Ç122	Ç138	Ç139	Ç140	**Libya**	
Ç123	Ç124	Ç125	Ç141	Ç142	Ç143	**Ibn Al Idrisi** (130) (ex-*Turkish Ç130*)	
Ç126	Ç127	Ç128	Ç144	Ç145	Ç146	**Ibn Marwan** (131) (ex-*Turkish Ç131*)	
Ç129	Ç132	Ç133	Ç147	Ç148	Ç149	**El Kobayat** (132) (ex-*Turkish Ç133*)	
Ç134	Ç135	Ç137	Ç150				

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 100
- Tanks: 5
- Cargo: 350 tonnes

SHIP-SHORE LIFT

- None

AMPHIBIOUS FACILITIES

- Flat, bottom-hinged combined bow door/ramp.
- Kedge anchor at stern.

Turkish Ç120 in drydock showing its typical LCT barge-like, flat-bottomed hull
(H & L van Ginderen Collection)

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm in twin Mk 10 mountings
Two Oerlikon 20 mm in Mk 10 mountings.

Specifications
Gun
Calibre: 35 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,175 m/s (3,855 ft/s)
Range:
anti-surface: 2.7 n miles (5 km)
anti-air: 4,500 m (14,764 ft)
Rate of fire: 550 rds/min/barrel
Ammunition: 1.56 kg (3.4 lb)

Mounting
Elevation: −15 to +90°
Weight: 431-499 kg (950-1,100 lb) (unloaded). Includes 12.7 mm shield weighing 109 kg (240 lb)

M2HB 12.7 mm machine guns
Two M2HB 12.7 mm machine guns are carried. The M2HB is a selective short recoil automatic operation weapon with a 1,143 mm long barrel and eight right-hand grooves turning once every 381 mm.

Specifications
M2HB
Calibre: 12.7 mm
Barrel: 90 calibres
Gun weight: 38.1 kg (84.0 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca
One Racal-Decca, I-band, navigation radar is installed, type unknown.

PROPULSION

Specifications
System: Diesel
Main machinery: 3 General Motors GM 6-71 diesels, 390 kW (522 hp) sustained
Shafts: 3

FURTHER INFORMATION

PROGRAMME

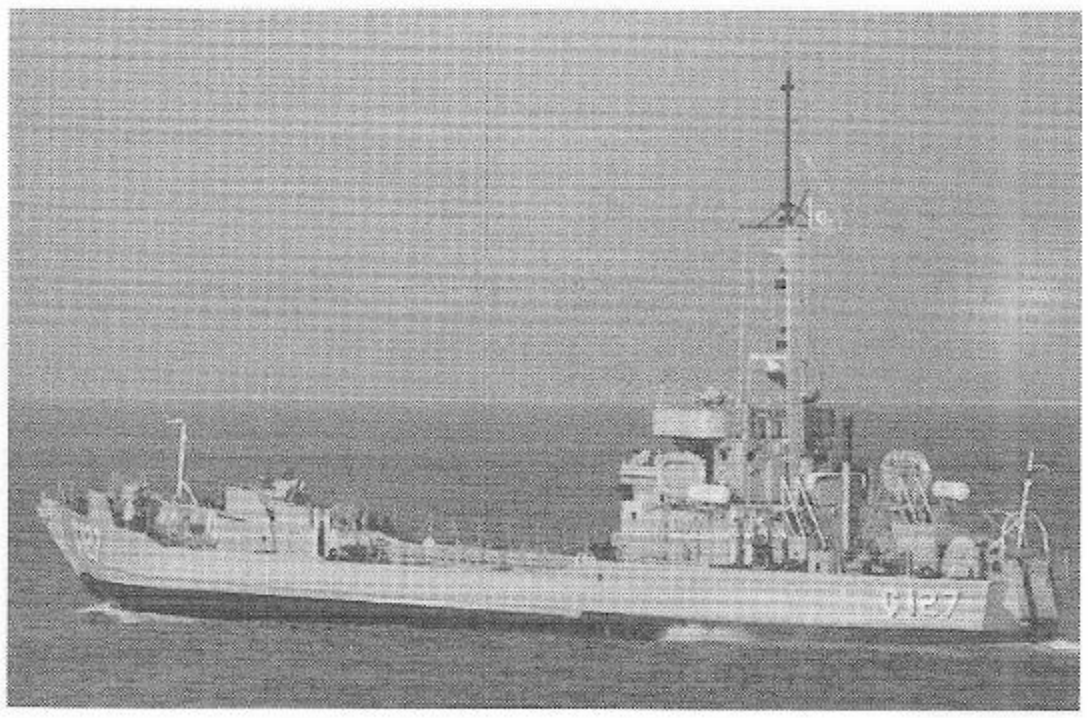
Turkey
Construction of these craft started at the naval yards of Golçuk and Taşkizak in 1977 and continued at a rate of two or three a year until 1987. The two launched in July 1987 were not completed and commissioned until 1991, and three more were then built, being completed in 1992.

Ç130 and Ç131 were transferred to Libya in 1979, plus one other later. Ç136 sank in 1985.

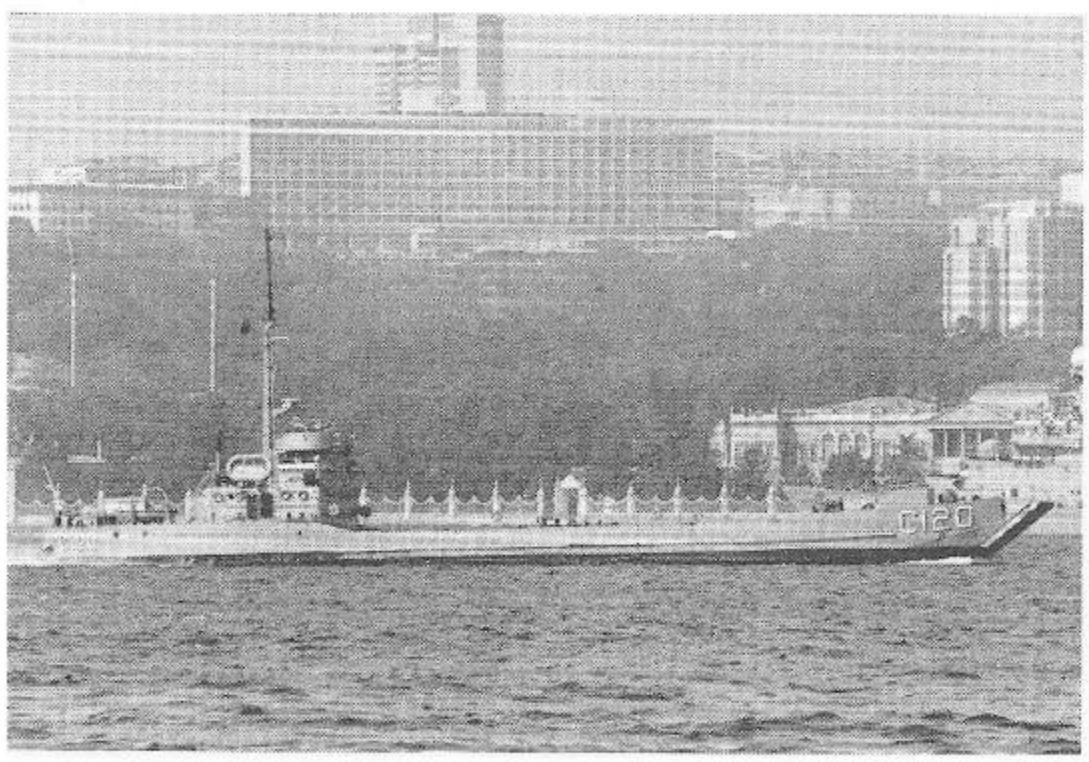
Libya
Libya operates three former Turkish Navy LCTs, Nos Ç130 and Ç131, built at the Turkish naval yards of Golçuk and Taşkizak and transferred on 7 December 1979 to Libya. A third of the class was reported in 1991, but its former Turkish number is not known. At one stage, the number of these ships in the Libyan Navy was thought to be much greater. It is unclear how many of these three remain operational.

DESIGN

Although sometimes described as 'EDIC-type' the design of these craft was based on the earlier Ç-107 class which was, in turn based on the British LCT Mk 4, of which the Turkish Navy operated six. The Turkish craft have virtually the same dimensions as the British design but differ in having three General Motors diesels instead of two Paxman diesels.

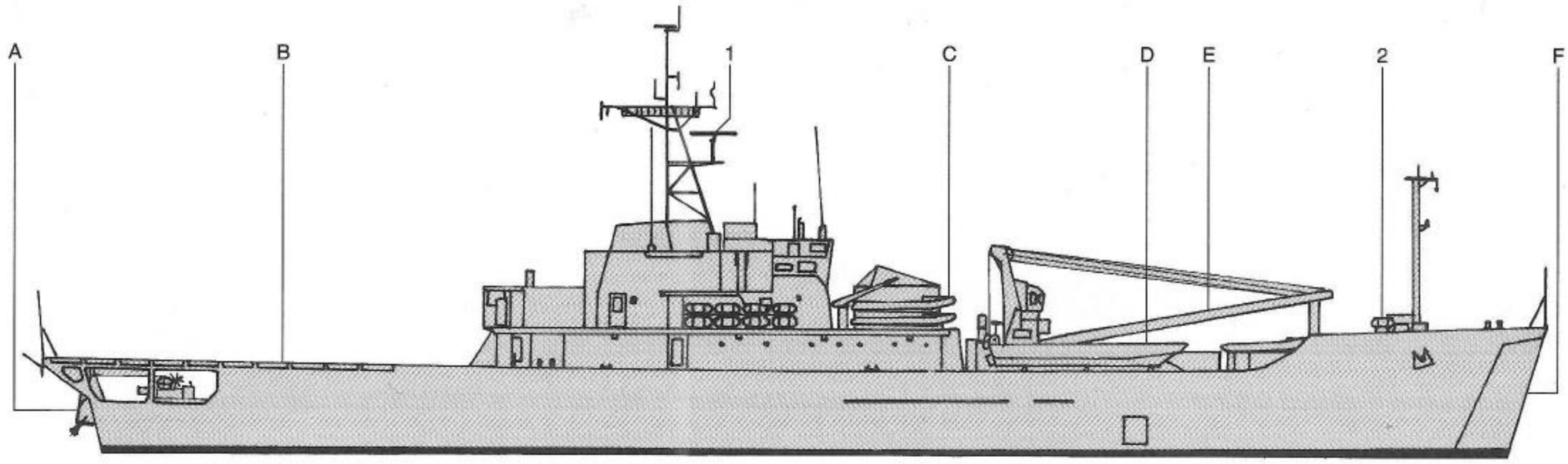


Ç127, one of a large number of LCTs of various classes operated by the Turkish Navy



A Turkish LCT, Ç120

HENGAM



Lavan *(Iran) LSL — as delivered* (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Flight deck* **C** *Inflatables* **D** *LCVP* **E** *10 tonne crane* **F** *Bow doors with internal ramp*

General 1 *Racal-Decca Type 1229 navigation radar* **2** *BM-21 rocket launcher*

GENERAL SPECIFICATIONS

Country of Origin: United Kingdom
Operator: Iran

Class: HENGAM (LSL)

Built: 4
Active: 4

Displacement:
full load: 2,540 t

Dimensions
Length: 93 m (305 ft)
Beam: 15 m (49 ft)
Draught: 2.4 m (7.3 ft)

Speed: 14.5 kts
Range: 4,000-plus n miles at 12 kts

Complement: 80

SHIPS

HENGAM (511)
Builder Yarrow (Shipbuilders) Ltd, Scotstoun, Clydebank, UK
Launched 27 Sep 1973
Commissioned 12 Aug 1974

LARAK (512)
Builder Yarrow (Shipbuilders) Ltd, Scotstoun, Clydebank, UK
Launched 7 May 1974
Commissioned 12 Nov 1974

TONB (513)
Builder Yarrow (Shipbuilders) Ltd, Scotstoun, Clydebank, UK
Launched Late 1979
Commissioned 21 Feb 1985

LAVAN (514)
Builder Yarrow (Shipbuilders) Ltd, Scotstoun, Clydebank, UK
Launched 12 June 1979
Commissioned 16 Jan 1985

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 227
- Tanks: 9
- Cargo: 600 tonnes

SHIP-SHORE LIFT

- Two LCVPs (MiG-G-1200SC) are carried on chocks on the foredeck.
- Small landing craft are carried on davits.

AVIATION FACILITIES

Specifications
Flight deck: Large flight deck aft
Hangar: None
Helicopters: Can embark one Sikorsky MH-53D

AMPHIBIOUS FACILITIES

- Clamshell bow doors with internal ramp.
- 10 tonne crane
- Vehicle deck 39.6 × 8.9 m (130 × 29 ft)

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60 in Mk 3 single mountings

***Hengam, Larak* only.** Four Bofors 40 mm/60 in four single mountings.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s) (new gun); 850 m/s (2,789 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,639 ft)
Rate of fire:
practical: 80 rds/min
cyclic: 160 rds/min for water-cooled weapons
Ammunition: 2.21 kg (4.9 lb)

Mountings
Traverse: Nominal 360° at 30°/s
Elevation: −15 to 85/90° at 24°/s

Russian ZU-23-2 23 mm/80 in four twin mountings

***Tonb* and *Lavan* only.** Eight former Soviet 23 mm/80 in four twin mountings. The Soviet Army ZU-23 was not produced for the Soviet Navy, which preferred 30 mm weapons, but the mounting has been adapted as the ZU-23-2 by a number of navies to produce a cheap, lightweight, short-range, point defence system on both large and small warships. They are most extensively used by Iran and Poland but during the Iran-Iraq War a number of Indian merchantmen carried these weapons for self-protection. The ZU-23-2 consists of two air-cooled 2A14 cannon fed from 50-round belts in boxes fitted to each side of the trunnions. A ZAP-23 optical sight is attached to the rear of the weapon which is on a manually operated firing platform. The whole mounting weighs 893 kg (1,969 lb) and it has a five-man crew, of whom two are on the mounting and three are ammunition carriers and loaders.

Lavan *(514) the fourth of the 'Hengam' class LSLs built by Yarrow for the Iranian Navy. The crane is used to transfer the LCVPs into the water* (Yarrow)

Specifications
Calibre: 23 mm
Length of barrel: 87 calibres
Traverse: 360°
Elevation: −10 to +90
Rates of fire: 200 rds/min/barrel (practical)
Projectile: 0.19 kg (0.42 lb)
Range:
anti-surface: 1.1 n miles (2 km)
anti-air: 1,500 m (4,920 ft)

12.7 mm machine guns
There are two 12.7 mm machine guns on all four vessels. The type is not known but they are probably Russian-made Degtyarev DShK-38/46 or DShK-M. The performance of the latter is given as an example.

Specifications
DShK-M
Gun weight: 35.7 kg (78.7 lb)
Muzzle velocity: 860 m/s (2,822 ft/s)
Cyclic rate of fire: 575 rds/min
Practical rate of fire: 80 rds/min
Effective range: 0.80 n miles (1.5 km)

BM-21 multiple rocket launcher
One BM-21 is mounted on the foredeck, which must have been fitted in all four after arrival in Iran. BM-21s are designed for use immediately before an amphibious assault and consist of two clusters, each of 20 tubes, on either side of an electrically operated mounting which holds training and elevation gears. They are reloaded automatically from a below-deck magazine. The mounting is about 2 m (6.5 ft) high and 2 m (6.5 ft) long and can traverse 360° and elevate from 0 to +55°. The standard missile for these weapons is the M-21-OF spin- and fin-stabilised rocket which comes in 3.226 (10.6) and 2.87 m (9.4 ft) lengths and can carry high explosive fragmentation, smoke, incendiary or chemical warheads.

Specifications
Rockets

	M-21-OF (9M22U)	M-21-OF (9M22M)
Diameter	122 mm	122 mm
Length	3.226 m (10.6 ft)	2.87 m (9.4 ft)
Weight	77.5 kg (170.8 lb)	66 kg (145.5 lb)
Range	500-20,380 m (1,640-66,867 ft)	500-20,000 m (1,640-65,620 ft)
Warhead weight	19.3-19.4 kg (42.5-43 lb)	18.4 kg (40.5 lb)
Max velocity	690 m/s (2,263 ft/s)	700 m/s (2,297 ft/s)

ELECTRONIC WARFARE SYSTEMS

DECOYS

UK Mk 5 rocket flare
Two launchers are installed.

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca 1229
The navigation radar is the Racal-Decca Type 1229, with an output of 20 kW. It is equipped with a 2.7 m (8.8 ft) antenna and operates in the I/J-band.

Specifications
Role: Navigation
Frequency: I/J-band
Beam: 1.3 × 30°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
PRF: 1,300/650 pps
Scan rate: 25 rpm

Manufacturer/Contractor
Racal-Decca, UK.

IFF

SSR 1520
Hengam and *Larak* only.

TACAN
AN/URN-25.

'Hengam' class LSLs carry two LCVPs, which are military versions of this MiG-G-1200-SC, which is made in Iran. The craft is 12.4 m (40.7 ft) long with a beam of 3.0 m (9.8 ft) and carries 30 troops or 1.66 tonnes at a speed of 23 knots (IRI Marine Industries)

PROPULSION

Specifications
System: Diesels
Main machinery:
***Hengam* and *Larak* only** — 4 Paxman 12YJCM diesels, 2.24 MW (3,000 hp) sustained
***Tonb* and *Lavan* only** — 4 MTU 16V 652 TB81 diesels 3.38 MW (4,600 hp) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

Two ships of this class were ordered by the Shah of Iran's regime in 1972 and delivered by Scottish shipyard Yarrow two years later. In 1977, the Shah's regime ordered four more, the first two of which were close to launch (and much of the material for the other two had been ordered), when the Shah was overthrown but the new Iranian Government cancelled the order. Yarrow had little choice but to go ahead and finish the hulls of the second pair and launch them.

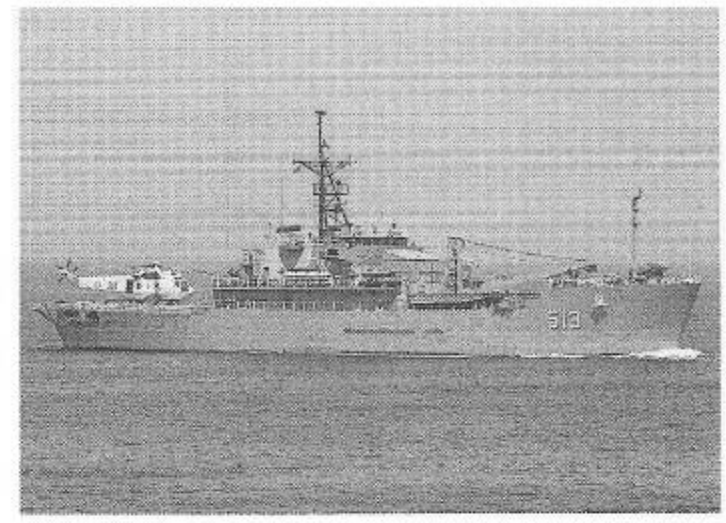
The new Iranian Government then asked for the order to be reinstated, but Yarrow did not obtain British Government authorisation to proceed with the sale until 1985, when the ships were declared to be 'hospital ships'. The third, final pair was never built. The 'hospital ships' are now armed with eight 23 mm cannon, two 12.7 mm machine guns and a BM-21 rocket launcher.

DESIGN

These ships are a straightforward LSL design with bow doors, but do not have a stern ramp. They have a large flight deck capable of handling a CH-53, of which six to seven are still operational, although it is more usual to see SH-3D aboard.

DEPLOYMENT

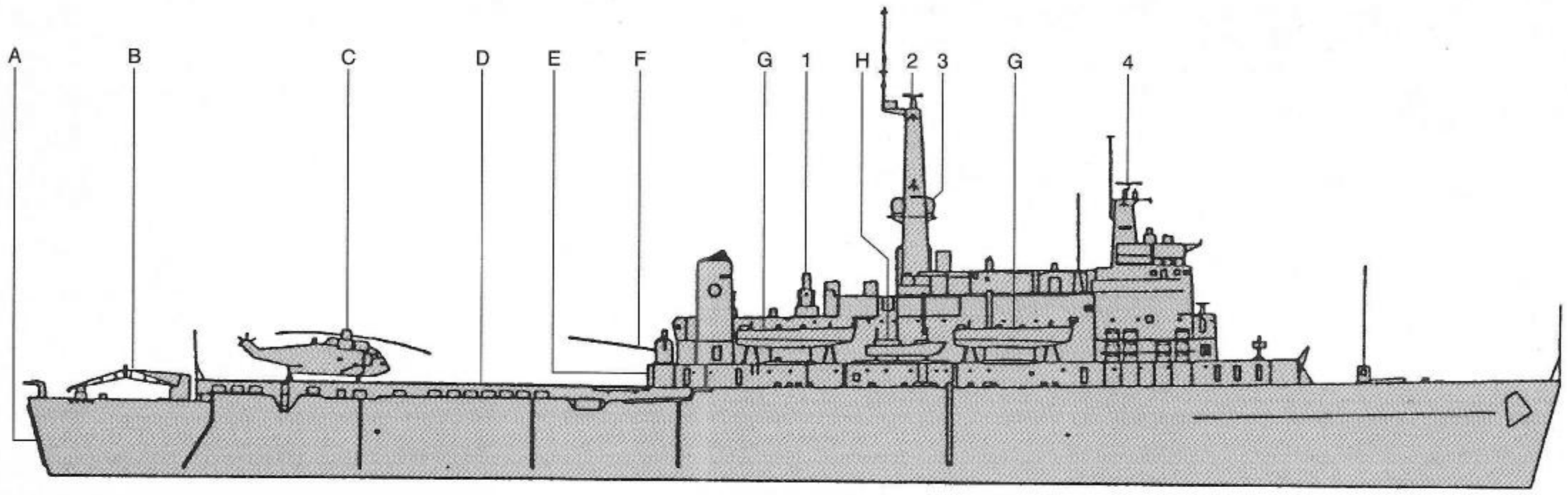
These are employed as amphibious ships, but also act as depot ships for mine countermeasures vessels (MCMVs) and other small craft. They have also been used to ferry Pasdaran small craft around the Gulf.



Tonb *(513) with Iranian Air Force Sikorsky SH-3 on the flight deck*

Larak *(512). Note LCVP on foredeck* (H & L van Ginderen Collection)

FEARLESS



Fearless (Ian Sturton)
Amphibious A *Stern gate* **B** *Crane* **C** *Sea King HC4 helicopter* **D** *Flight deck* **E** *Hangar* **F** *Crane* **G** *LCVP Mk 4* **H** *LCPL*

General 1 *Hughes Mk 15 Phalanx CIWS (two)* **2** *Siemens-Plessey Type 994 surface search radar* **3** *SCOT 1D Satcom (two)* **4** *Kelvin-Hughes Type 1006 navigation radar*

GENERAL SPECIFICATIONS

Operator: United Kingdom
Type: Landing Platform Dock (LPD)

Class: FEARLESS

Built: 2
Active: 1 (plus one in reserve)

Displacement:
standard: 11,060 t
full load: 12,120 t
ballasted down: 16,950 t

Dimensions
Length: 158.5 m (520 ft) (oa), 152.4 m (500 ft) (wl)
Beam: 24.4 m (80 ft)
Draught: 6.2 m (20.5 ft) (9.8 m (32 ft) flooded)

Speed: 21 kts
Range: 5,000 n miles at 20 kts

Complement: 550, including 50 officers, plus 22 (3 officers) air group, plus 88 (3 officers) Royal Marines

SHIPS

FEARLESS (L 10)

Builder	Harland & Wolff, Belfast, UK
Laid down	25 Jul 1962
Launched	19 Dec 1963
Commissioned	25 Nov 1965

INTREPID (L 11) (in reserve)

Builder	John Brown, Clydebank, UK
Laid down	19 Dec 1962
Launched	25 June 1964
Commissioned	11 Mar 1967

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 380-400 (normal); 1,000 (hard-lying)
- Tanks 15 main battle tanks, plus seven 4-tonne trucks, plus 20 Land Rover trucks (specimen load).

SHIP-SHORE LIFT

- 4 LCU Mk 9 in dock
- 4 LCVP Mk 4 in davits

AVIATION FACILITIES

Specifications
Flight deck: Large flight deck aft. 2 landing spots
Hangar: In superstructure
Helicopters: 4 Westland Sea King HC 4

AMPHIBIOUS FACILITIES

- Stern gate
- Docking well accommodates four LCM Mk 9
- Mezzanine deck for light vehicles
- Tank deck

WEAPONS SYSTEMS

GUNS

Hughes Mk 15 CIWS Phalanx

Fearless (L10) — two Hughes Mk 15 CIWS Phalanx. *Intrepid* (L 11) — fitted for but not with two Hughes Mk 15 CIWS Phalanx. Vulcan Phalanx is a close in weapons system (CIWS) and two units are mounted atop the superstructure to provide the innermost layer of defence against anti-ship missiles. The 20 mm M61A1 Vulcan, six-barrel, Gatling-principal gun has a cylindrical magazine with the feed mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA.

RO/Oerlikon 30 mm/75 in GCM-A03 mountings

***Intrepid* (L 11) only.** Four RO/BMARC 30 mm/75 cannon in two GCM-A03 twin mountings. The GCM-A03-1 is a locally operated mounting with enclosed position which may be air conditioned, with a magazine carrying 320 or 500 rounds of ammunition. The similar GCM-A03-2 (the more likely of the two to be used in these ships) has an open operator mounting with two boxes of ammunition, each with 250 rounds.

Specifications
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Range:
anti-surface: 1.15 n miles (3 km)
anti-air: 3,500 m (11,483 ft)
Rate of fire: 650 rds/min/barrel
Ammunition: 870 kg (1,918 lb)

Mounting (GCM-A03)
Traverse: 360° at 80°/s
Elevation: −15 to +85° at 60°/s

Manufacturer/Contractor
Royal Ordnance, UK.

RO/Oerlikon 20 mm in GAM-BO1 mounting
Both ships have two single Oerlikon 20 mm cannon in GAM-BO1 mountings.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.7 km
anti-air: 1,700 m (5,578 ft)
Rate of fire: 900 rds/min
Round weight: 320-345 g
Projectile: 110-125 g

Mounting
Elevation: −15 to +60°
Total weight: 500 kg (1,102 lb) (including shield)

Fearless *(L 10) in 1994, prior to the recent modifications, the outline showing the general similarity to the US Navy's 'Raleigh' class. The two British ships,* Fearless *and* Intrepid *were commissioned in 1965 and 1967 respectively and have now exceeded their expected lives by a wide margin* (H M Steele)

Manufacturer/Contractor
Royal Ordnance, UK.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

GEC-Marconi Mentor A; radar warning
Mentor A is a low-cost threat warning equipment for detecting, measuring and analysing radar signals. Identification uses an easily updated mission library to give immediate and accurate warning of threats, although the lack of a jammer prevents any passive countermeasures. The system gives a capability over the E through J-bands (2 to 20 GHz) with optional C/D-band (0.5 to 2 GHz) coverage available if required. Mentor comes as a set of lightweight units. The two detector units are mounted on either side of the mast or superstructure and wired to a compact signal processing unit.

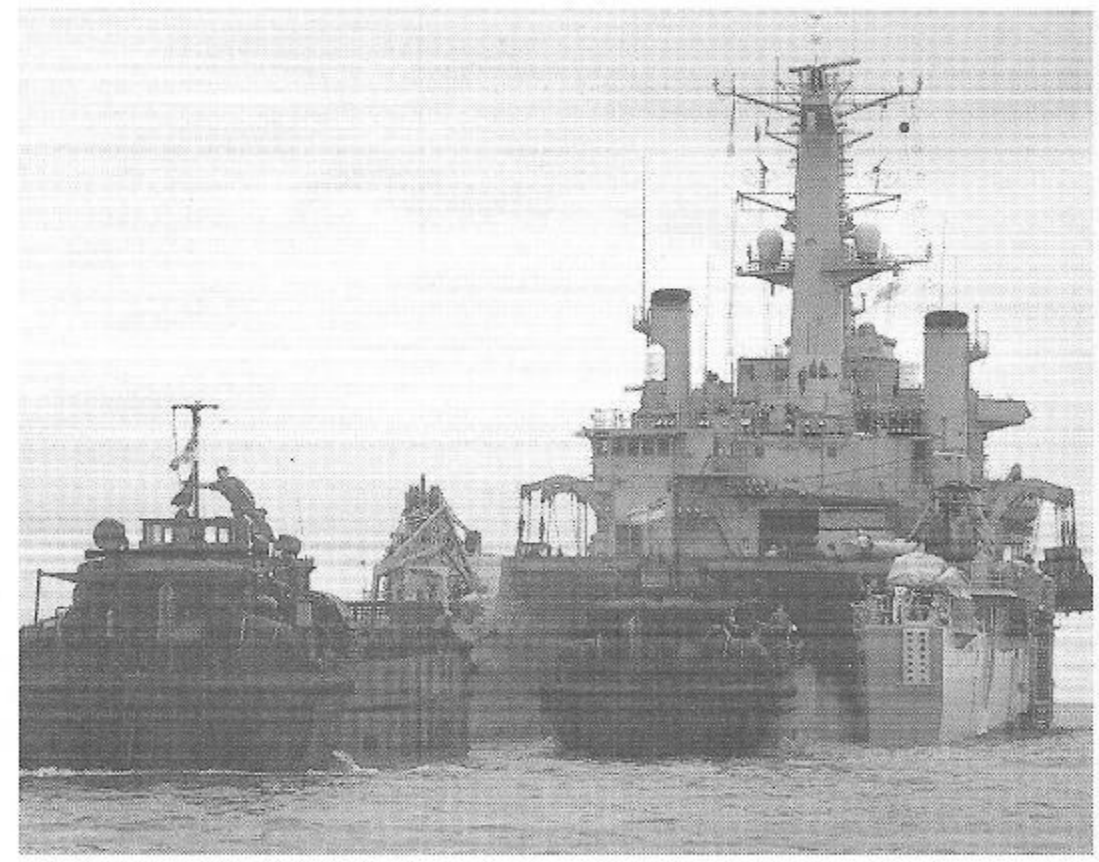
Manufacturer/Contractor
GEC-Marconi Radar and Defence Systems Ltd, Defence Systems Division, Stanmore, Middlesex, UK.

DECOYS

Outfit DLJ(1)
Outfit DLJ is the British Royal Navy designation for the NATO Sea Gnat system; the version in these LPDs is DLJ(1) with four Sea Gnat 130 mm/102 mm launchers. The system uses a new control unit, new launcher with 130 mm tubes and new munitions. The control unit provides for the launching of the most effective combination of rounds for distraction and centroid/seduction, taking into account the type, speed and direction of the threat, the ship's speed and heading as well as wind direction and speed. The munitions involved are the Mk 214 RF seduction and Mk 216 RF distraction rounds which are provided by Chemring Ltd. A Mk 218 IR seduction round entered service in 1995.

The basic system, Outfit DLB, has four Hunting Engineering 130 mm six-barrel launchers which are grouped in pairs on either beam and a modified version replaces the rear two barrels with 102 mm barrels for N4 rockets pending introduction of the Mk 216 Mod 1. The version in the LPDs is Outfit DLJ, a version of Outfit DLB optimised for larger warships: DLJ(1) has four DLB and four DLD (SRBOC) launchers, while DLJ(2) has eight DLB launchers.

Fearless *ballasted down and with the stern gate open ready to receive landing craft. There are two Sea King HC4 on the flight deck, with a third preparing to land. In addition, a loaded LCVP Mk 4 is being lowered into the water from its davits* (H M Steele)



Two Royal Marine-operated LCM Mk 9 enter Fearless' *docking well* (H M Steele)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Plessey Nautis
Both ships are fitted with the Nautis (AN/SYQ-15) command system, which grew out of a purely tactical picture compilation system, using the NAUTIC (Naval AUTonomous Intelligent Console) multifunction intelligent workstation. NAUTIC is based upon the Intel iAPX-86 16-bit processor with 3 Mbyte RAM together with 2 Mbyte non-volatile magnetic bubble memory. Dual iAPX-286 microprocessors are used in Multibus configurates, while iAPX-186 microprocessors are used for intelligent interfaces. The system capacity is 200 to 300 air, surface and submarine tracks and reference points with integral radar auto-tracking for up to 80 air and surface targets. A dual-redundant MIL-STD-1553B highway links the workstations, each of which uses 150,000 lines of Ada-language software code to support Nautis. The system database is replicated in each console and can typically cover an area of 2,000 × 2,000 n miles (3,704 km²), including radar and sonar tracks, route/search plans, user-designated tactical maps and synthetic charts. The database can include up to six user-designated tactical maps, 15 synthetic charts, 200 labelled reference points, 5,000 fully detailed underwater contacts and 32 labelled bearing lines. Manually initiated automatic radar tracking is possible for a minimum of 20 tracks.

The system for major amphibious warfare ships is to provide mission planning, surveillance, target tracking,

self-defence, control of landing craft and helicopters as well as task force command. For smaller vessels there can be one or two consoles providing command and surface picture compilation facilities while for larger vessels there can be six or seven consoles. The system selected for HMS *Fearless* has seven monochrome display consoles and interfaces with Type 994 surface search radar and Type 1006 navigation radar and Sea Gnat ECM system together with the Phalanx close in weapon system.

Manufacturer/Contractor
Siemens-Plessey, UK.

RADAR

Siemens-Plessey Type 994
The E/F-band Type 994 uses the Outfit AKD 'quarter cheese' antenna from the earlier Type 993 mated to the transceiver from the Plessey (now Siemens-Plessey Systems) AWS-4 equipment.

Specifications
Type 994
Role: Air/surface search
Frequency: E/F-band
Beam: 2 × 35°
Peak power: 500 kW
Pulsewidth: 0.7/1.5/1.9 µs
PRF: 500 pps
Scan rate: 5/10/15 rpm

LCU Mk 9 (LCU — Landing Craft Utility) of which 12 are operated by the Royal Marines. These craft are 27.5 m (90.2 ft) long with a beam of 6.8 m (21.5 ft), and can carry one main battle tank, 120 troops or 70 tonnes of stores (H & L van Ginderen Collection)

Manufacturer/Contractor
Siemens-Plessey, UK.

NAVIGATION

Kelvin Hughes Type 1006 in I-Band

Specifications
Type 1006
Role: Navigation
Frequency: I-band
Range: 64 n miles (118 km)
Beam: 1 × 18°/0.75 × 18°
Peak power: 25 kW
Gain: 31 dB/34 dB
Pulsewidth: 0.8 or 0.25 µs/0.75 µs
PRF: 1,600/800 pps
Scan rate: 24 rpm

Manufacturer/Contractor
Kelvin Hughes Ltd, Hainault, Essex, UK.

PROPULSION

Specifications
System: Steam turbine
Main machinery: 2 Babcock & Wilcox boilers, 38.66 kg/cm² (550 psi) and 454°C (850°F); 2 English Electric steam-turbines, 16.4 MW (22,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These two ships have had an unusual history. They were ordered in 1962 and were represented at the time as being to an exceptional new concept, although they were, in fact, simply updated versions of the wartime LSD, but with improved seaworthiness and capacity, and the addition of a helicopter flight deck. They were, in fact, generally very similar to, but smaller than, the US Navy's contemporary 'Raleigh' class assault ships.

Having entered service in 1963-64, their first set-back was in 1976 when a Defence cost-savings exercise led to *Intrepid* being placed in reserve and *Fearless* being relegated to a training role. *Intrepid* returned to service briefly between 1979 and 1981 to enable *Fearless* to be refitted, but was then offered for sale. Argentina expressed strong interest but the details had not been finalised when the Falklands (Malvinas) War broke out. (Had the sale been completed, presumably the former *Intrepid* would have led the Argentine invasion forces.) Both ships took part in the Falklands (Malvinas) War. They are now due to continue to serve until the LPD(R)s enter service, which could not now be earlier than 2002, for the first, and 2003/4 for the second.

DESIGN

These ships have a large docking well aft which can accommodate four medium LCUs, and a large flight deck for helicopters. They are thus good examples of the amphibious warfare ship design in the transitional period between the Second World War originals and the modern era where airborne capability has primacy. Landing craft are floated through the open stern by flooding compartments of the ship and lowering her in the water.

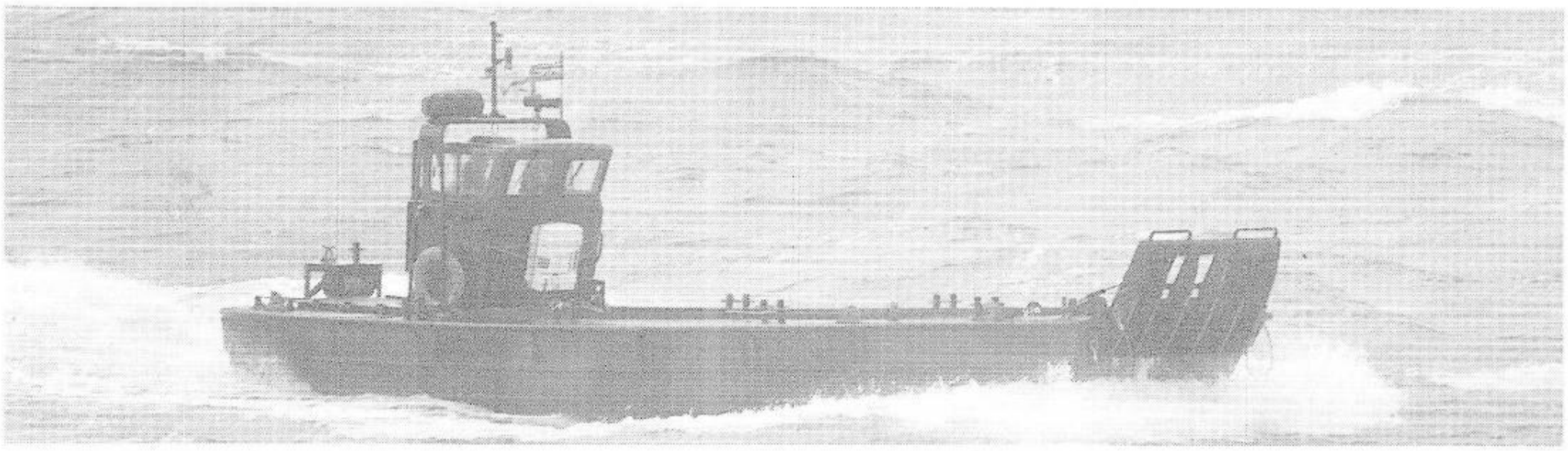
One of the important innovations at the time they entered service were their extensive command and control facilities, which enabled them to act as Naval Assault Group/Commando Brigade headquarters. They are fitted with an assault operations room from which naval and military personnel can mount and control the progress of an assault operation.

MODERNISATION

Fearless was refitted in 1979-81 and given a major modernisation in 1987-90, which included two Vulcan Phalanx CIWS gun mountings and new decoy launchers. *Intrepid* was refitted in 1984-85 but, although some further work was carried out while it was in reserve in 1993, the work concentrated on fitting for rather than with items such as Vulcan Phalanx and chaff launchers. *Intrepid* is now in a state euphemistically known as 'Preservation by Operation', which is supposed to mean that it could be brought up to operational status in 30 days. Few believe that to be credible and, if such a requirement was to arise, it seems more likely that the carriers *Illustrious* and *Invincible* would be equipped to become temporary amphibious command ships, and additional troop-carrying capacity would be obtained by leasing suitable merchant ships.

These were the last ships in the UK Royal Navy to be armed with the Seacat missile, but the installations were removed from both ships in late 1994.

These two ships must, therefore, continue in service for several more years. *Fearless* is operational while *Intrepid* is in reserve at Portsmouth and the intention is that it should not be used again. However, until the navy gets its new LPDs, both ships will have to be maintained.



LCVP Mk 4 (LCVP — Landing Craft Vehicles and Personnel). Four are carried on davits and they can carry a light vehicle, 20 troops or 5.5 tonnes of stores (H & L van Ginderen Collection)

VSEL LSL

OVERVIEW

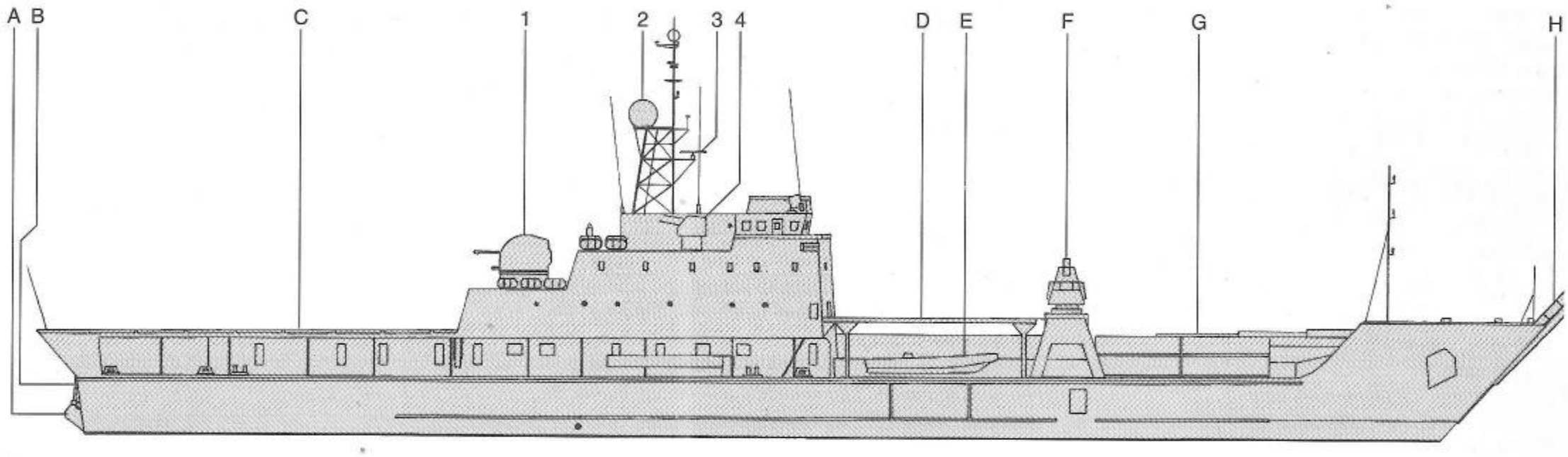
In the late 1970s the British shipbuilding company Brooke Marine produced a design for a 2,500 t landing ship logistics (LSL). This has a flat bow door, which incorporates an articulated 60-tonne capacity ramp, a straight-through hold, and a 60-tonne capacity stern ramp. The hold will accommodate 16 60-tonne tanks, which is equivalent to a squadron/company of the heaviest main battle tanks.

The design also incorporates a travelling gantry crane over the forward hold and a flight deck aft, capable of handling a Sea King-size helicopter.

Three were built, two by Brooke Marine and one by Vosper-Thornycroft at Woolston, both in the UK. Two went to Algeria and one to Oman, but no more have been sold.

When Brooke Marine went out of business, VSEL purchased the designs.

KALA'AT BENI HAMMAD (VSEL LSL)



Kala'at Beni Rached (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Stern door* **C** *Flight deck* **D** *Platform for pontoon sections* **E** *LCPL* **F** *Travelling gantry crane* **G** *Sliding hold cover* **H** *Bow door/ramp*

General 1 *OTOBREDA twin 40 mm gun* **2** *GEC-Marconi S 802 fire-control radar* **3** *Racal-Decca 1229 navigation radar* **4** *Russian 2-M-3 25 mm twin mounting/twin*

GENERAL SPECIFICATIONS

Country of Origin: United Kingdom
Operator: Algeria
Type: Brooke Marine LSL (Landing Ships Logistic)

Class: KALA'AT BENI HAMMAD

Built: 2
Active: 2

Displacement:
full load: 2,450 t

Dimensions
Length: 93 m (305 ft)
Beam: 15.5 m (50.9 ft)
Draught: 2.5 m (8.1 ft)

Speed: 15 kts
Range: 3,000 n miles at 12 kts

Complement: 81

SHIPS

KALA'AT BENI HAMMAD (472)
Builder Brooke Marine, Lowestoft, Suffolk, UK
Launched 18 May 1983
Commissioned Apr 1984

KALA'AT BENI RACHED (473)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 15 May 1984
Commissioned Oct 1984

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

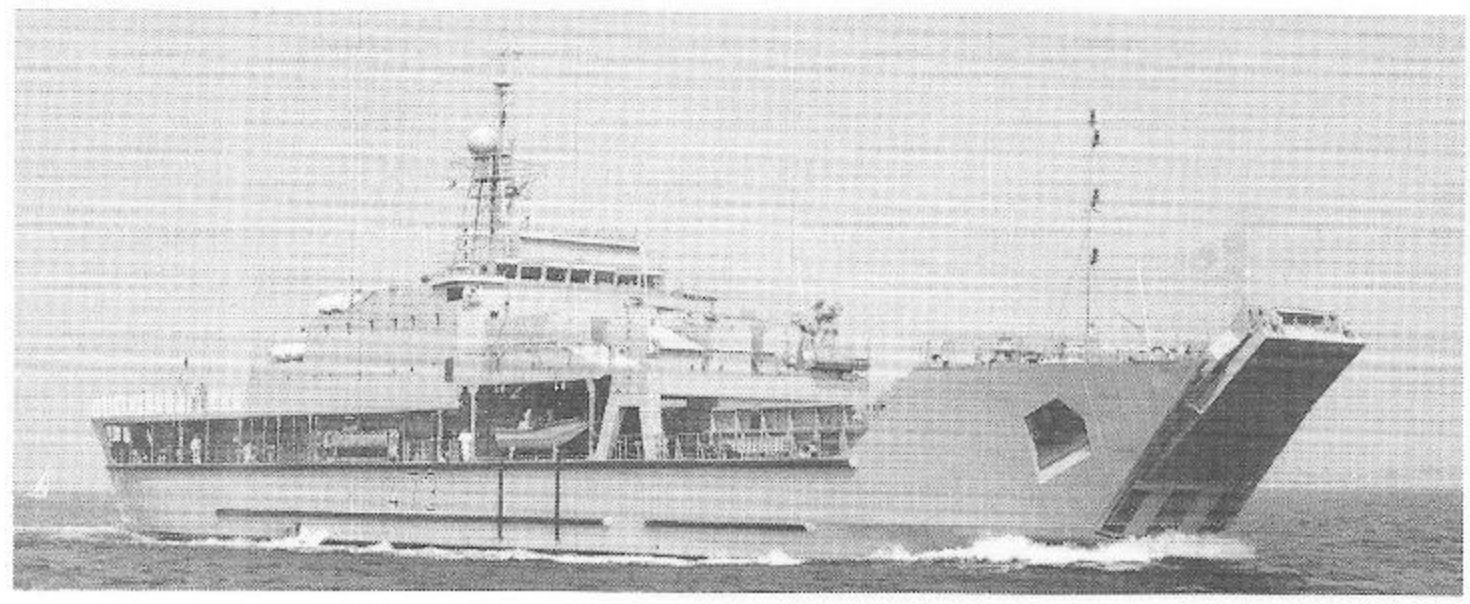
- Troops: 240
- Tanks: 16 main battle tanks and 380 tonnes of other cargo

SHIP-SHORE LIFT

- 2 LCPL on davits

AVIATION FACILITIES

Specifications
Flight deck: Large flight deck aft
Hangar: None



Kala'at beni Rached *(473), built by Vosper Thornycroft and commissioned in 1984. Note the travelling gantry crane and the floating pontoon sections on the platform between the gantry and the bridge* (Vosper Thornycroft)

Helicopter: The Algerian Navy does not operate any helicopters.

AMPHIBIOUS FACILITIES

- Through tank deck measures 75 m × 7.4 m (246 × 24.3 ft).
- Forward ramp. Two sections, 18 m (59 ft) long (extended), 5 m (16.4 ft) wide. 60 tonnes capacity.
- Stern ramp. Single-section ramp, 4.3 × 4 m (14.1 × 13 ft) with the addition of 1.1 m (3.61 ft) finger flaps. 60 tonnes capacity.
- Side access doors are provided on each side forward.
- The tank deck bulkheads extend 2.25 m (7.4 ft) above the upper deck between the forecastle and the forward end of the superstructure, and provide two hatch openings to the tank deck below.
- 16 tonne crane with athwartships travel.

WEAPONS SYSTEMS

GUNS

OTOBREDA 40 mm/70

One OTOBREDA 40 mm/70 twin mounting, located on the centreline abaft the superstructure. The Compact twin 40 mm mounting is designed for use against high-performance combat aircraft, against anti-ship missiles and for surface engagements. The mounting consists of two 40 mm guns which are 300 mm (12 in) apart, a feeding system with magazine, a local control panel, a power supply rack, a converter and an air-water panel.

Specifications

Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s) (Breda)
Range:
anti-surface: 6.75 n miles (12.5 km)
anti-air: 8,700 m (28,544 ft)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (13,124 ft)
Rate of fire: 600 rds/min
Ammunition: 2.4 kg (5.3 lb) (HCHE, PFHE), 2.5 kg (5.5 lb) (HE-T)

Mounting
Weight (unloaded): 5.6/5.4 t
Traverse: Nominal 360° at 90°/s
Elevation: −13 to +85° at 60°/s
Crew: 2

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

Russian 2-M-3 25 mm/60 in twin mountings

Four Russian 25 mm/60 in two twin mountings. The 2-M-3 consists of two guns installed one above the other in separate cradles and on their sides so that it is fed from the side. The guns have 1.5 m (5.0 ft) long air-cooled barrels of monobloc construction with flash suppressors at one end and an exposed spring recuperator wrapped around the barrel near the breech.

The mounting, which is 1.2 m (3.9 ft) high, 1.6 m (5.2 ft) long (excluding the barrel) and 1.5 m (4.9 ft) wide, may be either hydraulically or manually operated. With ammunition, the mounting weighs 1.735 tonnes and it has two on-mount operators and five loader-carriers.

Specifications

Calibre: 25 mm
Length of barrel: 60 calibres
Traverse: 360° at 25°/s manual; 70°/s hydraulic
Elevation: −10 to +85° at 15°/s manual; 40°/s hydraulic
Rates of fire: 450 rds/min/barrel
Projectile: 0.28 kg (0.6 lb) HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,186 ft)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal Cutlass B1 ESM system

Cutlass B1 is designed for operation in very dense signal environments, receiving signals in the 1 to 18 GHz frequency range, measuring their parameters, comparing these with those in the radar library which contains the parameters of 2,000 radars, and displaying the information — all within one second. The EW operator is presented with a tabular display for threat identity and threat evaluation, and a tactical display giving a pictorial representation of the RF environment. Selected digital outputs can be sent to other local systems, and hard copy printout of the intercepted radar is also available. The tabular display can indicate 150 intercepts, in the order of priority. Cutlass is wide open in both bearing and frequency: that is, it does not employ sweep techniques, giving a very high intercept probability (nearly 100 per cent). Cutlass B1 uses the Cutlass processor and an Instantaneous Frequency Measurement (IFM) receiver. It has a 32-element array antenna to provide bearing measurement by phase analysis techniques. This antenna also provides RF for the IFM. In both systems the processor is provided with fast and accurate information on incoming pulses.

Specifications

Frequency coverage: 2-18 GHz
Accuracy: 2° RMS in bearing
Coverage: 360° azimuth; +40 to −10° elevation
Pulse density capability: 500,000/s
Radar store capability: 2,000 modes

Manufacturer/Contractor
Racal Radar Defence Systems Ltd, Chessington, Surrey, UK.

ELECTRONIC COUNTERMEASURES (ECM)

Racal Cygnus B1 jammer

The Cygnus radar jammer operates in the I or J-bands and was designed for integration with Cutlass ESM equipment. Cygnus uses both responsive noise and deception jamming to provide an effective jamming capability against all types of radar including early warning, target acquisition and missile guidance. It has a narrow beamwidth giving high effective radiated power (300 kW) and is kept on target by a built-in, interferometer-type, passive tracking system in both azimuth and elevation. The tracking system may also be used to relay accurate position data to systems of other ships. RF received by the tracking antennas is also used as the basis of transmitted RF and modulation and power management is under the control of a processor which also controls the tracking procedure. Types of modulation sequence available include range gate pull off and false target generation.

Manufacturer/Contractor
Racal Radar Defence Systems, Chessington, Surrey, UK.

DECOYS

ML Aviation Barricade countermeasures system

Barricade (whose British Royal Navy designation is Outfit DLK) is designed to provide ships with an effective and lightweight means of deploying chaff and infra-red decoys as countermeasures to missile attack. The system gives a layered defence against the various phases and types of anti-ship missile attack, ranging from the long-range confusion mode, through medium-range distraction and dump modes to the close in centroid mode. The complete system consists of port and starboard launchers, safety switches, a control unit, ready-use ammunition lockers (27 rockets) and rockets. The launcher consists of six sets of triple cells, the outer three sets being angled 60° from the next in bearing so that the launchers provide all-round coverage.

Manufacturer/Contractor
ML Aviation Ltd.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

CSEE Naja electro-optical/optical directors

Naja is an improved version of the Panda Mk 2 with CILAS TMY 113 high-repetition rate Nd:YAG laser rangefinder, an automatic tracking capability, local or remote-control, a three-axis gyro unit and multiple weapon capability. The laser rangefinder operates in the 1.06 μm wavelength, has a peak power of >5 MW and a PRF of 20 pps.

Specifications

Naja
Height: 1.35 m (4.4 ft)
Width: 1.5 m (4.9 ft)
Weight: 480 kg (1,058 lb)
Elevation: −20 to +70°
Max velocity:
traverse: 60°/s
elevation: 60°/s

Manufacturer/Contractor
CSEE Défense, Paris, France.

RADARS

Racal-Decca 1226

The Type 1226 is part of the Solid State series and uses a 30 cm (11.8 in) PPI (Plan Position Indicator) display. It operates in the I-band, has 20 kW output and is equipped with a 1.83 m (6.0 ft) antenna.

Specifications

Type 1226
Role: Surface search
Frequency: I-band

Range: 48 n miles (89 km)
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm

Manufacturer/Contractor
Racal-Decca, UK.

Marconi S 800
The Marconi S 800 is an I-band navigation radar.

GEC-Marconi S 820
These ships are fitted with the GEC-Marconi S 820 fire-control radar. The antenna is housed in the small spherical radome at the masthead.

Specifications
Role: Fire control
Frequency: E/F-band (tunable)
Beam: 3 × 30°
Peak power: 200 kW
Pulsewidth: 1.2/0.6 µs
PRF: 750/1,500 pps
Scan rate: 24 rpm
Typical range: 44 n miles (80 km)

Manufacturer/Contractor
GEC-Marconi, Chelmsford, UK.

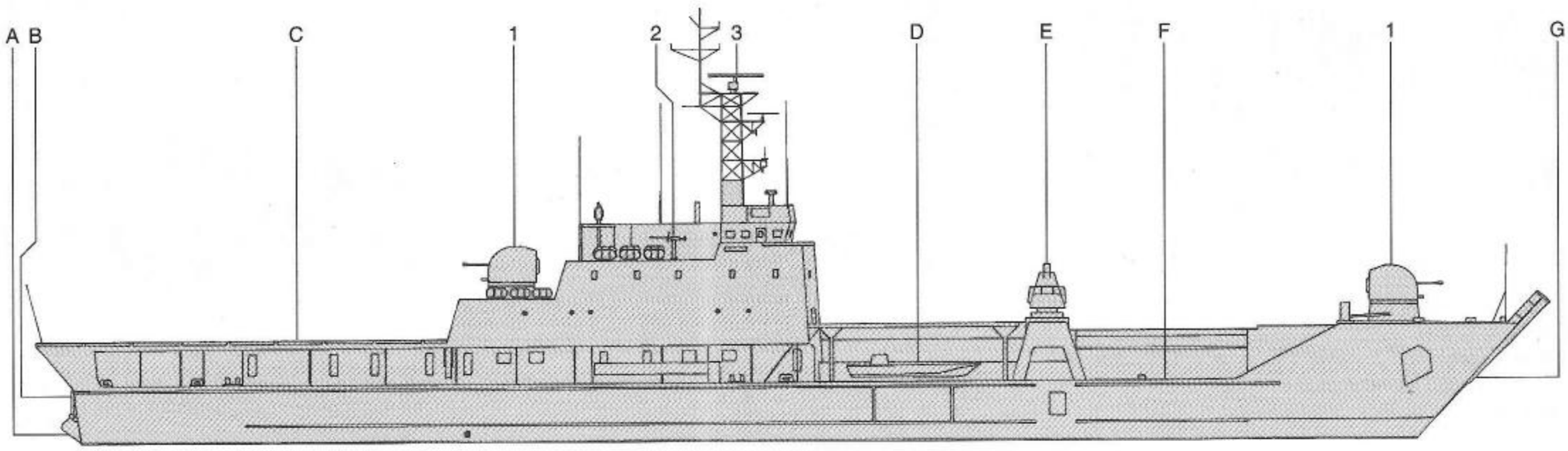
PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 16V 1163 TB82 diesels, 6.5 MW (8,880 hp) sustained
Shafts: 2

Kala'at beni Hammad *(472) with the articulated bow ramp fully deployed*

Kala'at beni Rached *(473). Note the very large flight deck (but no hangar) and the stern ramp* (H & L van Ginderen Collection)

NASR AL BAHR (VSEL LSL)



Nasr al Bahr (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Stern door* **C** *Flight deck* **D** *LCVP* **E** *Travelling crane (16 tonne capacity)* **F** *Tank deck* **G** *Articulated bow door/ramp*

General 1 *OTOBREDA twin 40 mm/70 automatic cannon* **2** *RO/Oerlikon 20 mm in GAM-B01 mounting* **3** *Racal-Decca 1226 navigation radar*

GENERAL SPECIFICATIONS

Country of Origin: United Kingdom
Operator: Oman
Type: Landing Ships (Logistic) (LSL)

Class: NASR AL BAHR

Built: 1
Active: 1

Displacement:
full load: 2,500 t

Dimensions
Length: 93 m (305 ft)
Beam: 15.5 m (50.9 ft)
Draught: 2.6 m (8.5 ft)

Speed: 16 kts
Range: 5,000 n miles at 15 kts

Complement: 81, including 13 officers

SHIPS

NASR AL BAHR (L 2)

Builder	Brooke Marine, Lowestoft, Suffolk, UK
Launched	16 May 1984
Commissioned	6 Feb 1985

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 240
- Tanks: 16 main battle tanks or 400 tonnes of cargo.

SHIP-SHORE LIFT

- 2 LCVPs on davits

AVIATION FACILITIES

Specifications
Flight deck: Large flight deck aft
Hangar: None
Helicopters: 1 Super Puma

AMPHIBIOUS FACILITIES

- Through tank deck measures 75 × 7.4 m (246 × 24.3 ft).
- Forward ramp. Two sections, 18 m (59 ft) long (extended), 5 m (16.4 ft) wide. 60 tonnes capacity.
- Stern ramp. Single-section ramp, 4.3 × 4 m (14.1 × 13 ft) with the addition of 1.1 m (3.61 ft) finger flaps. 60 tonnes capacity.
- Side access doors are provided on each side forward.
- The tank deck bulkheads extend 2.25 m (7.4 ft) above the upper deck between the forecastle and the forward end of the superstructure, and provide two hatch openings to the tank deck below.
- 16 tonne crane with athwartships travel.

WEAPONS SYSTEMS

GUNS

OTOBREDA 40 mm/70

Four OTOBREDA 40 mm/70 in two twin mountings. The 40 mm Bofors L/70 is an automatic cannon for air defence roles which may also be used to engage surface targets. The Compact twin 40 mm mounting is designed for use against high-performance combat aircraft, against anti-ship missiles and for surface engagements. The mounting consists of two 40 mm guns which are 300 mm (12 in) apart, a feeding system with magazine, a local control panel, a power supply rack, a converter and an air-water panel.

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,281 ft/s) (Breda)
Range:
anti-surface: 6.75 n miles (12.5 km)
anti-air: 8,700 m (28,545 ft)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 4,000 m (13,124 ft)
Rate of fire: 600 rds/min
Ammunition: 2.4 kg (5.3 lb) (HCHE, PFHE), 2.5 kg (5.5 lb) (HE-T)

Mounting
Weight (unloaded): 5.6/5.4 t
Traverse: Nominal 360° at 90°/s
Elevation: −13 to +85° at 60°/s
Crew: 2

RO/Oerlikon 20 mm in GAM-BO1 mounting

Both ships have two single Oerlikon 20 mm cannon in GAM-BO1 mountings.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.7 km
anti-air: 1,700 m (5,578 ft)
Rate of fire: 900 rds/min
Round weight: 320-345 g
Projectile: 110-125 g

Mounting
Elevation: −15 to +60°
Total weight: 500 kg (1,102 lb) (including shield)

12.7 mm machine guns

Two M2HB machine guns are carried. This is a selective short recoil automatic operation air-cooled weapon with a 1,143 mm long barrel using 110-round belts.

Specifications
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

Nasr al Bahr *(L 2), giving a good view of the forward hatch covers and the travelling crane* (H & L van Ginderen Collection)

ELECTRONIC WARFARE SYSTEMS

DECOYS

ML Aviation Barricade countermeasures system

Barricade (whose British Royal Navy designation is Outfit DLK) is designed to provide ships with an effective and lightweight means of deploying chaff and infra-red decoys as countermeasures to missile attack. The system gives a layered defence against the various phases and types of anti-ship missile attack, ranging from the long-range confusion mode, through medium-range distraction and dump modes to the close in centroid mode. The complete system consists of port and starboard launchers, safety switches, a control unit, ready-use ammunition lockers (27 rockets) and rockets. The launcher consists of six sets of triple cells, the outer three sets being angled 60° from the next in bearing so that the launchers provide all-round coverage.

Manufacturer/Contractor
ML Aviation Ltd, UK.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

CelsiusTech 9LV 100 GFCS

The CelsiusTech 9LV system is intended to control one or two 30 mm to 76 mm guns against air and surface targets as well as surface-to-surface missiles. It can track up to two air or surface targets and can receive designation from search and navigation radars or designators as well as being capable of being slaved to other types of directors. The main elements of the 9LV 100 are an electro-optic director weighing 140 kg (308.7 lb) with Saab TV camera and Ericsson 1.06 µm laser with optional infra-red tracker, a control and display console with a 41 cm (16 in) screen, gun and director controls, two bridge pointers for designation, and the fire-control computer.

Manufacturer/Contractor
CelsiusTech AB, Sweden.

RADAR

Racal-Decca 1226

The Type 1226 navigation radar is part of the Solid State series and uses a 30 cm (12 in) PPI (Plan Position Indicator) display. It operates in the I-band, has 20 kW output and is equipped with a 1.83 m (6.0 ft) antenna.

Specifications
Type 1226
Role: Surface search
Frequency: I-band
Range: 48 n miles (89 km)
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Paxman Valenta 18 CM diesels, 5.6 MW (7,500 hp) sustained

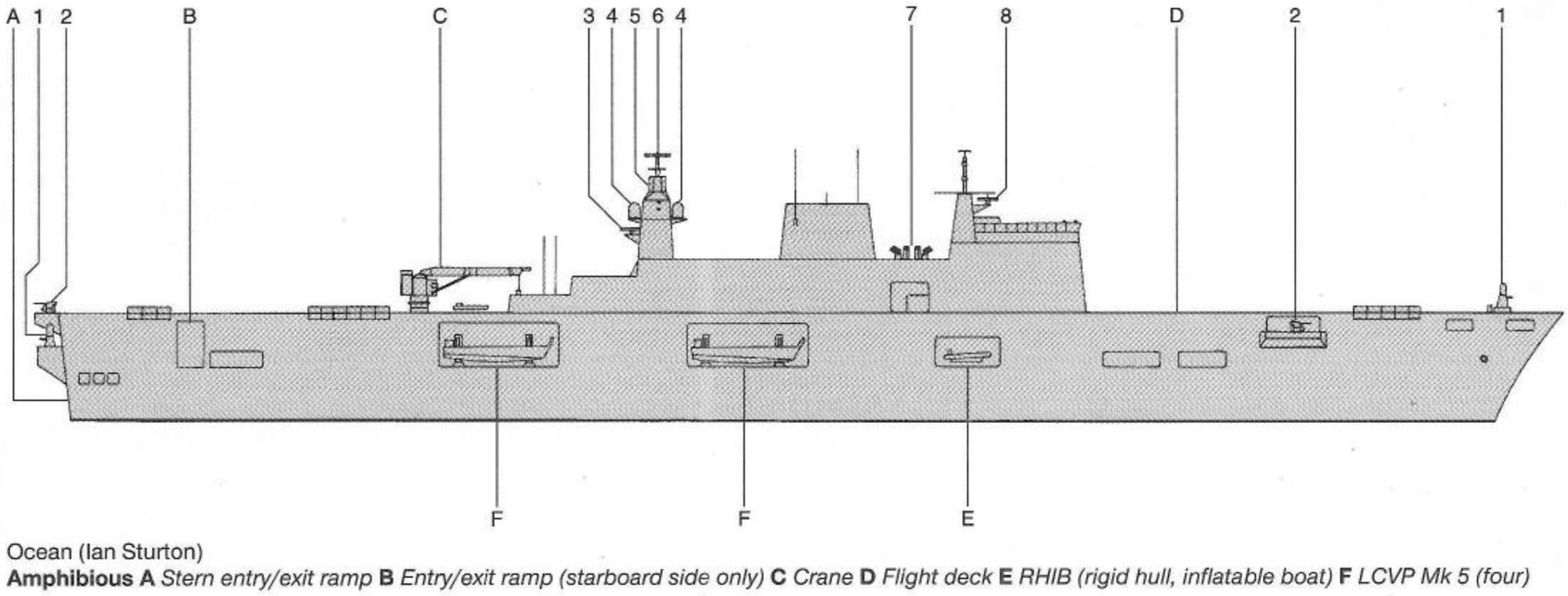
Shafts: 2
Propellers: Controllable pitch

FURTHER INFORMATION

Nasr al Bahr (L 2) is very similar to the Algerian ships of this class. The smaller and older *Al Munassir,* which was also built by Brooke Marine, is now in reserve and is used for harbour training, all armaments having been removed.

Nasr al Bahr *(L 2). An unusual feature of this ship is the 16 tonne capacity crane on the foredeck, which has both fore-and-aft and lateral travel. Total capacity is 16 main battle tanks or an equivalent vehicle mix. The articulated forward ramp has a total length of 18 m (59 ft) and a 60 tonne load capacity* (VSEL)

OCEAN



Ocean (Ian Sturton)
Amphibious A *Stern entry/exit ramp* **B** *Entry/exit ramp (starboard side only)* **C** *Crane* **D** *Flight deck* **E** *RHIB (rigid hull, inflatable boat)* **F** *LCVP Mk 5 (four)*

General 1 *Hughes Mk 15 Phalanx 20 mm CIWS (three)* **2** *BMARC twin 30 mm/75 in GCM-A03 mount (four)* **3** *Kelvin Hughes Type 1007 radar; carrier-controlled approach (CCA)* **4** *Marconi-Matra SCOT 1D Satcom* **5** *Thorn EMI outfit UAT radar intercept* **6** *Plessey-Siemens Type 996 air/surface search radar* **7** *Outfit DLJ NATO Sea Gnat chaff/IR launchers* **8** *Kelvin Hughes Type 1007 radar; navigation*

GENERAL SPECIFICATIONS

Operator: United Kingdom

Class: OCEAN (LPH)

Active: 0
Building: 1

Displacement:
full load: 20,500 t

Dimensions
Length: 203 m (666 ft) (oa); 193 m (633.2 ft) (pp)
Beam: 36.1 m (118.4 ft)
Draught: 6.6 m (21.3 ft)

Speed: 18 kts
Range: 8,000 n miles at 15 kts

Complement: 255, plus 206 aircrew

SHIPS

OCEAN (L12)		**Laid down**	30 May 1994
Builder		**Launched**	11 Oct 1995
Hull	Kvaerner Govan, Glasgow, UK	**Commissioned**	Mar 1998
Fitting out	VSEL, Barrow-in-Furness, Cumbria, UK		

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops
  Normal: 480 Royal Marines
  Hard lying: 800 Royal Marines
- Air wing: 206 aircrew
- Vehicles: 40 vehicles and 'most' equipment for a Royal Marine commando*

Note: *In the British Royal Marines a 'Commando' unit is equivalent in size to an infantry battalion and is some 500 strong.

SHIP-SHORE LIFT

- 4 LCVPs on davits

AVIATION FACILITIES

Specifications
Flight deck: 145 × 36 m (480 × 120 ft) (approximate). There will be six landing and six parking slots for aircraft.
Hangar: Below flight deck
Helicopters: 12 Sea King or EH 101 Merlins, plus six Lynx

Fixed-wing: Up to 20 Sea Harriers or Harrier GR7 can be carried, though not supported, with corresponding reductions in the number of helicopters carried.

AMPHIBIOUS FACILITIES

- Great attention has been paid to movement of troops within the ship, especially to the flight deck and exit ports.
- Large crane on starboard side abaft superstructure.

WEAPONS SYSTEMS

GUNS

RO 30 mm/75 in GCM-A03 mounting
Eight RO 30 mm/75 cannon in GCM-A03 twin mountings. The four mountings are on either side of the flight deck forward (two) and atop the transom (two). The GCM-A03-1 is a locally operated mounting with enclosed position which may be air conditioned, with a magazine carrying 320 or 500 rounds of ammunition. The similar GCM-A03-2 (the more likely of the two to be used on these ships) has an open operator mounting with two boxes of ammunition, each with 250 rounds.

Specifications
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Range:
anti-surface: 1.15 n miles (3 km)
anti-air: 3,500 m (11,483 ft)
Rate of fire: 650 rds/min/barrel
Ammunition: 870 kg (1,918 lb)

Mounting (GCM-A03)
Traverse: 360° at 80°/s
Elevation: −15 to +85° at 60°/s

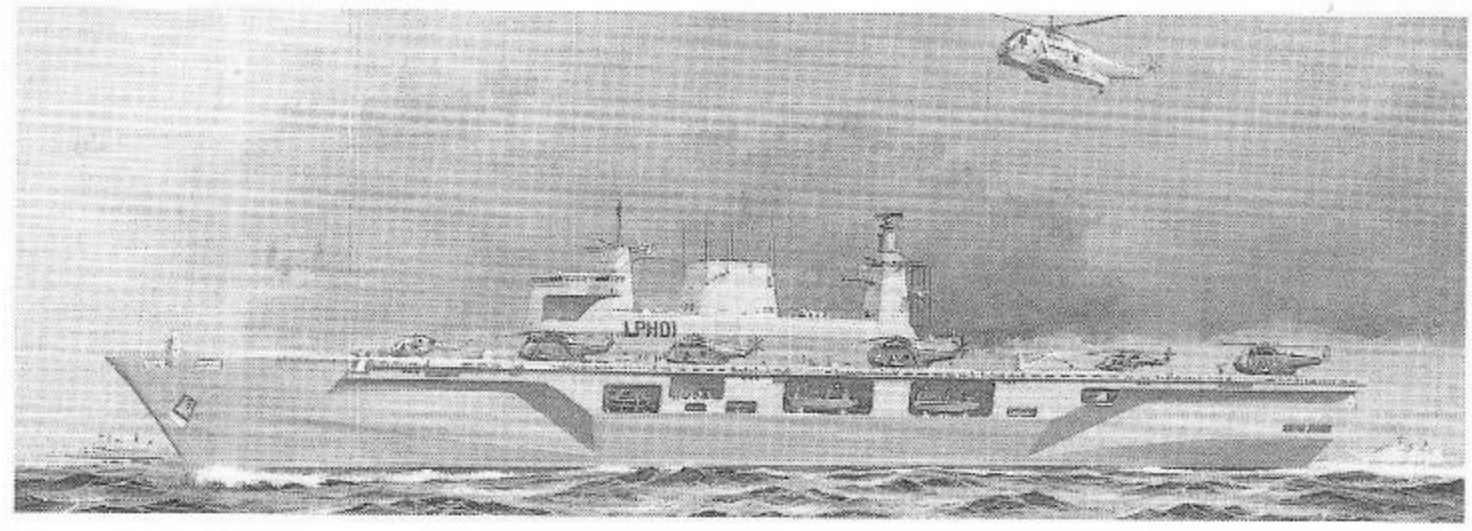
Manufacturer/Contractor
Royal Ordnance, UK.

Hughes Mk 15 CIWS Phalanx
Three Hughes Mk 15 CIWS Phalanx close in weapons systems (CIWS) will be mounted to provide the innermost layer of defence against anti-ship missiles. One will be at the forward end of the flight deck, the other two on sponsons on the transom. The 20 mm M61A1 Vulcan, six-barrel, Gatling-principal gun has a cylindrical magazine with the feed mechanism suspended beneath. Firing usually begins at 1 n mile (1.85 km) with a maximum probable kill at 460 m (1,500 ft). System reaction time is reported to be 3 seconds.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 3,000 rds/min
Range: 0.75 n miles (1.47 km) (effective, horizontal)
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

AN/UPS-2 radar
Frequency: 12-18 GHz (J-band)
System: Pulse Doppler

Manufacturer/Contractor
Hughes Missile Systems, Tucson, Arizona, USA.



The new British helicopter carrier, Ocean *(LPH 01). The hull design is based on that of the 'Invincible' class aircraft carriers, but with the internal arrangements and the flight deck optimised for helicopter operations* (VSEL)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-Thorn Outfit UAT (1)

Outfit UAT(1) is based on the Racal-Thorn Sceptre XL equipment and consists of three major components: an eight-element antenna array, a receiver/processor and an operator's console, and can be integrated with the ship's command system. Processing is undertaken by a system based on transputers. An integrated receiver system is employed and software control is used heavily across the entire system. The display is based on that of the Sceptre XL with two screens, one a situation display and the other an alphanumeric tabular display with emitter data information.

Manufacturer/Contractor
Racal-Thorn Defence, Crawley, Sussex, UK.

ELECTRONIC COUNTERMEASURES (ECM)

Thorn EMI Type 675 (2) jammer

Type 675 (Guardian) is an active/passive EW system designed to counter a wide range of threats, particularly radar-guided missiles. The system counters and confuses surveillance and missile homing radars by the use of selective jamming techniques for both area and point defence. Coverage is 360° in azimuth and 50° in elevation, with a detection range of up to 270 n miles (500 km). Type 675 has two antenna mounts to ensure uninterrupted all-round view, which can be installed either port and starboard, or forward and aft. Each antenna mount carries a direction-finding receiving antenna together with transmit antennas, using mechanical steering to give full azimuth and elevation coverage. Received signals are passed to a wideband receiver, where they are analysed and those representing a threat are then processed to allow generation of the jamming signal. High-power transmitter subsystems, matched to the antenna, provide jamming capability against several types of target simultaneously. A comprehensive ECM library stores the appropriate countermeasures to a range of potential threats and, on receipt of a warning from the ESM system, the ECM processor selects the appropriate jamming mode to give fast response.

Manufacturer/Contractor
Thorn EMI Electronics Ltd, Crawley, Sussex, UK.

DECOYS

Outfit DLJ

Outfit DLJ is the British Royal Navy designation for the NATO Sea Gnat system. Eight Sea Gnat 130 mm/102 mm launchers will be mounted in *Ocean*. The system uses a new control unit, new launcher with 130 mm tubes and new munitions. The control unit provides for the launching of the most effective combination of rounds for distraction and centroid/seduction, taking into account the type, speed and direction of the threat, the ship's speed and heading as well as wind direction and speed.

The munitions involved are the Mk 214 RF seduction and Mk 216 RF distraction rounds which are provided by Chemring Ltd. A Mk 218 IR seduction round entered service in 1995.

The basic system, Outfit DLB, has four Hunting Engineering 130 mm six-barrel launchers which are grouped in pairs on either beam and a modified version replaces the rear two barrels with 102 mm barrels for N4 rockets pending introduction of the Mk 216 Mod 1. The version planned for *Ocean* is Outfit DLJ, which is a version of Outfit DLB optimised for larger warships: DLJ(1) has four DLB and four DLD (SRBOC) launchers, while DLJ(2) has eight DLB launchers.

Manufacturers/Contractors
Thorn EMI/AB Precision Ltd (control unit)
Hunting Engineering (launchers).
Chemring Ltd (munitions).

Outfit DLH offboard decoys

Outfit DLH is also known as 'Replica', 'Rubber Duck' and, in the US Navy, as AN/SLQ-49. The system is a rapidly deployed, passive naval decoy which presents a ship-like image to the radar seeker of an incoming anti-ship missile. The equipment consists of a launcher and a pair of liferaft-type containers, each housing one octahedral-shaped radar reflector. The two reflecting bodies start to inflate as they leave the ship and, once in the water, they are linked to each other by a 5 m (16 ft) line with one of the container lids acting as a sea-anchor to ensure that they remain apart. The distance between the opposite tips of the decoy is approximately 2.5 m (8.2 ft) and it contains metal-coated nylon mesh curtains which are suspended from aluminium alloy tubes.

Manufacturer/Contractor
Irvin, Letchworth, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

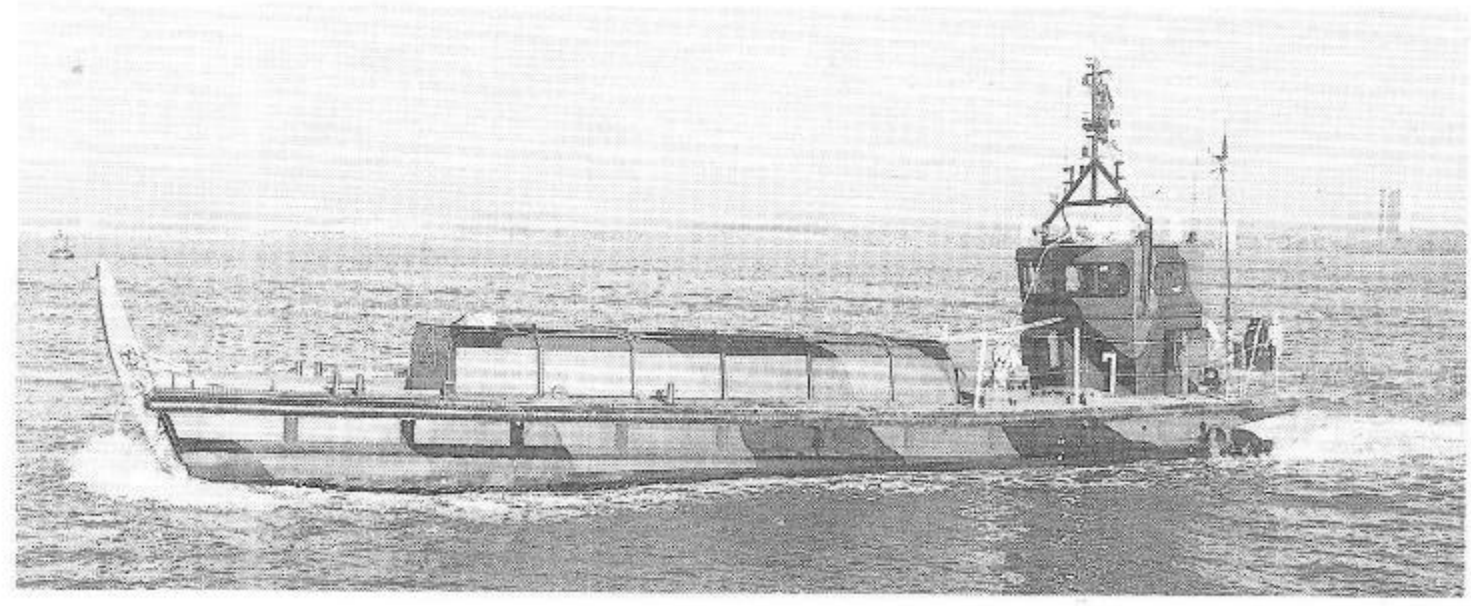
Ferranti ADAWS 2000

ADAWS creates a detailed picture of the air, surface and subsurface tactical situation around a task group or task force and directs responses to threats. The systems differ in detail but they are usually optimised for air defence and the following description of ADAWS 4/7 is generally applicable to the other systems.

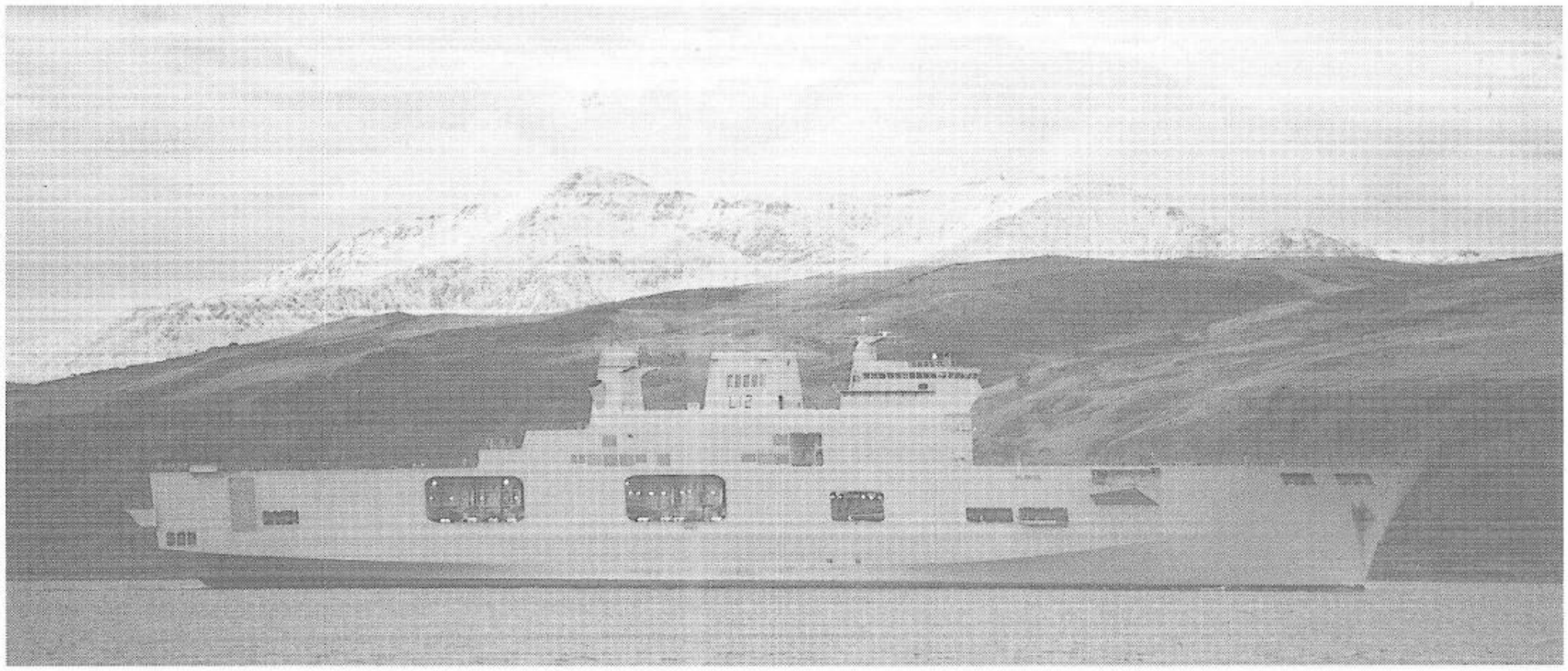
ADAWS is a mainframe architecture system based upon two Ferranti computers using Coral 66 language software. The computers receive data from ship sensors and from off-ship radars (via Link 11), process them and then present the result to the display systems. A DataLink PreProcessor (DLPP) is included to act as an interface with the Link 11 datalink. The computers also evaluate the threats from different targets and designate them to the most appropriate weapon system. They can also calculate data for controlling the operational use of both ASW helicopters and fighters. Autotracking of targets is available using LFX (Limited area/Full eXtraction) and LAX (Limited area Auto eXtraction) with or without auto-initiation of tracks. The system also features an AS 1077 sonar trainer, for onboard training, and is linked to the sensors and displays by a data highway.

ADAWS 2000 makes considerable use of commercial off-the-shelf (COTS) hardware and uses two F2420 computers but with an Ethernet standard local area network supplementing the CSH in the Royal Navy. The system supports workstations, single or double display consoles which can operate with Ada and C language software. Ada, Assembler and some limited Coral 66 software are used for the input/output gateway which links the consoles to the local area network, as well as providing the interface between CSH and the Ethernet highways.

The consoles will be based upon Motorola 68000 family microprocessors, UNIX, X-Windows and Motif software, and will use COTS software including an encyclopaedic database and spreadsheets for planning, fast signal traffic transfer using the e-mail package and the Maritime Asset Planning System (MAPS). The consoles have a radar scan converter and a powerful graphics engine with an HCI selected from QWERTY keyboards, electroluminescent panels, touchscreen,



The new LCVP Mk 5 developed specifically for use aboard Ocean. *The craft displaces 20 tonnes fully loaded and carries 35 troops or a 35 tonne payload at speeds up to 17 knots* (Vosper Thornycroft)



Ocean *en route from Glasgow to Barrow-in-Furness for fitting-out* (H M Steele)

rollerball, mouse or joystick. There will be 48.26 cm (19 in) 1,280 × 1,024 pixel display screens and the consoles will be capable of operating for 10 minutes after the total loss of ship's power. The system features a 1,000 track database on which 10 per cent can be updated every second. It will interface with up to seven radars, and with all sensors and weapon control systems and will be capable of data fusion, aircraft control and amphibious operations.

Manufacturer/Contractor
Ferranti International Defence Systems Integration.

COMMUNICATIONS AND DATALINKS

Datalinks
Link 11, Link 14, Link 16, Merlin computer link (to helicopters)

Satellite links
Marconi Matra Satcom 1D

RADARS

Air/surface search: Plessey Type 996, using E/F-Band
The Plessey Type 996 is used for air/surface search. This is an E/F-band, 3D surveillance and target indication radar and there is an unconfirmed report that the radar is equipped with a jammer location receiver subsystem.

Specifications
Type 996(2)
Role: Air/surface search
Frequency: E/F-band
Beam: 1.4 × 1.5°
Peak power: 125 kW
Gain: 41 dB
Pulsewidth:
low angle: 65 µs
high angle: 31.5 µs
PRF: 550-3,000 µs
Scan rate: 12.5-20 rpm
Typical range: More than 80 n miles (150 km) against MPA (maritime patrol aircraft)

Manufacturer/Contractor
Siemens Plessey Systems, Air Defence Division, Cowes, Isle of Wight.

Kelvin Hughes Type 1007
Two Type 1007s are used for surface search, navigation and carrier-control approach. The Type 1007 is the standard I-band navigation radar for the UK Royal Navy.

Specifications
Type 1007
Role: Navigation/surface search/CCA
Band: H/I (9,410 MHz)
Beam: 1.0 × 18°/0.75 × 18°
Peak power: 25 kW
Pulsewidth: 0.08/0.3/0.8 µs
PRF: 1,600/800/400 pps
Scan rate: 26 rpm

Manufacturer/Contractor
Kelvin Hughes Ltd, Hainault, Essex, UK.

PROPULSION

Specifications
System:
Main machinery: 2 Crossley-Pielstick 16 PC2.6 V 400 diesels, 17.57 MW (23,904 hp) sustained

Shafts: 2
Propellers: 2 KaMeWa controllable pitch
Thruster: 1 bow thruster

FURTHER INFORMATION

PROGRAMME

The British Royal Navy was one of the early pioneers of vertical (helicopter-borne) assault and several otherwise redundant light fleet, fixed-wing aircraft carriers were refitted as 'commando carrier' in the 1950s, 1960s and 1970s. With the retirement of *Bulwark* (R 08) in 1981 there was a long period during which there was no dedicated commando carrier and the bid for a replacement failed to achieve sufficient priority for it to be funded. There was a brief period of optimism in 1987 when 'invitations to tender' were issued to industry, but these were allowed to lapse. Eventually, the contract was placed in 1993, with the hull to be built by Kvaerner/Govan on Clydeside, Scotland, with outfitting to take place at the VSEL yard at Barrow-in-Furness. There was some damage to the hull at the launch, but it was repaired without disrupting the schedule and the ship moved to Barrow-in-Furness in November 1996 for completion.

It is intended that *Ocean* should provide a helicopter lift and assault capability. The prime role will be to embark, support and operate a squadron of helicopters, currently Westland Sea King HC-4s, later EH 101 Merlins, and carry most of a Royal Marines commando unit, including vehicles, arms and ammunition. A second of the class is needed to meet the operational requirement fully; without it, the LPH will link with the new LPDs *Albion* and *Bulwark*.

DESIGN

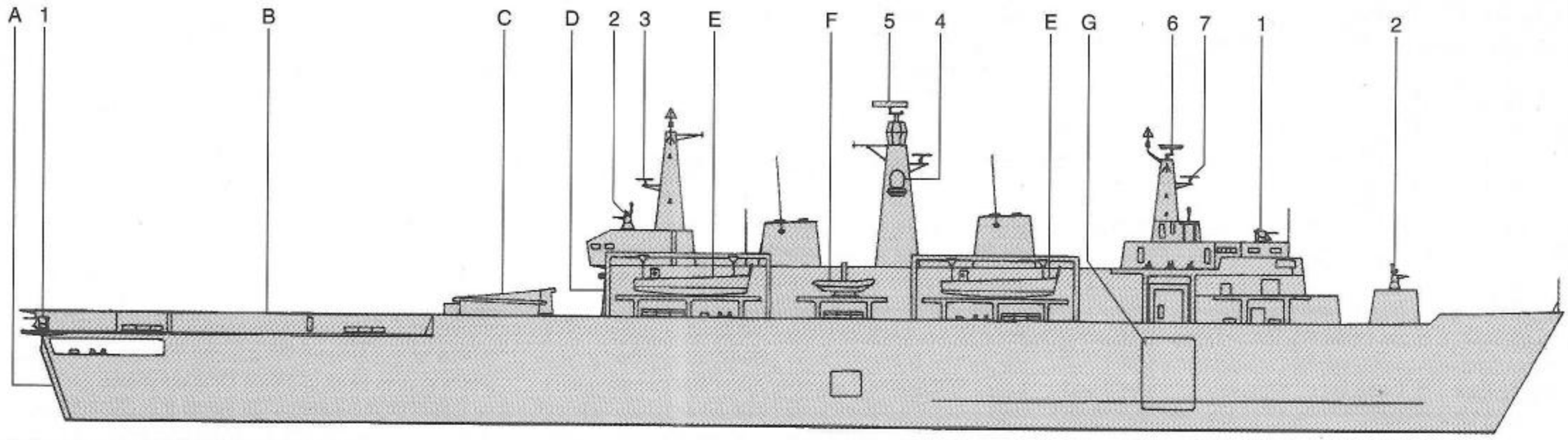
Unlike its predecessors, *Ocean* is a purpose-built helicopter carrier (LPH) and is intended to provide the major proportion of the helicopter-carrying capacity for an amphibious assault group, with the balance being provided by the new LPDs, which were ordered in July 1996. Very careful consideration has been given to the proper accommodation of troops, and to efficient and rapid outloading, which should make it among the most effective of its type in any navy.

The hull form is based on that of the 'Invincible' class aircraft carriers with a modified superstructure and a large flight deck, which is strong enough to take Chinook helicopters. Unlike the Invincible design there is no separate forecastle, thus restricting the arena available to aircraft, but it has still been found unavoidable to locate a Phalanx CIWS in the eyes of the ship. Despite the intended secondary use of the ship for V/STOL Harriers and Sea Harriers there is no ski ramp to assist take off as that would restrict helicopter operations.

There are two centreline lifts of sufficient size to handle EH101 Merlin helicopters (with rotors and tail folded) and Sea Harriers. They will not, however, accept Chinook helicopters which, if embarked, will remain on the flight deck.

Sea Harrier and Harrier V/STOL aircraft can be embarked.

ALBION



'Albion' class (LPD(R)) (Ian Sturton)
Amphibious A *Stern gate* **B** *Flight deck* **C** *Crane* **D** *Hangar* **E** *LCVP Mk 5* **F** *RHIB* **G** Entry port

General 1 *BMARC twin 30 mm GCM-A01* **2** *Signaal Goalkeeper CIWS* **3** *Kelvin Hughes Type 1007; carrier-controlled approach* **4** *Marconi Matra SCOT 1D Satcom* **5** *Type 998 air/surface search radar* **6** *Surface search radar; type unknown* **7** *Kelvin Hughes Type 1007; navigation*

GENERAL SPECIFICATIONS

Operator: United Kingdom
Type: Landing Platform Dock (LPD)

Class: ALBION

Active: 0
Ordered: 2

Displacement:
standard: 13,000 t
full load: 16,000 t

Dimensions
Length: 176 m (577.4 ft)
Beam: 31 m (101.7 ft)
Draught: 6.6 m (21.7 ft)

Speed: 18 kts

Complement: 325

SHIPS

ALBION
Builder VSEL, Barrow-in-Furness, Cumbria, UK
In service date 2001 (estimated)

BULWARK
Builder VSEL, Barrow-in-Furness, Cumbria, UK
In service date 2003 (estimated)

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops:
  Normal 300
  Hard lying 600
- Vehicles: 70 support vehicles

SHIP-SHORE LIFT

- 4 LCU Mk 10 in dock
- 4 LCVP Mk 5 on davits

AVIATION FACILITIES

Specifications
Flight deck: Large flight deck aft
Hangar: In after end of superstructure
Helicopters: Two Merlin EH 101

AMPHIBIOUS FACILITIES

- Docking well entered through stern gate.
- 4 davits for LCVP Mk 10
- Large crane on starboard side of flight deck
- Side ramp access.

WEAPONS SYSTEMS

GUNS

RO 30 mm/75 in GCM-A03 mountings
Eight RO/BMARC 30 mm/75 cannon in four GCM-A03 twin mountings. The four mountings are on either side of the flight deck forward (two) and atop the transom (two).

Specifications
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Range:
anti-surface: 1.15 n miles (3 km)
anti-air: 3,500 m (11,483 ft)
Rate of fire: 650 rds/min/barrel
Ammunition: 870 kg (1,918 lb)

Mounting (GCM-A03)
Traverse: 360° at 80°/s
Elevation: −15 to +85° at 60°/s

Manufacturer/Contractor
Royal Ordnance, UK.

Signaal/Hughes SGE-30 30 mm Goalkeeper close in weapons system
Two Signaal/Hughes 30 mm 7-barrelled Gatling Goalkeeper close in weapons system will be installed. One will be mounted on a pedestal on the foredeck, the other on the hangar roof.

Goalkeeper is an autonomous, fully automatic system consisting of a Hughes Sea Vulcan 30 gun, I-band search radar, I/K-band tracking radar, TV camera, and ancillaries. The Sea Vulcan 30 is based upon the electrohydraulically powered GAU-8/A 30 mm seven-barrel, Gatling gun, with each barrel firing once during each revolution of the barrel cluster. The gun is very reliable, with 33,000 mean rounds between stoppages. The mounting has an ammunition capacity of 1,190 rounds carried in a linkless system using a feed and storage drum, which is claimed to be sufficient for several target engagements before reloading is necessary. The warhead kill capability of Goalkeeper against anti-ship missiles is achieved by use of MPDS rounds which have high-density, tungsten alloy penetrators. For 'soft' targets, HEI and TP types of ammunition can be used.

The I-band search radar uses a 2,050 × 280 mm linear array antenna with an integrated sidelobe suppression antenna. The antenna rotates at 60 rpm and has a horizontal beamwidth of 1.7° and a vertical beamwidth of 60°. The radar is powered by a water-cooled, synthesiser-driven, TWT transmitter with high output

power for greater frequency and PRF flexibility in the face of ECM threats.

Specifications
Calibre: 30 mm
Muzzle velocity: 1,020 m/s (3,346 ft/s) (TP, HEI); 1,150 m/s (3,773 ft/s) (APDS)
Traverse: 360°
Elevation: −25 to +85°
Mounting weight: 6,800 kg (14,994 lb)
Crew: 0
Range: 200 m to 3 km (1.61 n miles)
Rate of fire: 4,200 rds/min
Ammunition: 369 g (TP, HEI, HEISD, API, MPDS)

Manufacturers/Contractors
Hollandse Signaalapparaten, Hengelo, The Netherlands (system/radar).
Hughes, Armament Systems Department, USA (gun).

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal-Thorn Outfit UAT (1)
Outfit UAT(1) is based on the Racal-Thorn Sceptre XL equipment and consists of three major components: an eight-element antenna array, a receiver/processor and an operator's console, and is integrated with the ship's command system. Processing is undertaken by a system based on transputers. An integrated receiver system is employed and software control is used heavily across the entire system. The display is based on that of the Sceptre XL with two screens, one a situation display and the other an alphanumeric tabular display with emitter data information.

Manufacturer/Contractor
Racal-Thorn Defence, Crawley, Sussex, UK.

ELECTRONIC COUNTERMEASURES (ECM)

Thorn EMI Type 675 (2) jammer
Type 675 (Guardian) is an active/passive EW system designed to counter a wide range of threats, particularly radar-guided missiles. The system counters and confuses surveillance and missile homing radars by the use of selective jamming techniques for both area and point defence. Coverage is 360° in azimuth and 50° in elevation, with a detection range of up to 270 n miles (500 km). Type 675 has two antenna mounts to ensure uninterrupted all-round view, which can be installed either port and starboard, or forward and aft. Each antenna mount carries a direction-finding receiving antenna together with transmit antennas, using mechanical steering to give full azimuth and elevation coverage. Received signals are passed to a wideband receiver, where they are analysed and those representing a threat are then processed to allow generation of the jamming signal. High power transmitter subsystems, matched to the antenna, provide jamming capability against several types of target simultaneously. A comprehensive ECM library stores the appropriate countermeasures to a range of potential threats and, on receipt of a warning from the ESM system, the ECM processor selects the appropriate jamming mode to give fast response.

Manufacturer/Contractor
Thorn EMI Electronics Ltd, Crawley, Sussex, UK.

DECOYS

Outfit DLJ
Outfit DLJ is the British Royal Navy designation for the NATO Sea Gnat system. Eight Sea Gnat 130 mm/102 mm launchers will be mounted in each LPD (R). The system uses a new control unit, new launcher with 130 mm tubes and new munitions. The control unit provides for the launching of the most effective combination of rounds for distraction and centroid/seduction, taking into account the type, speed and direction of the threat, the ship's speed and heading as well as wind direction and speed.

The munitions involved are the Mk 214 RF seduction and Mk 216 RF distraction rounds which are provided by Chemring Ltd. A Mk 218 IR seduction round entered service in 1995.

The basic system, Outfit DLB, has four Hunting Engineering 130 mm six-barrel launchers which are grouped in pairs on either beam and a modified version replaces the rear two barrels with 102 mm barrels for N4 rockets pending introduction of the Mk 216 Mod 1. The version planned for the two LPDs is Outfit DLJ which is a version of Outfit DLB optimised for larger warships: DLJ(1) has four DLB and four DLD (SRBOC) launchers, while DLJ(2) has eight DLB launchers.

Manufacturer/Contractor
Thorn EMI/AB Precision Ltd (control unit).
Hunting Engineering (launchers).
Chemring Ltd (munitions).

Outfit DLH offboard decoys
Outfit DLH is also known as 'Replica', 'Rubber Duck' and in the US Navy as AN/SLQ-49. The system is a rapidly deployed, passive naval decoy which presents a ship-like image to the radar seeker of an incoming anti-ship missile. The equipment consists of a launcher and a pair of liferaft-type containers, each housing one octahedral-shaped radar reflector. The two reflecting bodies start to inflate as they leave the ship and, once in the water, they are linked to each other by a 5 m (16 ft) line with one of the container lids acting as a sea-anchor to ensure that they remain apart. The distance between the opposite tips of the decoy is approximately 2.5 m (8.2 ft) and it contains metal-coated nylon mesh curtains, which are suspended from aluminium alloy tubes.

Manufacturer/Contractor
Irvin, Letchworth, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

ADAWS 2000 Command System
ADAWS 2000 has been developed from proven ADAWS software, using an Open Systems architecture to produce a low-risk, high-performance system. The system offers a 1,000 track database with over 100 track updates per second and interfaces with a maximum of seven radar, IFF, sonar, all missile and gun systems, datalinks and EW equipment. In addition to weapon control and Threat Evaluation and Weapon Assignment (TEWA) it employs the latest data fusion techniques to present a clear tactical picture from multi-platform inputs over large operational areas. Commercial Off-The-Shelf (COTS) hardware and software is used with modular software (Ada, C and Assembler) for each function and common infrastructure software. Radar Scan Conversion is used for the multiple radar inputs and a powerful graphics engine drives single or twin colour consoles and large-screen displays which feature CCTV input, electroluminescent and touch panels with soft keys and pull-down menus. The system has a dual-redundant Ethernet LAN which connects to the dual-redundant Combat System Highway.

Manufacturer/Contractor
GEC-Marconi Naval Systems Ltd, Combat Systems Division, Addlestone, Surrey.

COMMUNICATIONS AND DATALINKS

Datalinks
Link 11, Link 14, Link 16.
Merlin helicopter-ship datalink.

Satcom
Marconi Matra Scot 2D

RADARS

Siemens Plessey Type 996
The Plessey Type 996 is used for air/surface search. This is an E/F-band, 3D surveillance and target indication radar and there is an unconfirmed report that the radar is equipped with a jammer location receiver subsystem.

Specifications
Type 996(2)
Role: Air/surface search
Frequency: E/F-band
Beam: 1.4 × 1.5°
Peak power: 125 kW
Gain: 41 dB
Pulsewidth:
low angle: 65 µs
high angle: 31.5 µs
PRF: 550-3,000 µs
Scan rate: 12.5-20 rpm
Typical range: More than 80 n miles (150 km) against MPA (Maritime Patrol Aircraft)

Manufacturer/Contractor
Siemens Plessey Systems, Air Defence Division, Cowes, Isle of Wight.

Kelvin Hughes Type 1007
Two Type 1007s are used for surface search, navigation and carrier-control approach. The Type 1007 is the standard I-band navigation radar for the UK Royal Navy.

Specifications
Type 1007
Role: Navigation/surface search/CCA
Band: H/I (9,410 MHz)
Beam: 1.0 × 18°/0.75 × 18°
Peak power: 25 kW
Pulsewidth: 0.08/0.3/0.8 µs
PRF: 1,600/800/400 pps
Scan rate: 26 rpm

Manufacturer/Contractor
Kelvin Hughes Ltd, Hainault, Essex, UK.

PROPULSION

Specifications
System: Diesel, with diesel-electric for slow speeds
Main machinery: 2 diesels; 2 slow-speed electric motors

Shafts: 2
Thruster: 1 bow thruster

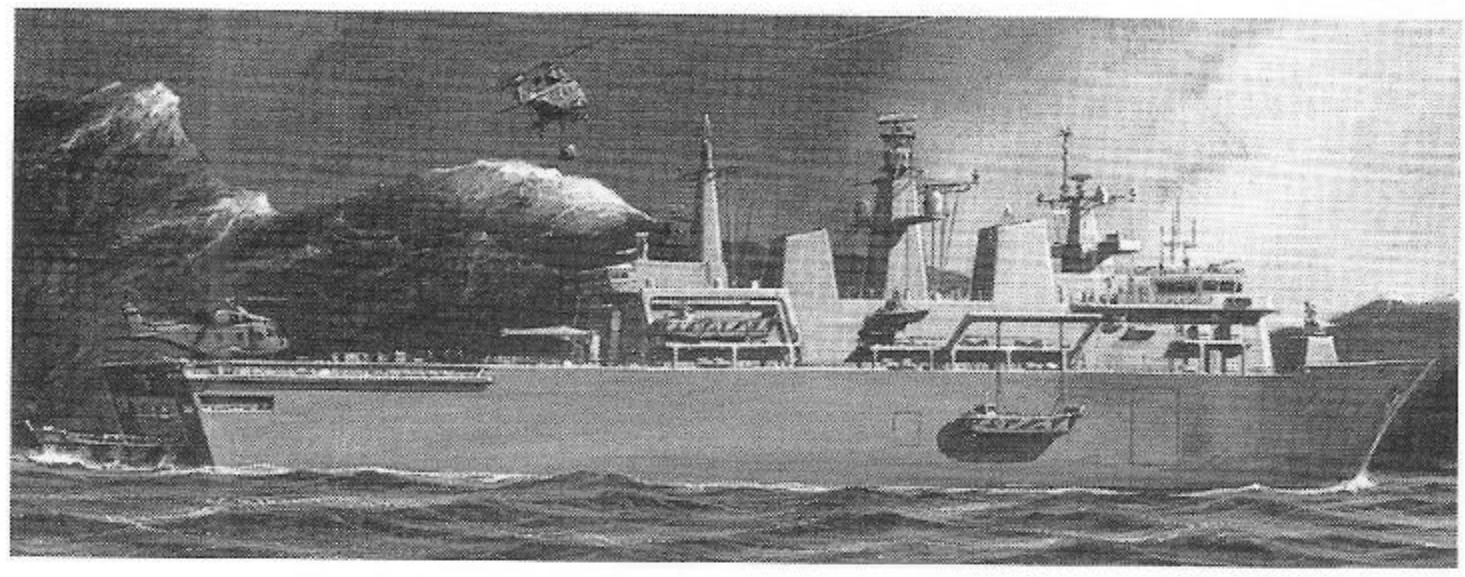
FURTHER INFORMATION

PROGRAMME

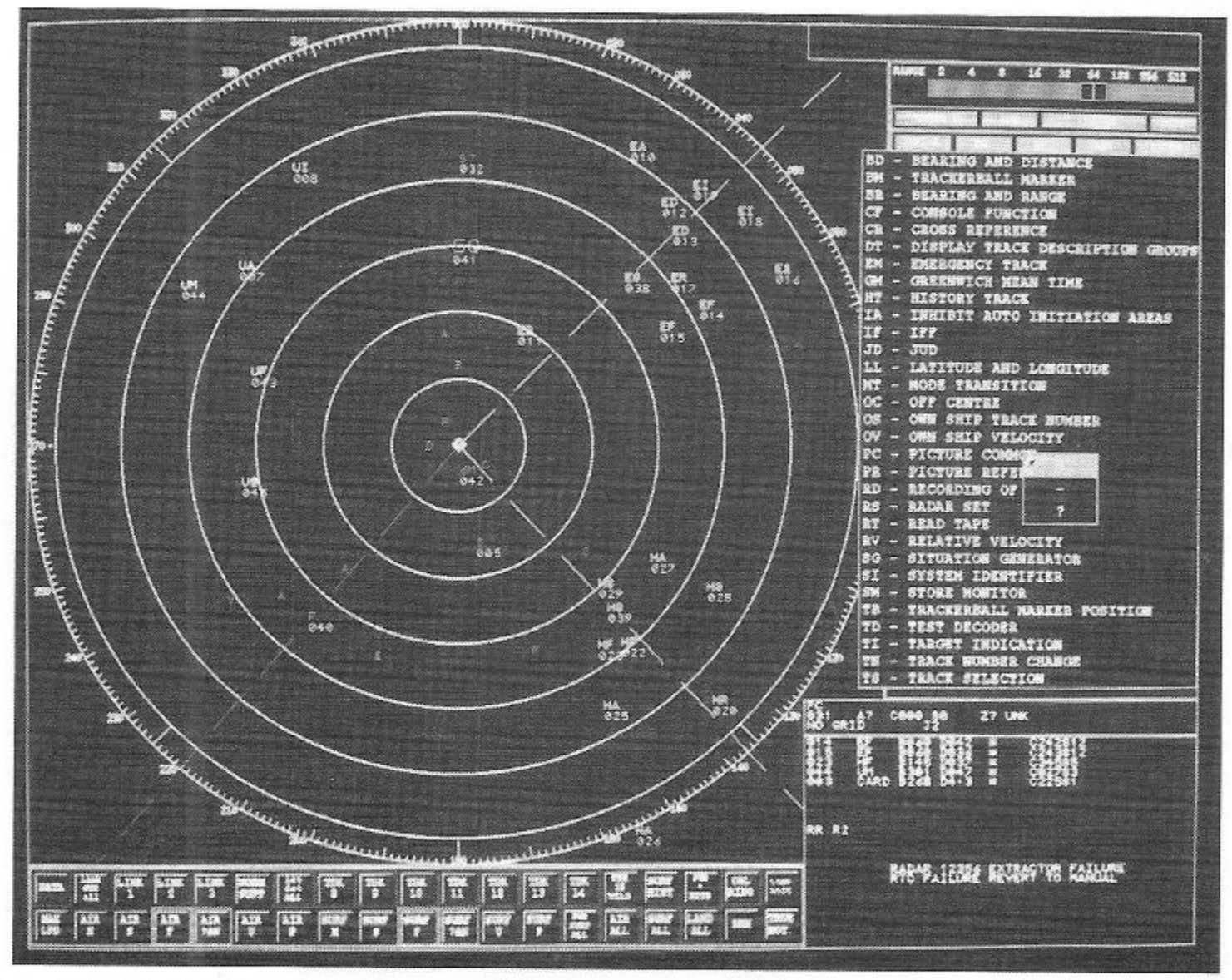
Like numerous other British projects, the LPD(R) (R = replacement) has had a very protracted gestation period, and while the discussions grew longer, the two ships to be replaced (*Fearless* and *Intrepid*) have become ever older and more expensive to maintain.

Three yards (VSEL, Yarrow and Vosper-Thornycroft) were invited to bid, but only one eventually tendered. The UK Ministry of Defence announced on 18 July 1996 that it had placed a UK £450 million order with GEC-Marine to build the two LPDs at the VSEL shipyard at Barrow-in-Furness, Cumbria. The ships will be named *Albion* and *Bulwark* (taking the names of two previous amphibious warfare ships) and are expected to enter service 'early in the next decade'. This was originally intended to be August 2000 and October 2002, respectively, but this has been delayed due to prevarication over the placing of the order.

The two new ships will replace the existing assault ships, *Fearless* and *Intrepid,* and will be based at Plymouth, Devon, UK.



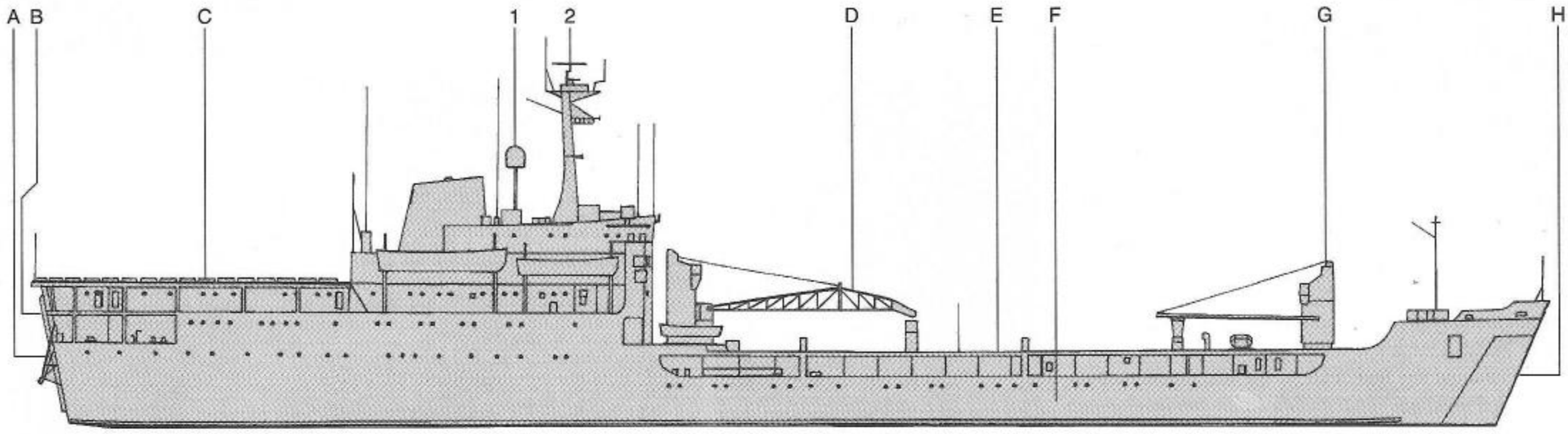
Artist's impression of the Albion *class landing-platform, dock (LPD)* (VSEL)


BD - BEARING AND DISTANCE
BM - TRACKERBALL MARKER
BR - BEARING AND RANGE
CF - CONSOLE FUNCTION
CR - CROSS REFERENCE
DT - DISPLAY TRACK DESCRIPTION GROUPS
EM - EMERGENCY TRACK
GM - GREENWICH MEAN TIME
HT - HISTORY TRACK
IA - INHIBIT AUTO INITIATION AREAS
IF - IFF
JD - JUD
LL - LATITUDE AND LONGITUDE
MT - MODE TRANSITION
OC - OFF CENTRE
OS - OWN SHIP TRACK NUMBER
OV - OWN SHIP VELOCITY
PC - PICTURE COMMON
PR - PICTURE REFER
RD - RECORDING OF
RS - RADAR SET
RT - READ TAPE
RV - RELATIVE VELOCITY
SG - SITUATION GENERATOR
SI - SYSTEM IDENTIFIER
SM - STORE MONITOR
TB - TRACKERBALL MARKER POSITION
TD - TEST DECODER
TI - TARGET INDICATION
TN - TRACK NUMBER CHANGE
TS - TRACK SELECTION

A workstation for the ADAWS 2000 with (inset) a picture of the display (GEC-Marconi)

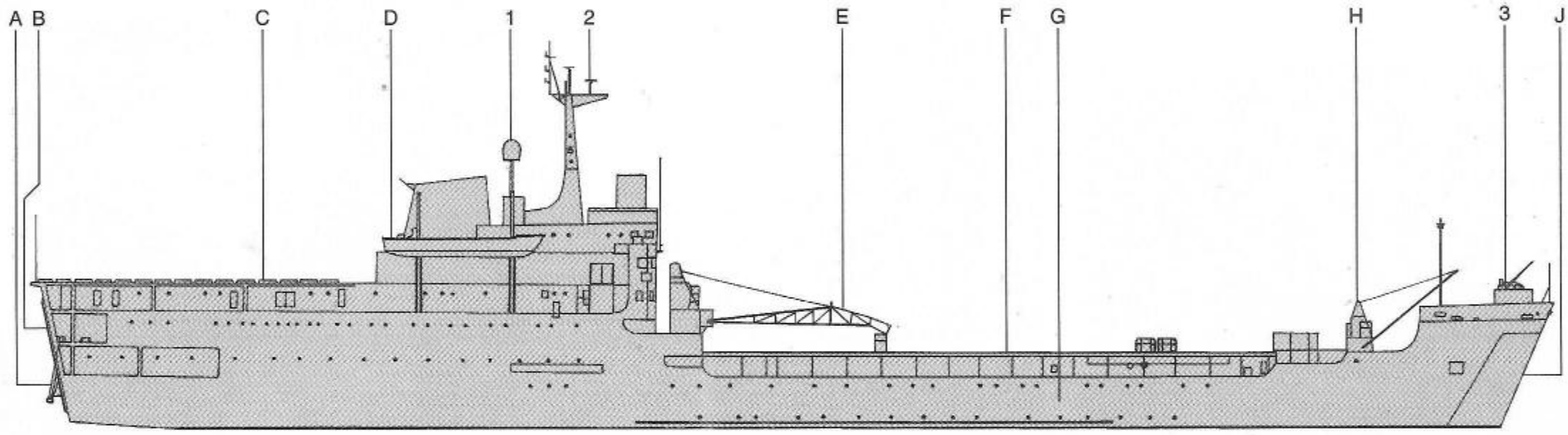
UK Landing Ships Logistics (LSL)

OVERVIEW



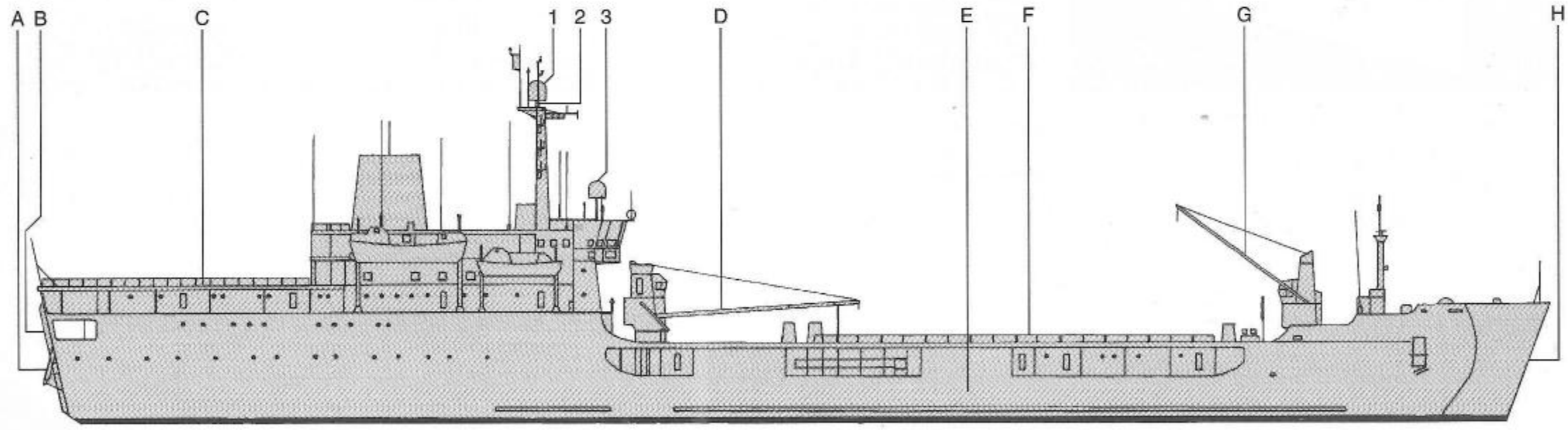
Sir Percivale *(LST-UK)* (Ian Sturton)
Amphibious A *Kedge anchors (2)* **B** *Stern ramp* **C** *Flight deck* **D** *Crane; 25 tonne* **E** *Vehicle/flight deck* **F** *Tank deck* **G** *Crane; 8.6 tonne (two)* **H** *Bow doors; clamshell*

General 1 *Satcom* **2** *Kelvin Hughes Type 1006*



Perseverance *(Singapore)* (Ian Sturton)
Amphibious A *Kedge anchors (2)* **B** *Stern ramp* **C** *Flight deck* **D** *Fast Craft Utility* **E** *Crane; 20 tonne* **F** *Vehicle/flight deck* **G** *Tank deck* **H** *Crane; 4.5 tonne (two)* **J** *Bow doors; clamshell*

General 1 *Satcom* **2** *Kelvin Hughes Type 1006 navigation radar* **3** *Bofors 40 mm/70*

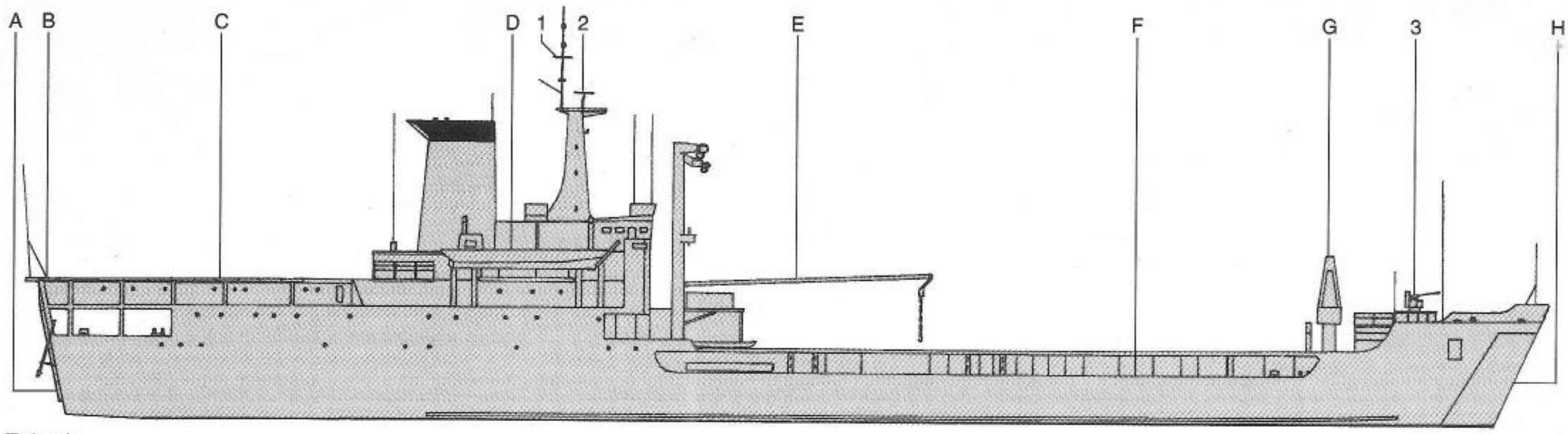


Sir Galahad (ii) *(UK)* (Ian Sturton)
Amphibious A *Kedge anchors (2)* **B** *Stern ramp* **C** *Flight deck* **D** *Crane; 25 tonne* **E** *Tank deck* **F** *Vehicle/flight deck* **G** *Crane; 8.6 tonne (two)* **H** *Bow door (vertical lifting)*

General 1 *Satcom* **2** *Kelvin-Hughes Type 1007 navigation radar* **3** *INMARSAT*

The British LSLs stem from a staff requirement issued by the War Office (the predecessor to the present-day Ministry of Defence (Army Department)) in the late 1950s to replace the wartime Landing Ships Tank Mk 3 (LST(3)). First to be completed was *Sir Lancelot* (L 3029), which served, in effect, as a prototype and the remaining five were of a slightly larger design. The ships were procured by the Ministry of Transport on behalf of the British Army, and were named after six of the twelve legendary 'Knights of the Round Table', but their operation was originally contracted to the British India Steamship Line. In 1970 the ships were taken over by the Royal Navy, which managed them on behalf of the Army, but designated the ships Royal Fleet Auxiliaries (Government-owned merchant ships) and manned them with officers and mariners of the Royal Fleet Auxiliary Service (RFA), which has operated them ever since.

Their peacetime role has always been logistical in nature, transporting troops, equipment, materiel and ammunition in support of the Army, either on routine peacetime deployments or on exercises. In the 1982 Falklands (Malvinas) War, however, they served as front-line amphibious warfare ships, taking part in the main British landing at San Carlos, while two were later bombed (8 June 1982) by A-4 Skyhawks of the Argentine Navy when taking part in a landing operation at Bluff Cove. The two ships, *Sir Galahad* and *Sir Tristram,* were both severely damaged. *Sir Galahad* (i) caught fire and there were numerous casualties, and after the war the hulk was towed out to sea and sunk as a war grave.



Tobruk
Amphibious A *Stern door* **B** *Kedge anchors* **C** Flight deck **D** *LCVP (two)* **E** *70 tonne derrick* **F** *Tank deck* **G** *4.25 tonne crane (two)* **H** *Bow doors*

General 1 *Kelvin Hughes Type 1006 surface search radar* **2** *Racal Decca RM 916 navigation radar* **3** *Bofors 40 mm gun (two)*

The other ship, *Sir Tristram,* was less badly damaged and was used as an accommodation ship in Stanley Harbour until June 1983 when it was carried back to the UK aboard a transporter ship to be rebuilt.

The work carried out on *Sir Tristram* amounted to a rebuild to the existing design, but with some improvements, which included replacing the aluminium alloy superstructure, which had been virtually destroyed in the Argentine attack, with a new steel structure. This resulted in a major increase in weight aft, which had to be compensated by lengthening the hull, with an 8.84 m (29 ft) plug being inserted in the forward part of the ship to restore the balance. This, of course, resulted in increased carrying capacity, but that was an incidental advantage and not the fundamental reason for the plug. Other changes include a new flight deck, which is slighlty longer and narrower than previously, and a new gantry-type mainmast.

Meanwhile, the loss of *Sir Galahad* was made good by the construction of a new replacment ship[1]. Although the replacement ship was built to the same basic design, the opportunity was taken to incorporate improvements including a longer hull, a new type of bow door, and new engines.

Faced with the approaching end of life of the remaining three original LSLs the Ministry of Defence decided to give *Sir Bedivere* a much more fundamental rebuild, designated the Ship Life Extension Programme, or SLEP, which results in what amounts to a new ship. This is described in the 'Sir Bedivere (SLEP)' entry below.

The UK has an urgent need to expand its amphibious capabilities and a variety of options has been examined. The situation has been partially eased by leasing the civilian ro-ro ship, *Sea Consort,* to meet the requirements of the Joint Rapid Deployment Force (JRDF). One of the choices facing the planners lay between purchasing the redundant Australian heavy-lift ship, *Tobruk* (which is, in fact, to virtually the same design as the LSLs) or to SLEP the remaining two original LSLs. At one stage these two proposals were considered of equal merit, but it now appears that the LSL SLEP option is the favoured one, although a final decision will not be made until the work on *Sir Bedivere* has been completed and its effectiveness assessed.

All LSLs have two landing spots: one on the flight deck and a second on the foredeck. Note also the stern ramp and the two kedge anchors, used to assist in hauling the ship off a beach

The tank deck of an LSL transporting vehicles on a UN deployment, a role these ships have frequently had to fulfil over the past decade

Sir Geraint *(L 3027) is representative of the original standard of the UK LSLs. Note the clamshell bow doors, the twin 4 tonne cranes at the forward end of the vehicle deck and the 20 tonne crane at the after end. If not used for vehicles the foredeck can be used as a helicopter landing deck. Only two of the British-operated ships —* Sir Geraint *and* Sir Percivale *— remain at this standard* (UK MoD)

The rebuilt Sir Tristram *(L 3505) with a MEXEFLOTE strapped to the side. The MEXEFLOTE (Military EXperimental Establishment FLOTation Equipment) is a modular, self-propelled pontoon used to move troops and vehicles between ship and shore*

It is however, reported that the SLEP is taking considerably longer than forecast and that much extra work has been done — all of which has increased the cost very considerably. In fact, a third option — building two completely new ships, may be the most cost-effective solution.

Footnote: [1] The British pennant number system causes a difficulty in that the new ship has exactly the same name and pennant number, *Sir Galahad* (L 3005), as the original ship. For the purposes of this book, they will be referred to as: the original ship, launched in 1966 and sunk in 1982 — *Sir Galahad* (i); the new ship launched in 1986 — *Sir Galahad* (ii).

OTHER DESIGNS

The basic LSL design gave rise to some derivatives and the Australian LSL, *Tobruk,* is so close as to be included in the same class. In addition, the replacement *Sir Galahad,* while larger, is generally similar in design and layout. The Indian 'Magar' class, on the other hand, although it has certain superficial similarities with the British LSLs, is a completely different design.[2]

Footnote: [2] Confirmed by UK MoD.

DEPLOYMENT

The British LSLs are constantly operational, operating from the military port at Marchwood in support of the British armed forces and, to a lesser extent, the other two Services. All of the class saw action in the Gulf War of 1990/91, being fitted with additional 20 mm guns, decoy systems and navigation equipment.

SUMMARY

In summary seven LSLs were built and seven are in service:

- *Perseverance,* in service with the Republic of Singapore Navy (RSN) was the original *Sir Lancelot.*
- *Sir Geraint* and *Sir Percivale* are the last two in British service still in their original state. Their future is uncertain.
- *Sir Tristram* was given a complete reconstruction after being damaged in the Falklands War; it is now longer than *Sir Geraint* and *Sir Percivale* but otherwise generally similar.
- *Sir Bedivere* is currently undergoing a SLEP and will be different from *Sir Tristram.*
- *Sir Galahad* (ii) was built as a replacement for *Sir Galahad* (i) and is to a modified and modernised design.
- *Tobruk* was built in Australia and is generally similar to *Sir Geraint.*

Class	*Sir Lancelot*[1]	*Sir Bedivere*[2] (original)	*Tobruk*	*Sir Tristram*[4] (rebuilt)	*Sir Bedivere* (SLEP)	*Sir Galahad* (ii)
Ship	*Sir Lancelot* (L 3029)	*Sir Bedivere* (L 3004) *Sir Galahad* (L 3005)(i)[3] *Sir Tristram* (L 3505) *Sir Geraint* (L 3027) *Sir Percivale* (L 3036)	*Tobruk* (L 50)	*Sir Tristram* (L 3505)	*Sir Bedivere* (L 3004)	*Sir Galahad* (L 3005) (ii)
Displacement						
deadweight	2,215 t	2,443 t	3,300 t	n/k	n/k	3,055 t
light	3,270 t	3,270 t	5,700 t	n/k	n/k	n/k
full load	5,674 t	5,674 t		5,800 t	6,400 t	8,585 t
Dimensions						
length (oa)	126.5 m (415 ft)	125.6 m (412.1 ft)	127 m (417 ft)	134.5 m (441.1 ft)	134.4 m (441.1 ft)	140.5 m (461 ft)
beam	18.2 m (59.8 ft)	18.2 m (59.8 ft)	18.3 m (60 ft)	18.2 m (59.8 ft)	18.2 m (59.8 ft)	19.5 m (64 ft)
draft	3.9 m (12.8 ft)	4 m (13 ft)	4.9 m (16 ft)	4 m (13 ft)	4 m (13 ft)	4.3 m (14.1 ft)
Speed	17.25 kts	17 kts	18 kts	17 kts	17 kts	18 kts
Range	8,000 n miles at 15 kts	8,000 n miles at 15 kts	8,000 n miles at 15 kts	8,000 n miles at 15 kts	8,000 n miles at 15 kts	13,000 n miles at 15 kts
Complement	75	51	73	52	49	53
Troops						
normal	340	340	350	340	340	339
hard lying	534	534	500	534	534	524
Tanks	16	17	15	18	18	18
Flight deck	Yes (2)	Yes (2)	Yes	Yes (2)	Yes (2)	Yes (2)
Engines	2 Denny-Sulzer 12MH51 diesel (12 cylinder)	2 Mirrlees 10-ALSSDM diesel (10 cylinder)	Mirrlees-Blackstone KDMR-8 diesels	2 Mirrlees 10-ALSSDM diesel (10 cylinder)	2 Wärtsila 12SW28 diesel (12 cylinder)	2 Mirrlees-Blackstone KMG Major (12 cylinder)

Notes:
[1] Now the Singaporean Navy's *Perseverance*
[2] The only ships now to this standard are *Sir Geraint* (L 3027) and *Sir Percivale* (L 3036)
[3] Original *Sir Galahad*; sunk 1982
[4] Rebuilt after serious damage in Falklands (Malvinas) War

Sir Galahad *(ii) (L 3005) built after the Falklands War to replace the ship of the same name which was lost. The design was considerably modified with a longer hull and a vertically opening bow door* (UK MoD)

The bow doors of Sir Geraint *(L 3027) with the internal, two-part ramp lowered. The specialist vehicle is laying flexible trackway to ensure that wheeled vehicles do not bog down in soft sand*

PERSEVERANCE (UK LSL)

GENERAL SPECIFICATIONS

Country of Origin: United Kingdom
Operator: Singapore
Type: UK (LSL)

Class: PERSEVERANCE

Built: 1
Active: 1

Displacement:
deadweight: 2,215 t
light: 3,270 t
full load: 5,674 t

Dimensions
Length: 126.5 m (415.0 ft) (oa)
Beam: 18.2 m (59.8 ft)
Draught: 3.9 m (12.8 ft)

Speed: 17.25 kts
Range: 8,000 n miles at 15 kts

Complement: 75

SHIPS

PERSEVERANCE (L 206)					
Builder	Fairfield, Glasgow, UK	**Transferred to UK Royal Fleet Auxiliary**	1970 (RFA *Sir Lancelot* (L 3029))	**Recommissioned (Republic of Singapore Navy)**	5 May 1994 *(Perseverance)*
Laid down	Mar 1962	**Paid off by RFA**	1989		
Launched	25 Jun 1963	**On various civil registers**	1989-1992 *(Lowland Lancer)*		
Entered service (British Army)	16 Jan 1964 (SS *Sir Lancelot)*	**Purchased by Singapore**	Oct 1992		

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops
  normal: 340
  hard-lying: 534
- Tanks: 16
- Mixed vehicles: 34
- Petroleum, oil and lubricants: 120 tonnes
- Ammunition: 30 tonnes

SHIP-SHORE LIFT

- Facilities exist for two MEXEFLOTE self-propelled pontoons to be carried (each MEXEFLOTE carried reduces vehicle deck capacity by seven 4-tonne (equivalents). However, it is not known whether the RSN has purchased MEXEFLOTES.
- Two Fast Craft Utility (FCU) on davits

AVIATION FACILITIES

Specifications
Flight deck: Platform for two medium helicopters
Hangar: None
Helicopters: The RSN does not operate helicopters, but army helicopters could be embarked

AMPHIBIOUS FACILITIES

- Fitted for bow and stern loading with drive-through facilities and deck-to-deck ramps.
- One 20 tonne crane; two 4.5 tonne cranes.

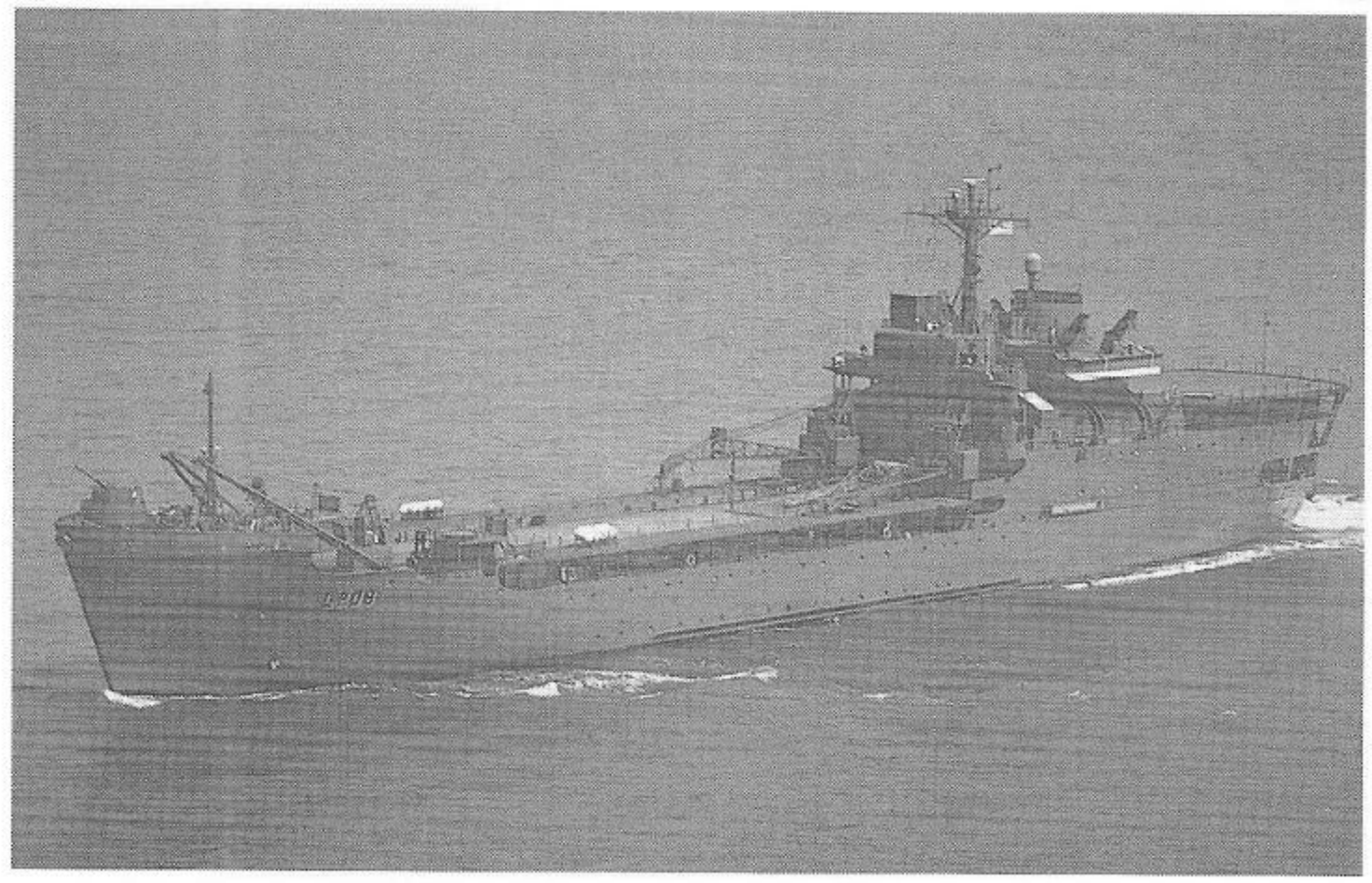
WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Matra SIMBAD close in weapons system
There are four SIMBAD *(Système Intégre de Mistral Bi-tube d'Auto-Défense)* launchers, each with two Mistral missiles. The Mistral missile contains a SAT two-colour (3-5 µm infra-red and ultraviolet) seeker under IR-transparent magnesium fluoride panels. The seeker has a field of view of ±38° and is cooled concurrently with gyro run-up, in approximately 2 seconds. The whole system has a reaction time of approximately 5 seconds and the missile leaves its launch tube with a velocity of 40 m/s (131 ft/s) accelerating rapidly to its maximum speed of Mach 2.5.

SIMBAD is manually operated, with two missile launcher-containers. When the target is designated, the operator tracks it, selects a missile and activates the battery/coolant unit to cool the seeker and warm up the missile, while the prelaunch electronics box uses the seeker to determine whether or not the target is within range. If the answer is positive, the seeker locks on and the operator receives an audio signal allowing him to launch the missile. If, for some reason, the firing has to be postponed, the missile system automatically compensates minor aiming errors and remains ready for launch.

Specifications
Mistral Missile
Length: 1.81 m (6.0 ft)
Diameter: 9.2 cm (3.6 in)
Wing span: 1.9 cm (0.7 in)
Weight: 18.4 kg (40.5 lb)
Speed: Mach 2.6
Range: 700 m to 5 km



Perseverance *(L 206) under the Singapore flag. Note the Bofors 40 mm on the forecastle, the box-shaped structure on the bridge roof (purpose unknown) and the satellite antenna above the stack* (Republic of Singapore Navy)

Warhead:
HE: 1 kg (2.2 lb)
tungsten balls: 1.95 kg (4.3 lb)
Booster: 2 SNPE rocket motors

Manufacturer/Contractor
Matra Defénse, France.

GUNS

One Bofors 40 mm/70
There is one Bofors 40 mm/L 70 mounting in the bows.

Specifications
Calibre: 40 mm

Length of barrel: 70 calibres
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Rate of fire: 300 rds/min
Ammunition: 2.4 kg (5.3 lb) (HCHE, PFHE), 2.5 kg (5.5 lb) (HE-T)

M2HB 12.7 mm machine guns

Six M2HB 12.7 mm (0.50 in) machine guns are carried.

Specifications
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

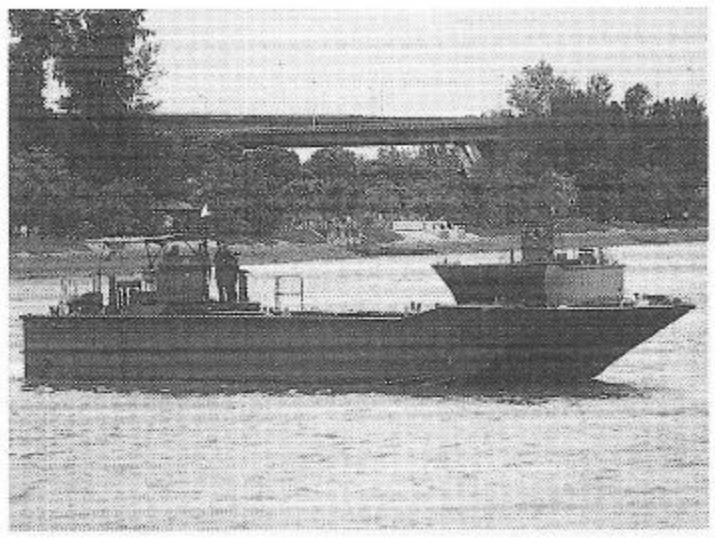
RADARS

Kelvin Hughes Type 1006

The Type 1006 has, for many years, been the standard I-band navigation radar for the British Royal Navy and many other navies.

Specifications
Type 1006
Role: Navigation
Frequency: I-band (approximately 9,445 MHz)
Beam: 1 × 18°/0.75 × 18°
Peak power: 25 kW
Gain: 31 dB/34 dB
Pulsewidth: 0.8 or 0.25/0.75 µs
PRF: 1,600/800 pps
Scan rate: 24 rpm
Typical range: 64 n miles

Manufacturer/Contractor
Kelvin Hughes Ltd, Hainault, Essex, UK.



Two Singapore-designed and built Fast Craft Utility (FCU) are carried on davits. These craft can carry a load of 18 tonnes at a speed of 20 knots
(David Boey)

PROPULSION

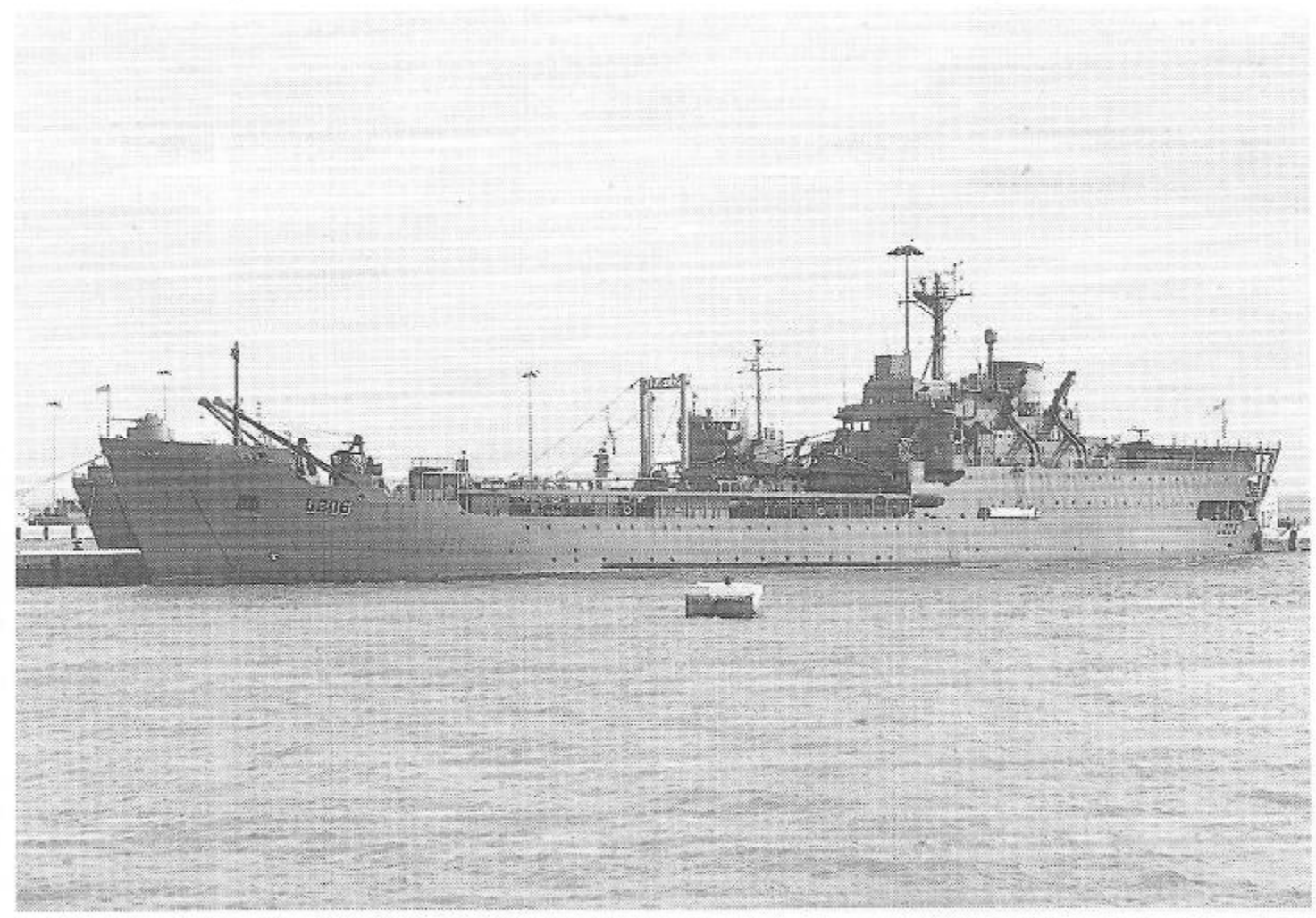
Specifications
System: Diesel
Main machinery: 2 Denny-Sulzer 12-cylinder 12MH51 diesels, 7.1 MW (9,520 hp)
Shafts: 2
Thruster: 1 bow thruster

FURTHER INFORMATION

Sir Lancelot was the first of the British post-war LSLs to be built, and thus, in effect, the prototype. As a result of experience with the ship, the design was recast, and the following five ships had substantial differences, being slightly larger and having different mechanical and general arrangements.

Sir Lancelot took part in the Falklands War but was paid off in 1989 and sold to a commercial company. Renamed *Lowland Lancer,* the ship operated initially as a commercial survey vessel, but then became an off-shore casino, operating out of Cape Town, South Africa. This project does not seem to have been too successful and the ship was soon back on the market and was bought by the Republic of Singapore Navy (RSN).

In Singapore, it has been extensively refitted, with upgraded accommodation and new armaments. Aside from its amphibious role, it is also used to train midshipmen on long cruises.



Perseverance *(L 206)*
(H & L van Ginderen Collection)

UK LSL (pre-SLEP)

GENERAL SPECIFICATIONS

Operator: United Kingdom

Class: LSL (pre-SLEP)

Built: 5
Active: 3

Displacement:
deadweight: 2,443 t
standard: 3,270 t
full load: 5,674 t

Dimensions
Length:
L 3027, L 3036: 126.02 m (413.5 ft) (oa)
L 3505: 134.43 m (441.1 ft)
Beam: 17.94 m (58.86 ft)
Draught
normal: 3.9 m (12.8 ft)
with tanks: 4.57 m (15 ft)

Speed: 17.25 kts

Range: 13,000 n miles at 15 kts; 9,800 n miles at 17 kts

Complement:
L3027, L3036: 51 including 18 officers
L3505: 53

SHIPS

SIR GERAINT (L 3027)

Builder	Alexander Stephen, Glasgow, UK
Laid down	Jun 1965
Launched	26 Jan 1967
Commissioned	12 Jul 1967

SIR PERCIVALE (L 3036)

Builder	Hawthorn Leslie, Hebburn-on-Tyne, UK
Laid down	Apr 1966
Launched	4 Oct 1967
Commissioned	23 Mar 1968

SIR TRISTRAM (L 3505)

Builder	Hawthorn Leslie, Hebburn-on-Tyne, UK
Laid down	Feb 1966
Launched	12 Dec 1966
Commissioned	14 Sep 1967
Reconstruction	1984-9 Oct 1985

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops
  normal: 337
  hard lying (dormitories): 470
  hard lying (maximum): 534
- Tank deck: 16 main battle tanks or 27—4 tonne vehicles (or equivalent)
- Vehicle deck: 34—4-tonne vehicle equivalents
- Petroleum, oil, lubricants: 120 tonnes
- Ammunition: 30 tonnes
- If no other cargo is carried, an LSL can transport 11 helicopters on the tank deck and nine on the vehicle deck

SHIP-SHORE LIFT

- Two MEXEFLOTE self-propelled pontoons (each MEXEFLOTE carried reduces vehicle deck capacity by seven 4-tonne vehicle equivalents).

AVIATION FACILITIES

Specifications
Flight deck: Large flight deck aft. Foredeck has landing spot
Hangar: No hangar, but has refuelling and re-arming facilities.
Helicopters: Can operate Gazelle, Lynx or Sea King from flight deck, and Gazelle and Lynx from foredeck

AMPHIBIOUS FACILITIES

- Two clamshell bow doors
- Internal bow ramp with 60 tonne weight classification

Sir Bedivere *(L 3004) in its original state* (UK MoD)

- Stern ramp with 60 tonne weight classification
- Bow and stern ramps can be connected to MEXEFLOTE rafts or causeways
- Full drive-through facilities
- One 20.32 tonne crane at after end of vehicle deck
- Two 4.32 tonne cranes at forward end of vehicle deck.
- Two ramps from tank deck to vehicle deck
  forward ramp: 14.55 × 3.96 m (47.75 × 13 ft)
  after ramp: 13.59 × 3.96 m (44.6 × 13.0 ft)
  gradient on both ramps is 1:3
  load limit on both ramps is 10 tonnes
- Bow opening 4.57 m (15 ft) wide by 5.41 m (17.75 ft) wide
- Stern opening is 4.57 m (15 ft) wide by 4.95 m (16.25 ft) high

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm

Two or four Oerlikon 20 mm manually operated mountings.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range
anti-surface: 1.5 km
anti-air: 1,150 m (3,773 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

Mounting
Elevation: −15 to +90°
Total weight: 497 kg (1,096 lb) (including shield)

L7A1 7.62 mm machine guns

A variable number of L7A1 machine guns is carried, typically four, but operationally could be more. The L7A1 is a gas-operated weapon with a maximum practical rate of fire of 200 rds/min.

ELECTRONIC WARFARE SYSTEMS

DECOYS

Plessey Shield Tactical Decoy System

There are two Plessey Shield 12-barrelled decoy launchers for chaff. Shield is a microprocessor-controlled, fully automatic missile decoy system, which is designed to provide effective protection for various sizes of ship, including fast attack craft, corvettes, frigates and destroyers. On detecting a threat, Shield selects the most appropriate response from up to six million scenarios held in its EPROM memory, using data obtained from onboard sensors such as radar and ESM and then automatically deploys the pattern of decoys that will give the highest probability of success. GEC-Marconi chaff rockets are fitted with a variable fuze which allows the chaff to be dispersed at optimum positions along the trajectory. To counter threats with a dual-mode capability, both chaff and infra-red decoys can be deployed automatically. Shield offers four protection modes — confusion; distraction; seduction/breaklock; and seduction dump — and uses two types of decoy — chaff and infra-red — which may be used on their own, or in combination with each other.

The munition is the N8 rocket, which has a 7.5 kg (16.5 lb) payload of customised chaff to give equal performance against both horizontally and vertically polarised radars. The fuze is set electronically immediately before firing for the optimum chaff cloud. There is also an N5 Broad Band Chaff (BBC) rocket with a manually set fuze.

Chaff rockets carry an 8.5 kg (18.7 lb) payload and chaff deployment takes place at ranges of 50-2,500 m (164-8,202 ft) (with 0.25 second and 16 second fuze settings respectively) at a height of about 100 m (328 ft). The N6 IR round, which operates on the mortar principle, has seven submunitions which are deployed progressively further from the ship, beginning at a distance of 50-200 m (164-656 ft) and lasting for 1-15 seconds. These submunitions operate in the 3-5 µm and 8-13 µm bands.

Manufacturer/Contractor
GEC-Marconi Naval Systems, Addlestone, UK.

COMMAND AND CONTROL SYSTEMS

RADAR

Kelvin Hughes Type 1006

The Type 1006 has, for many years, been the standard I-band navigation radar for the British Royal Navy and many other navies. One ship may be fitted with the Racal-Decca 2690; performance is similar.

Specifications
Type 1006
Role: Navigation
Frequency: I-band (approximately 9,445 MHz)
Beam: 1 × 18°/0.75 × 18°
Peak power: 25 kW
Gain: 31 dB/34 dB
Pulsewidth: 0.8 or 0.25 µs/0.75 µs
PRF: 1,600/800 pps
Scan rate: 24 rpm
Typical range: 64 n miles

Manufacturer/Contractor
Kelvin Hughes Ltd, Hainault, Essex, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Mirrlees National ten-cylinder 10-ALSSDM diesels, 7.01 MW (9,400 hp)
Shafts: 2
Thruster: 1 Brown/Voith-Schneider bow thruster, 400 hp

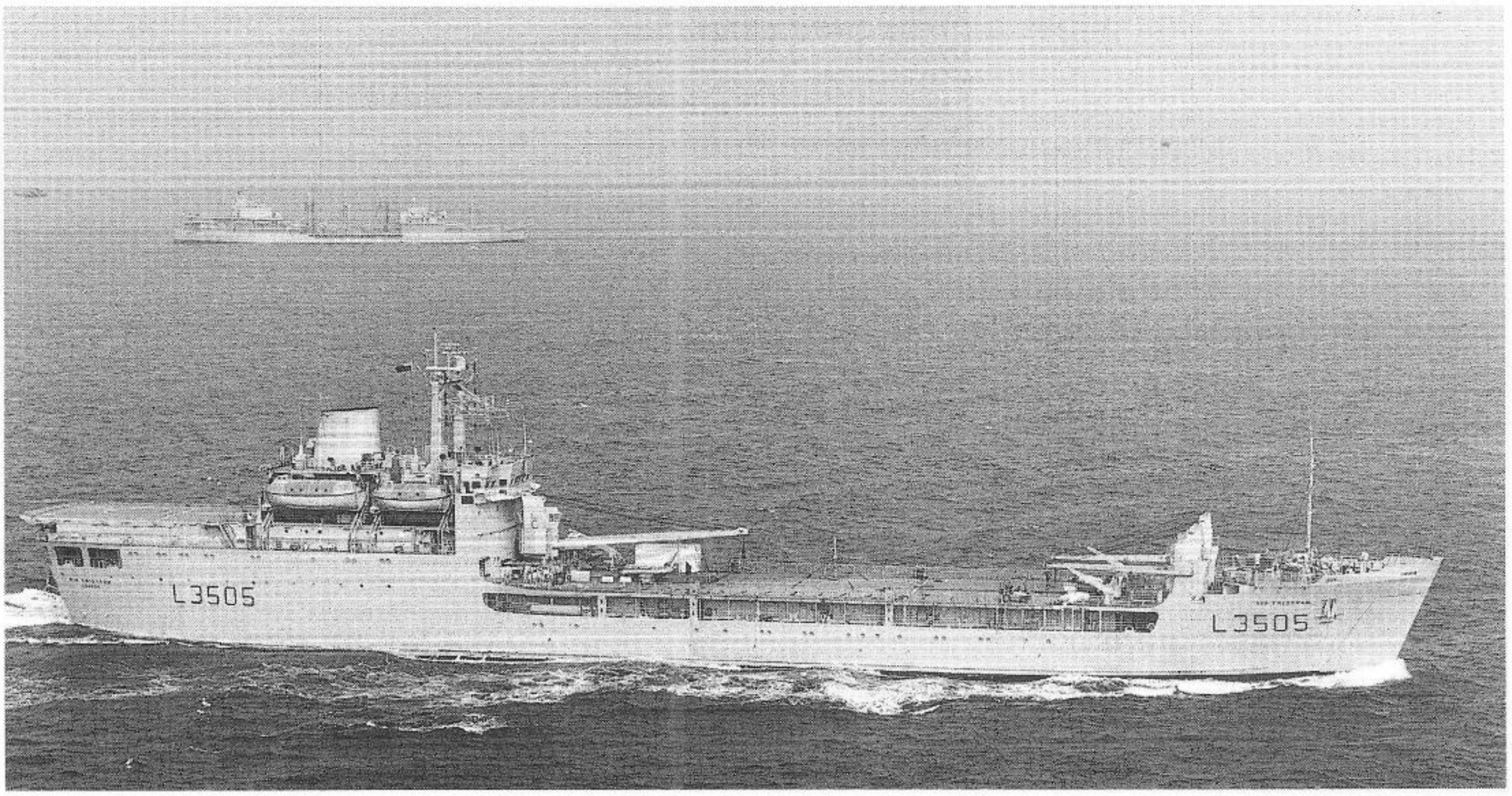
FURTHER INFORMATION

PROGRAMME

Five LSLs were built to the standard described in this entry. Of these, *Sir Galahad* (i) was so badly damaged that it had to be sunk, while *Sir Tristram's* damage was less severe, enabling it to be returned to the UK, where it was rebuilt. It was, however, rebuilt to the original design, with relatively minor changes, and not totally reconstructed, as is the case with *Sir Bedivere* (see next entry).

Sir Tristram

Although *Sir Tristram* (L 3505) survived the attack in the Falklands War, the ship still had to be transported back to the UK on a heavy-lift ship, where Tyne Shiprepairers was given a contract to repair and modify it. This included lengthening the hull by 8.8 m (29 ft), enlarging the flight deck to take Chinook helicopters, and installing a new bridge and a gantry mast. Other changes included replacing the aluminium superstructure with steel, installing new communications facilities, EMR and Satcom, new navigation systems and helicopter control radar. The work did not involve replacing the engines, which remain the original Mirrlees. This work, which was considerably less ambitious than the SLEP recently carried out on *Sir Bedivere,* was completed on 9 October 1985.



The rebuilt Sir Tristram. *The rebuilding was considerably less ambitious than the SLEP currently being carried out on* Sir Bedivere *but it did include lengthening the ship by 8.84 m (29 ft). This was not done in order to increase the capacity of the ship (although it did have that effect) but in order to counterbalance the additional weight of the new steel superstructure* (UK MoD)

UK LSL (SLEP[1])

GENERAL SPECIFICATION

Operator: United Kingdom

Class: UK LSL

Converted: 1
Active: 1
Planned: (see 'Further Information')

Displacement:
standard: 3,322 t
full load: 6,502 t

Dimensions:
Length: 140.0 m (459.3 ft) (oa)
Beam: 19.3 m (63.3 ft)
Draught: 4 m (13.1 ft)

Speed: 17 kts
Range: 8,000 n miles at 15 kts

Complement: 49, including 15 officers

Footnote: [1]SLEP — Service Life Extension Programme

SHIPS

SIR BEDIVERE (L 3004)

Builder	Hawthorn Leslie, Hebburn-on-Tyne, UK
Laid down	Oct 1965
Launched	20 Jul 1966
Commissioned	18 May 1967
SLEP	1994-Mar 1997

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops
  normal: 400
  hard lying: 534
- Main battle tanks: 18
- Vehicles: 34—4 tonne equivalents
- Petroleum, oil, lubricants: 120 tonnes
- Ammunition: 30 tonnes
- If no other cargo is carried, has capacity for 11 helicopters on the tank deck and nine on the vehicle deck

SHIP-SHORE LIFT

- Two MEXEFLOTE self-propelled pontoons (each MEXEFLOTE carried reduces vehicle deck capacity by seven 4 tonne equivalents).

AVIATION FACILITIES

Flight deck: Large flight deck aft. Foredeck has landing spot
Hangar: No hangar, but has refuelling and re-arming facilities
Helicopters: Can operate Gazelle, Lynx, Sea King and Chinook from flight deck, and Gazelle and Lynx from foredeck

Sir Bedivere *(L 3004) one of the UK's five LSLs* (UK MoD)

AMPHIBIOUS FACILITIES

- Two clamshell bow doors.
- Internal bow ramp with 60 tonne weight classification.
- Stern ramp with 60 tonne weight classification.
- Bow and stern ramps can be connected to MEXEFLOTE rafts or causeways.
- Full drive-through facilities.
- One Clarke Chapman 25 tonne crane at after end of vehicle deck.
- Two 4.32 tonne cranes at forward end of vehicle deck.
- Two ramps from tank deck to vehicle deck.
- Bow opening 4.57 m (15 ft) wide by 5.41 m (17.75 ft) high.
- Stern opening is 4.57 m (15 ft) wide by 4.95 m (16.25 ft) high.

WEAPONS SYSTEMS

GUNS

20 mm Oerlikon mountings

Four single GAM-BO1 20 mm mounts are fitted on the upper deck. GAM-BO1 uses a swivel fork with the side walls having the trunnion bearings. The cradle is made of light alloy and the weapon's working parts are enclosed in a protective case whose top opens to ease maintenance and installation. The sight, shoulder rests and back support strap are all attached to the sight bracket which is adjustable for height. Usually these mountings have an optical ring sight but they can also be fitted with a lead computing sight. The ammunition box with 200 rounds is attached to the front of the mounting and the belt is fed from the right side of the gun, with spent cartridge cases being ejected between the sidewalls of the cradle into a separate compartment, while the links are collected in a bag on the other side of the mounting.

Specifications

GAM-BO1
Elevation: 55°
Gun Model: KAA
Calibre: 20 mm
Length of barrel: 85 calibres
Effective range:
surface target: 2,500 m (2,700 yd)
aircraft: 1,200 m (4,000 ft)
Rate of fire: 1,000 rds/min
Round weight: 320-345 g
Projectile: 110-125 g

Manufacturers/Contractors

Royal Ordnance, UK.
Oerlikon Contraves AG, Defence (cannon)

L7A1 7.62 mm machine guns

A variable number of L7A1 machine guns carried, typically four, but operationally could be more. The L7A1 is a gas-operated weapon with a maximum practical rate of fire of 200 rds/min.

ELECTRONIC WARFARE SYSTEMS

DECOYS

Plessey Shield Tactical Decoy System

There are two Plessey Shield 12-barrelled decoy launchers for chaff. Shield is a microprocessor-controlled, fully automatic missile decoy system, which is designed to provide effective protection for various sizes of ship, including fast attack craft, corvettes, frigates and destroyers. On detecting a threat, Shield selects the most appropriate response from up to six million scenarios held in its EPROM memory, using data obtained from onboard sensors such as radar and ESM and then automatically deploys the pattern of decoys that will give the highest probability of success. GEC-Marconi chaff rockets are fitted with a variable fuze which allows the chaff to be dispersed at optimum positions along the trajectory. To counter threats with a dual-mode capability, both chaff and infra-red decoys can be deployed automatically. Shield offers four protection modes — confusion; distraction; seduction/breaklock; and seduction dump — and uses two types of decoy — chaff and infra-red — which may be used on their own, or in combination with each other.

The munition is the N8 rocket, which has a 7.5 kg (16.5 lb) payload of customised chaff to give equal performance against both horizontally and vertically polarised radars. The fuze is set electronically immediately before firing for the optimum chaff cloud. There is also an N5 Broad Band Chaff (BBC) rocket with a manually set fuze.

Chaff rockets carry an 8.5 kg (18.7 lb) payload and chaff deployment takes place at ranges of 50-2,500 m (164-8,202 ft) (with 0.25 second and 16 second fuze settings respectively) at a height of about 100 m (328 ft). The N6 IR round, which operates on the mortar principle, has seven submunitions which are deployed progressively further from the ship, beginning at a distance of 50-200 m (164-656 ft) and lasting for 1-15 seconds. These submunitions operate in the 3-5 µm and 8-13 µm bands.

Manufacturer/Contractor

GEC-Marconi Naval Systems, Addlestone, UK.

COMMAND AND CONTROL SYSTEMS

RADARS

Kelvin Hughes Type 1006

The Type 1006 has, for many years, been the standard I-band navigation radar for the British Royal Navy and many other navies. The Type 1007 is now supplementing the earlier equipment in the role. One ship may be fitted with the Racal-Decca 2690; performance is similar.

Specifications

Type 1006
Role: Navigation
Frequency: I-band (approx 9,445 MHz)
Beam: 1 × 18°/0.75 × 18°
Peak power: 25 kW
Gain: 31 dB/34 dB
Pulsewidth: 0.8 or 0.25 µs/0.75 µs
PRF: 1,600/800 pps
Scan rate: 24 rpm
Typical range: 64 n miles

Manufacturer/Contractor

Kelvin Hughes Ltd, Hainault, Essex, UK.

Kelvin Hughes Type 1007

One Kelvin Hughes Type 1007 is installed for use in aircraft control.

Specifications

Type 1007
Role: Carrier-control approach (CCA)
Frequency: I-band (9,410 MHz)
Beam: 1.0 × 18°/0.75 × 18°
Peak power: 25 kW
Gain: 31/33 dB
Pulsewidth: 0.08/0.3/0.8µs
PRF: 1,600/800/400 pps
Scan rate: 26 rpm
Range: 96 n miles

Manufacturer/Contractor

Kelvin Hughes Ltd, Hainault, Essex, UK.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Wärtsilä 12 SW280, 7.2 MW (9,840 hp) sustained
Shafts: 2
Thruster: 1 Brown/Voith-Schneider bow thruster, 720 kW (980 hp)

FURTHER INFORMATION

PROGRAMME

Sir Bedivere will complete an ambitious Service Life Extension Programme (SLEP) in March 1997. It remains undecided, however, whether funding can be found for the remaining two ships to be given similar treatment.

The SLEP involves the ship being cut in two at a point approximately half-way along the vehicle deck and a new 13 m (42.65 ft) section added. The forecastle is extended aft and some 40 per cent of the plating is replaced. In replacing the vehicle deck it has been replated and strengthened to enable Chinook (CH-47) helicopters to land. During preparations for this work on *Sir Bedivere* it was discovered that parts of the hull had deteriorated considerably more than had been expected and additional work (at additional expense) had to be authorised to make this good.

The original aluminium alloy superstructure has been totally removed and replaced by a steel structure, which includes a number of changes, of which the most important is that the flight deck has been lowered by one deck level. Other changes include new davits for LCVP Mk 4 and a new gantry-type mainmast.

The original Mirrlees diesel engines have been removed and will now be cannibalised for spares for the remaining engines in the 'un-SLEPed' LSLs. They have been replaced by Wärtsilä diesels, of the same model as used as cruise engines in the RNethN's 'Karel Doorman' class, the first time this maker's engines have been used in British naval vessels.

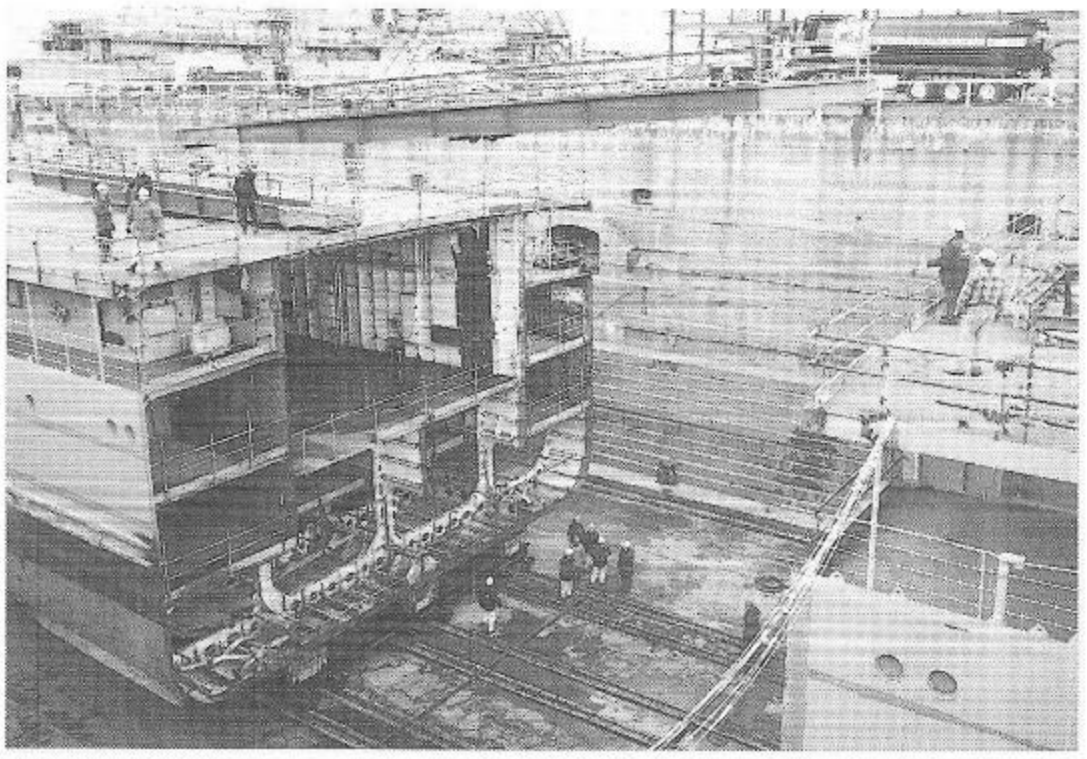
The two 8 tonne cranes forward have been refurbished, while the 20 tonne crane aft has been removed and replaced by a new 25 tonne crane. New davits have been installed on the superstructure to handle two LCVP Mk 4, making this ship the only one of the five LSLs to operate such craft.

Finally, four GAM-BO1 guns have been installed and an additional radar (Kelvin Hughes Type 1007) installed for more effective air control.

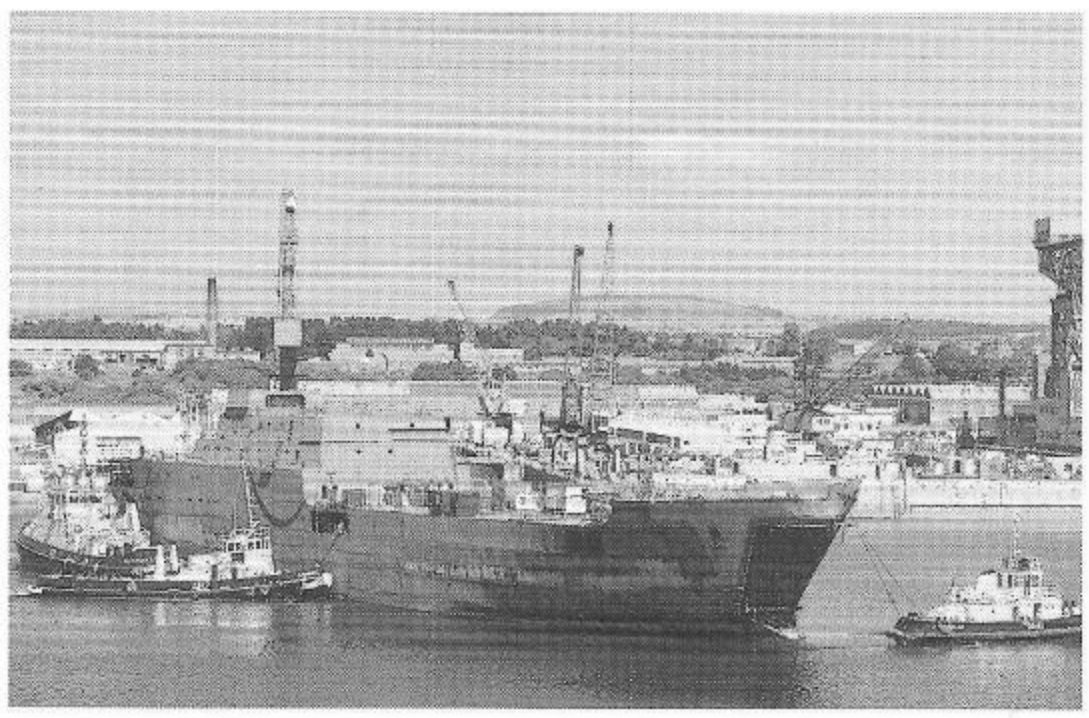
THE FUTURE

The SLEP gives *Sir Bedivere* an additional 15 years operational life, which will enable it to run on to 2011, at least.

If *Sir Geraint* and *Sir Percivale* are not SLEPed, however, their life expectancy cannot be more than 3 to 4 years, at most, which would result in both ships and *Sir Tristram* reaching the end of their operational lives at much the same time.



Sir Bedivere *cut in two in preparation for the insertion of the 13 m (42.65 ft) 'plug', allowing the size of the tank deck to be seen*



Sir Bedivere *was temporarily floated out of the dry-dock mid-way through the SLEP. Note that the clamshell bow doors are unchanged and that the flight deck has been lowered by one deck level*

TOBRUK (UK LSL)

GENERAL SPECIFICATIONS

Country of Origin: United Kingdom
Operator: Australia
Type: Heavy Lift Ship

Class: TOBRUK

Built: 1
Active: 1

Displacement:
standard: 3,300 t
full load: 5,700 t

Dimensions
Length: 127 m (417 ft)
Beam: 18.3 m (60 ft)
Draught: 4.9 m (16 ft)

Speed: 18 kts
Range: 8,000 n miles at 15 kts

Complement: 60 including 13 officers

SHIPS

TOBRUK (L 50)
Builder Carrington Slipways Pty, Tomago, Australia
Laid down 7 Feb 1978
Launched 1 Mar 1980
Commissioned 23 Apr 1981

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 350-500 troops
- Cargo: 1,300 tonnes
- Tanks: can embark a squadron of Leopard tanks (12-15 tanks) plus a number of wheeled vehicles and artillery, in addition to its troop lift

SHIP-SHORE LIFT

- Two LCVPs in davits
- Two LCM 8 carried on deck

AVIATION FACILITIES

Specifications
Flight deck: There is a large flight deck aft. There are two landing spots on the vehicle deck
Hangar: None
Helicopters: Up to 4 Sea Kings

AMPHIBIOUS FACILITIES

- Clamshell-type bow doors with vertical hinges
- Bow and stern ramps
- Fitted for side-carrying two NLE pontoons
- 70 tonne capacity derrick forward of the bridge
- Two 4.25 tonne cranes at forward end of vehicle deck

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60
There are two Bofors 40 mm/60 mountings on the forecastle

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s); 850 m/s (2,789 ft/s)
Ammunition: 2.4 kg (5.3 lb) (HCHE, PFHE), 2.5 kg (5.5 lb) (HE-T)

Range:
anti-surface: 5.25 n miles (9.8 km)
anti-air: 7,100 m (23,294 ft)
Rate of fire: 60 rds/min (practical)
Ammunition: 2.21 kg (4.9 lb)

Mounting
Traverse: 360° at 35°/s
Elevation: −5 to +90° at 45°/s
Crew: 3

M2HB 12.7 mm machine guns
Two M2HB are carried. M2HB is a selective short recoil automatic operation air-cooled weapon with a 1,143 mm (45 in) long barrel and eight right-hand grooves turning once every 381 mm (15 in).

Specifications
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

Tobruk *(L 50) was built in Australia and commissioned in 1981. It is basically similar to the British original, but with a massive 70 tonne derrick before the bridge* (RAN)

COMMAND AND CONTROL SYSTEMS

RADARS

Kelvin Hughes Type 1006

Specifications
Type 1006
Role: Surface search
Frequency: I-band (approximately 9,445 MHz)
Beam: 1 × 18°/0.75 × 18°
Peak power: 25 kW
Gain: 31 dB/34 dB
Pulsewidth: 0.8 or 0.25 µs/0.75 µs
PRF: 1,600/800 pps
Scan rate: 24 rpm
Typical range: 64 n miles

Manufacturer/Contractor
Kelvin Hughes Ltd, Hainault, Essex, UK.

Racal-Decca RM 916

The navigation radar is a Racal-Decca RM 916, which is one of the Transar series of radars, using 30 or 41 cm (11.8 or 16 in) displays and 1.83 or 2.7 m (6.0 or 8.9 ft) antennas. It operates in the I-band.

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Mirrlees Blackstone KDMR8 diesels, 7.2 MW (9,600 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

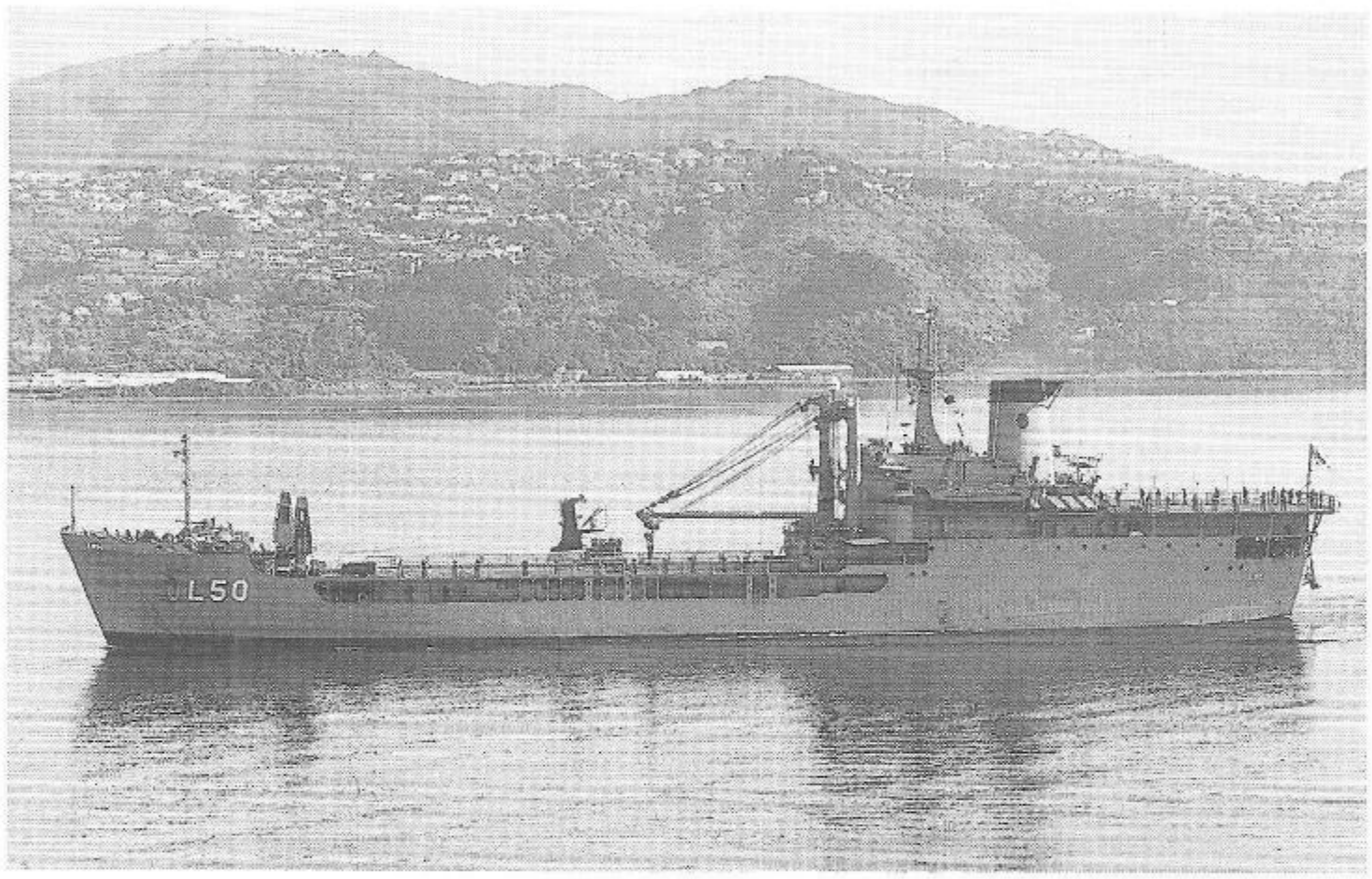
Tobruk was built in Australia some ten years after the British LSLs and the design was updated and modified slightly to meet Australian requirements. The major differences in the Australian ship are that it has a 70 tonne capacity derrick at the after end of the vehicle deck and it carries two LCVPs and two LCMs.

The ship also has minor hospital facilities.

THE FUTURE

Tobruk is due to be stricken in 1997, when it will be replaced by the two 'Newport' class LSTs purchased from the USA in 1994. Although these ships are larger and more capable than *Tobruk,* they are actually ten years older, but it is hoped to recoup some of the cost of acquiring and converting them by selling *Tobruk.*

Purchase of *Tobruk* has been given active consideration by the UK Royal Navy, as an alternative to refurbishing *Sir Geraint* or *Sir Percivale*. New Zealand and Singapore are also believed to have expressed interest in the ship.



The Australian LSL, Tobruk *(L 50), is due to be sold in 1997, with New Zealand, Singapore and the UK having shown interest* (H & L van Ginderen Collection)

SIR GALAHAD (ii)

GENERAL SPECIFICATIONS

Operator: United Kingdom

Class: SIR GALAHAD (II) (LSL)

Built: 1
Active: 1

Displacement:
deadweight: 3,055 t
full load: 8,585 t

Dimensions
Length: 140.5 m (461 ft)
Beam: 19.5 m (64 ft)
Draught: 4.3 m (14.1 ft)

Speed: 18 kts
Range: 13,000 n miles at 15 kts

Complement: 53

SHIPS

SIR GALAHAD (ii) (L 3005)
Builder Swan Hunter Shipbuilders, Wallsend-on-Tyne, UK

Laid down 12 May 1985
Launched 13 Dec 1986
Commissioned 25 Nov 1987

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops
- normal: 339
- hard lying: 524
- Main battle tanks: 18
- Vehicles: 20—4 tonne equivalents
- Ammunition
- Fuel
- Military stores

SHIP-SHORE LIFT

- Maximum of four MEXEFLOTE can be carried on the side of the ship.

AVIATION FACILITIES

Specifications
Flight deck: Large flight deck aft. One helicopter spot on vehicle deck
Hangar: None
Helicopter: 1 Westland Sea King HC 4

AMPHIBIOUS FACILITIES

- Bow and stern ramps, with a visor bow gate.
- One 25 tonne and three 8.6 tonne cranes.
- Internal ramp between tank deck and vehicle deck.

Sir Galahad (ii) *(L 3005) which was built to replace the ship of the same name, which was sunk after being severely damaged in the Falklands War. The new ship has a number of differences from the original design: it is longer, has a vertically opening bow door and a gantry-type mast* (Swan Hunter)

WEAPONS SYSTEMS

GUNS

Two Oerlikon 20 mm in GAM-BO3 mountings

The KAA gun is a single barrel, gas-operated, air-cooled, link-belt fed weapon with feeding from either side. The 1.856 m (6.0 ft) long barrel is of monobloc construction with cooling ribs and a muzzle brake. It weighs 28 kg (61.7 lb) and has 12 grooves with a right-hand angle rifling to 6.5° extending 1.7 m (5.6 ft). The complete weapon is 2.668 m (8.75 ft) long and weighs 90 kg (198 lb).

The GAM mounting is an unpowered light, compact design for use in a wide variety of vessels, but especially those involved in patrol operations. It is of the swivel fork type with the sidewalls having the trunnion bearings. The cradle is made of light alloy and the weapon's working parts are enclosed in a protective case whose top opens to ease maintenance and installation. The sight, shoulder rests and back support strap are all attached to the sight bracket which is adjustable for height. Usually these mountings have the RC35 optical ring sight but they can be fitted with the SLC 001 lightweight lead computing sight.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,150 m/s (3,445-3,773 ft/s)
Range
anti-surface: 1.7 km
anti-air: 1,700 m (5,577 ft)
Rate of fire: 900 m/s (2,953 ft/s)
Round weight: 320-345 g
Projectile: 110-125 g

Two 12.7 mm machine guns

The M2HB is a selective short recoil automatic operation air-cooled weapon with a 1,143 mm (45 in) long barrel and eight right-hand grooves turning once every 381 mm (15 in). Muzzle energy is 1,867 mkp and the weapon uses 110-round belts.

Specifications
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

ELECTRONIC WARFARE SYSTEMS

DECOYS

Plessey Shield Tactical Decoy System

There are two Plessey Shield 12-barrelled decoy launchers for chaff. Shield is a microprocessor-controlled, fully automatic missile decoy system, which is designed to provide effective protection for various sizes of ship, including fast attack craft, corvettes, frigates and destroyers. On detecting a threat, Shield selects the most appropriate response from up to six million scenarios held in its EPROM memory, using data obtained from onboard sensors such as radar and ESM and then automatically deploys the pattern of decoys that will give the highest probability of success. GEC-Marconi chaff rockets are fitted with a variable fuze which allows the chaff to be dispersed at optimum positions along the trajectory. To counter threats with a dual-mode capability, both chaff and infra-red decoys can be deployed automatically. Shield offers four protection modes — confusion; distraction; seduction/breaklock; and seduction dump — and uses two types of decoy — chaff and infra-red — which may be used on their own, or in combination with each other.

The munition is the N8 rocket, which has a 7.5 kg (16.5 lb) payload of customised chaff to give equal performance against both horizontally and vertically polarised radars. The fuze is set electronically immediately before firing for the optimum chaff cloud. There is also an N5 Broad Band Chaff (BBC) rocket with a manually set fuze.

Chaff rockets carry an 8.5 kg (18.7 lb) payload and chaff deployment takes place at ranges of 50-2,500 m (164-8,202 ft) (with 0.25 second and 16 second fuze settings respectively) at a height of about 100 m (328 ft). The N6 IR round, which operates on the mortar principle, has seven submunitions which are deployed progressively further from the ship, beginning at a distance of 50-200 m (164-656 ft) and lasting for 1-15 seconds. These submunitions operate in the 3-5 µm and 8-13 µm bands.

Manufacturer/Contractor

GEC-Marconi Naval Systems, Addlestone, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Racal-Decca CANE data automation (Outfit DEB-1)

CANE is a fully distributed command and control system with stand-alone workstations, which evolved from the integration of navigation equipment; hence the name, Command And Navigation Equipment (CANE). CANE has a single-bus architecture, using a control application processor with intelligent input-output nodes, and using Coral 66 software language for all application codes, with Assembler code for device drivers. The system is based upon software-driven workstations (Tactical Command Consoles (TCC)), which can be augmented by an Automatic Chart Table and/or an Automatic Plotter. Multiconsole systems are linked by a fully deterministic, dual-redundant network based upon a Military Standard 1553B databus with the selection and degree of redundancy chosen by the customer.

Each TCC features a DS500 16-bit RISC (Reduced Instruction Set to Computer) processor with a typical memory of 1 Mbyte. Intelligent input-output is performed using VME-based subsystems with Motorola 68000 family processors. The PPI displays the raw radar data which can be combined with computer-generated synthetic video tactical, track, zone and navigation data together with multiple totes. CANE consoles include multiple radar tracking facilities involving primary and secondary returns.

Manufacturer/Contractor

Racal-Decca, UK.

RADAR

Kelvin Hughes Type 1007

The Type 1007 is the standard I-band navigation radar of the UK Royal Navy.

Specifications

Type 1007
Role: Surface search
Frequency: I-band (9,410 MHz)
Beam: 1.0 × 18°/0.75 × 18°
Peak power: 25 kW
Gain: 31/33 dB
Pulsewidth: 0.08/0.3/0.8 µs
PRF: 1,600/800/400 pps
Scan rate: 26 rpm
Range: 96 n miles

Manufacturer/Contractor

Kelvin Hughes Ltd, Hainault, Essex, UK.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Mirrlees Blackstone KMG Major diesels, 9.8 MW (13,130 hp)
Shafts: 2
Propellers: 2, controllable pitch

FURTHER INFORMATION

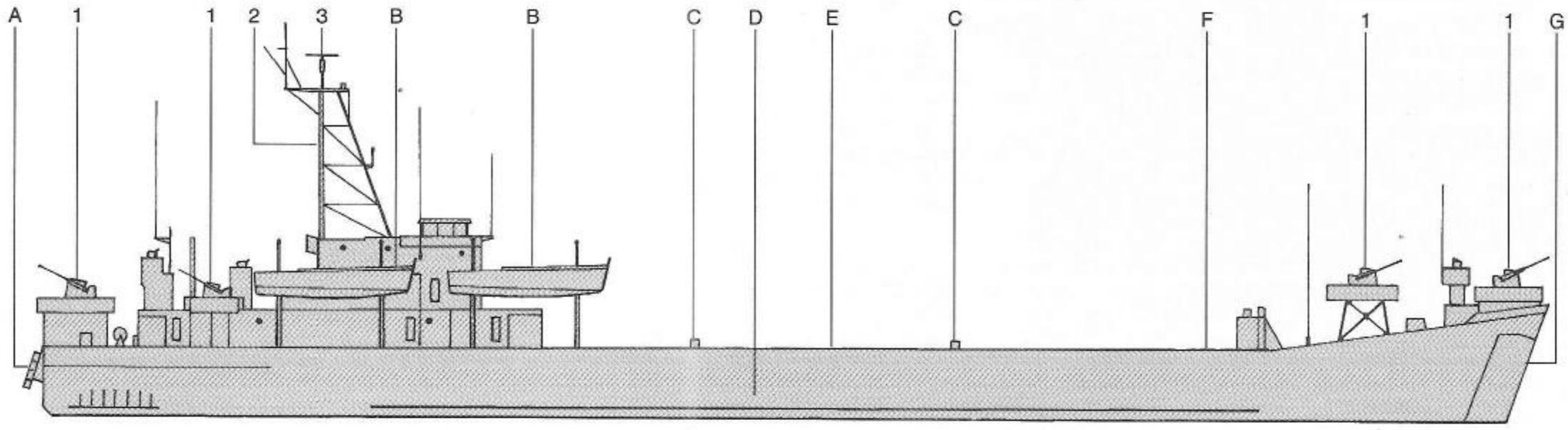
Sir Galahad (ii) (L 3005) was built as a replacement for the previous ship with the same name and pennant number, which was sunk as a war grave after incurring irreparable damage at Bluff Cove during the Falklands War of 1982. Because the new ship was built using special funds devoted to making good Falklands War losses the ship is a larger and more sophisticated ship than its predecessor.

Sir Galahad *carrying an army unit. Note the 105 mm light guns and Land Rovers on the vehicle deck and the MEXEFLOTE secured to the ship's side* (MoD UK)

The bow door on Sir Galahad *is unique among the LSLs* (Swan Hunter)

LST 1-1152 CLASS

OVERVIEW



LST 1-1152
Amphibious A *Kedge anchor* **B** *LCVP* **C** *Tank deck ventilation shafts* **D** *Tank deck* **E** *Vehicle deck* **F** *Elevator (LCT 1-541) or ramp (LCT 542-1152)* **G** *Clamshell doors with internal ramp*

General 1 *40 mm cannon* **2** *Tripod mast* **3** *Navigation-radar*
Note: There are many minor variations in weapons, number of davits, etc. This shows a typical LST 1-1152

A total of 1,052 tank landing ships (LSTs) was built between 1942 and 1945, all of them constructed in a rush, to a design that was intended to last for four years at most, with many built by companies with little or no experience of warship construction. This may seem an unpromising recipe for longevity, but over 60 remain in naval service in 1996 and there are others on civil registers, while many later designs are mere updates of the original LST.

The design of the LST had its origins in a British request to the United States early in the Second World War for a vessel capable of carrying some 20 tanks, each weighing 25 tonnes (then the weight of a main battle tank) from the US across the Atlantic and delivering them across a beach direct to a combat zone. The resulting design was prepared in a hurry and the ships were built in a host of small yards across the USA between 1942 and 1945. LST 294, for example, was constructed by the American Bridge Corporation at Ambridge, Pennsylvania, and was laid down on 11 September 1944, launched on 29 October 1944 and entered service on 8 January 1944, just 76 days later. The ship is still in service in 1997 as the Royal Thai Navy's *Aungthong* (711).

The type served in the US and allied navies during the Second World War and took part in the D-day landings in France while, in the Pacific, it was at the heart of all landings from 1943 onwards. It went on to serve in reducing numbers in the US Navy until the early 1970s.

NUMBERS AND SUB-CLASSES

1,152 LSTs were ordered for the US Navy during the Second World War, but only 1,052 were delivered, the missing 100 being accounted for by wartime cancellations: LST 85-116, 142-156, 182-196, 232-236, 248-260 and 296-300. Others in the main series never saw service as tank landing ships, but were converted during the completion stage of their construction for other duties, such as repair ships. Surprisingly, despite their front-line role, only 41 were lost during the war.

They all used essentially the same hull and engine design, although, with such a large class being built in many small yards, there were inevitable variations in equipment and armament. Officially, the most significant changes were introduced from LST 542 onwards, and the type is either designated collectively as the LST 1-1152 class, or separately as the LST 1-541 and LST 542-1152 classes.

Immediately after the war a large number of the LSTs were transferred to the reserve, and many were scrapped, though some returned to active service during the Korean War. The 158 remaining in the US Navy List on 1 July 1955 were given County or Parish names; although the unarmed 36 in the US-run but Japanese-manned Military Sea Transportation Service were not named.

Many LSTs were passed on to friendly governments, although in China and Vietnam some were captured from the original recipients. The Chinese and Vietnamese navies run LSTs to this day, as do 11 other navies.

DESIGN

The LST was a most important design, being the first amphibious warfare ship to employ the now-classic features of clamshell bow doors, cavernous tank deck, additional carrying capacity on the upper deck, and small island superstructure aft. The differences between the two groups were not great, the second group having a heavier battery, a 4,000 gallon per day water distillation plant, and other additions. These resulted in an increase in the deadweight of 133 t, reducing the payload for landing operations by a similar amount and on ocean-going voyages by 300 t. Another difference between earlier and later ships, but which was, in fact, introduced from LST 513 (with the sole exception of LST 531) was that the elevator between the main and tank decks was replaced by a ramp.

The upper deck could carry a maximum load of 350 t, consisting of trucks with a maximum individual weight of 10 t, or LVTs (landing vehicles, tracked) although these had to be mounted on baulks of timber to spread the load. Alternatively, a single LCT (landing craft, tank) Mk 5 or Mk 6 could be carried, either complete or in sections. In addition, a number of LCVPs (landing craft, vehicle/personnel) were carried on davits. Originally two davits were fitted but later this was increased to six, which required an increase of two officers and 16 men in the crew and a corresponding decrease in the numbers of passengers. Early experience showed that when an LCT Mk 5 or Mk 6 was carried on the main deck it was impossible to see forward from the bridge, so later ships had a raised conning position above the original pilot house.

The tank deck was 87.8 m (288 ft) long and 9.1 m (30 ft) wide, with an entrance 4.27 m (14 ft) high and 4.27 m (14 ft) wide, although the limiting height in the tank deck was 3.43 m (11 ft 3 in). This was designed to accommodate the heaviest tanks then known — the 25 tonne Sherman — although 40 tonne tanks were regularly carried later. The upper deck was accessed by an elevator 7.24 m (23.75 ft) long and 4.27 m (14 ft) wide in LST 1-512 or by a ramp (LST 513-1152).

The ship could unload over beaches with a gradient of 1:50 or could use sectional pontoons to form a causeway. These were carried lashed to the sides of the ship.

The only serious complaint against these ships was that they were too slow, rarely reaching their design speed of 10 knots, which gave rise to their ironic nickname of 'Large, Slow Targets'. On the other hand, their considerable cargo carrying capacity, voluminous hold, ability to beach where necessary and low operating costs have made the LSTs very popular with many navies and civil users, although the type has long since passed out of use with the US Navy.

In service in January 1997:

China	11	plus others in reserve and merchant service
Ecuador	1	
Greece	4	
Indonesia	1	plus 3 in reserve, 2 with Military Sealift Command
	1	Modified LST built 1961
South Korea	7	
Malaysia	2	
Mexico	3	
Philippines	7	
Singapore	2	
Taiwan	13	
	1	Converted to amphibious command ship
Thailand	5	
Turkey	2	Also used as minelayers
Vietnam	3	
Total	**63**	

SHAN (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: China
Type: LST 1-1152

Class: SHAN

Active: 11
Reserve: 2 (at least)

Displacement

	LST 1-541	LST 542-1152
Standard	1,490 t	1,623 t
Beaching	2,160 t	2,160 t
Sea-going	4,080 t	4,080 t

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 11 kts
Range: 15,000 n miles at 9 kts

Complement: 115

SHIPS

SHAN 351
SHAN 355
SHAN 901
SHAN 902
SHAN 921
SHAN 922
SHAN 923
SHAN 924
SHAN 903
SHAN 905
SHAN 906
SHAN 925
SHAN 926

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total Payload

	LST 1-541	LST 542-1152
Beaching	599 t	377 t
Ocean-going	2,100 t	1,900 t

SHIP-SHORE LIFT

- LCVPs: two, four or six, depending on number of davits fitted

AVIATION FACILITIES

- Helicopter can land on foredeck, if it is not occupied by vehicles or landing craft

AMPHIBIOUS FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 87.8 × 91 m (288 × 30 ft)
- Upper (vehicle) deck:
  area — 500 m²
  maximum total load — 350 tons
  maximum individual load — 10 tons
- Access to upper deck:
  LST 1-512 — elevator: 7.24 × 4.27 m (23.75 × 14 ft)
  LST 513-1152 — ramp: 4.27 m (14 ft) wide
- Pontoons: two lashed to ship's sides

WEAPONS SYSTEMS

GUNS

US Navy 76 mm (3 in/50 calibre) guns

There are two single, open mountings, both aft.

Specifications
Gun
Calibre: 76.2 mm (3 in)
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,730 ft/s) (new); 808 m/s (2,651 ft/s) (mid-life)
Range: 7 n miles (13 km)
Altitude: 8,951 m (29,366 ft)
Ammunition: 10.9 kg (24.0 lb)

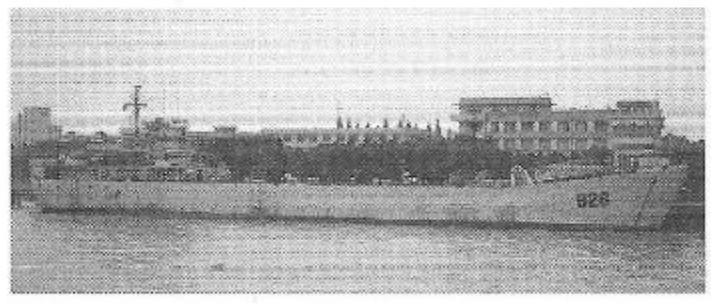
Mk 33 Mounting
Traverse: 360° at 30°/s
Elevation: −14/15 to +85° at 24°/s
Rate of fire: 100 rds/min

37 mm (W-11-M) Mountings

All ships carry Chinese 37 mm gun mountings in single and twin mountings. The number and location of the mountings varies between ships, although all seem to have a single mount in the extremity of the bow. This 62.8 calibre weapon has a flash suppressor and the barrels are enclosed in separate water jackets with exposed spring recuperators, and a hydraulic recoil buffer underneath the barrel. The loading mechanism consists of guides for ammunition, which is in five-round clips, the clips being automatically removed on the loading tray.

Specifications
W-11-M
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 886 m/s (2,907 ft/s)
Traverse: 360° at 17°/s
Elevation: −10 to +85° at 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition:
projectile: 0.732 kg (1.6 lb)
complete round: 1.42 kg (3.1 lb)
Range, anti-surface: 2 n miles (4 km)
Air defence: 3,000 m (9,842 ft)
Crew: 3

Ammunition (HE-T)
Projectile Weight: 708 g



'Shan' class LST 926 of the PLAN. All Chinese 'Shan' class ships were supplied by the US Navy to the Chinese Nationalists in 1945-49 and captured by the Communists in the civil war (Paul Beaver)

Explosive charge: 36 g (RDX/aluminium)
Muzzle velocity: 886 m/s (2,907 ft/s)

Rocket launchers

Some are reported to be armed with rocket launchers, but the type has not been identified.

MINES

All are capable of laying mines.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 12-567A diesels, 1.32 MW (1,800 hp)
Shafts: 2

FURTHER INFORMATION

Reports suggest that at least 20 former US LSTs are in Chinese Navy service, with a further 11 in merchant service. Former US LSTs positively identified include the 1-541 series vessels LST 355 and LST 406, and the 542-1152 series vessels LST 589, LST 804, LST 805 and LST 1027, but there could be many more. Two LSTs were transferred to North Vietnam for use as tankers, while others are in the Chinese merchant service or are used as tenders. Shan is Chinese for 'mountain'.

DEPLOYMENT

Five (901-3, 905-6) are in the North Sea Fleet at Luda; six (921-6) in the East Sea Fleet at Shanghai; and two (351, 355) are in the South Sea Fleet at Guangzhou. Two of this total are in reserve.

HUALCOPO (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Ecuador
Type: LST 1-1152

Class: HUALCOPO

Purchased: 1
Active: 1

Displacement:
standard: 1,679 t
full load: 4,145 t

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 11.6 kts
Range: 7,200 n miles at 10 kts

Complement: 119

SHIPS

HUALCOPO (TR61)

Builder	Chicago Bridge and Iron Co, Seneca, Illinois, USA	**Commissioned (US Navy)**	9 Jun 1945 ((LST 1146), later named *Summit County*)
		Transferred to reserve	16 Mar 1970
		Sold (Ecuador)	14 Feb 1977
		Recommissioned (Ecuador Navy)	Nov 1977

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200
- Tanks: 10-30, depending on size
- Total payload:
  Beaching — 377 tonnes
  Ocean-going — 1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: two

AVIATION FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 98.8 × 91 m (288 × 30 ft)
- Upper (vehicle), deck:
  area — 500 m²
  maximum total load — 350 tonnes
  maximum individual load — 10 tonnes
- Access to upper deck:

Pontoons: two lashed to ship's sides

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

Eight Bofors 40 mm/60, in two twin mountings and four single mountings.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s) (new gun); 850 m/s (2,789 ft/s (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,637 ft)
Rate of fire: 80 rds/min (practical); 160 rds/min: (cyclic) for water-cooled weapons
Ammunition: 2.21 kg (4.9 lb)

Mountings
Traverse: nominal 360° at 30°/s
Elevation: −15 to 85/90° at 24°/s
Crew:
twin mount: 4
quad mount: 11

Two Oerlikon 20 mm

There are two Oerlikon 20 mm cannon.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°
Traverse: 360°

Hualcopo *(TR 61). This was among the very last of the US Navy LST 1-1152 class to be completed and was originally intended for operations in the Arctic. The ice strengthening can be seen at the front of the bow doors and along the sides*

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 12-567A diesels, 1.32 MW (1,800 hp)
Shafts: 2

FURTHER INFORMATION

This ship served in a US Navy Arctic programme in the 1950s for which it was fitted with a strengthened bow; presumably it is still fitted. The Ecuadorean Navy is understood to have plans for a replacement, but no details have been announced.

SIROS (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Greece
Type: LST 1-1152

Class: SIROS

Purchased: 4
Active: 4

Displacement:
standard: 1,679 t
full load: 4,145 t

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 11.6 kts
Range: 9,500 n miles at 9 kts

Complement: 93 including eight officers

SHIPS

Class 1-541

SIROS (L 144)
Builder Philadelphia Navy Yard, Philadelphia, USA
Commissioned (US Navy) 1 Feb 1943 (LST 325)
Transferred (Greece) 29 May 1964

RODOS (L 157)
Builder Newport News Shipbuilding, Newport News, Virginia
Commissioned (US Navy) 3 Dec 1942 ((LST 391), later named *Bowman County*)
Transferred (Greece) 9 Aug 1960

Class 542-1152

IKARIA (L 154)
Builder American Bridge Co, Ambridge, Pennsylvania, USA
Commissioned (US Navy) 14 Mar 1945 ((LST 1086), later named *Potter County*)
Transferred (Greece) 9 Aug 1960

KRITI (L 171)
Builder Bethlehem Steel Co, Hingham
Commissioned (US Navy) 1 May 1945 ((LST 1076), later named *Page County*)
Transferred (Greece) Mar 1971
Sold (Greece) 11 Jul 1978

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total payload:

	LST 1-541	LST 542-1152
Beaching	500 tonnes	377 tonnes
Ocean-going	2,100 tonnes	1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: two, four or six, depending on number of davits fitted

AVIATION FACILITIES

- Helicopter can land on foredeck, if not occupied by vehicles or landing craft

AMPHIBIOUS FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 87.8 × 91 m (288 × 30 ft)
- Upper (vehicle) deck:
  area — 500 m²
  maximum total load — 350 tonnes
  maximum individual load — 10 tonnes
- Access to upper deck:
  LST 1-512 — elevator: 7.24 × 4.27 m (23.75 × 14 ft)
  LST 513-1152 — ramp: 4.27 m (14 ft) wide
- Pontoons: two lashed to ship's sides

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

***Siros, Ikaria, Kriti* only.** Eight Bofors 40 mm/60 in two twin and four single mountings.
***Rodos* only.** Six single, two twin Bofors 40mm/60.

Specifications

Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s) (new gun); 850 m/s (2,789 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,637 ft)

Rate of fire: 80 rds/min, (practical); 160 rds/min, (cyclic) for water-cooled weapons
Ammunition: 2.21 kg (4.9 lb)

Mountings
Traverse: Nominal 360° at 30°/s
Elevation: −15 to 85/90° at 24°/s
Crew:
twin mount: 4
quad mount: 11

Four Oerlikon 20 mm/two Rheinmetall 20 mm S 20

These LSTs are also armed with either four Oerlikon 20 mm or two Rheinmetall Rh-202 cannon.

	Oerlikon 20 mm	Rheinmetall Rh-202
Calibre	20 mm	20 mm
Length of barrel	70 calibres	85 calibres
Muzzle velocity	835 m/s (2,739 ft/s)	1,050-1,250 m/s (3,445-4,101 ft/s)
Range		
anti-surface	1.5 km	1 n miles (2,000 m)
anti-air	1,150 m (3,800 ft)	
Rate of fire	450 rds/min	800-1,000 rds/min
Round weight	241 g	241 g
Projectile	122 g	122 g
Elevation	−15 to +55°	−10 to +55°
Traverse	360°	360°

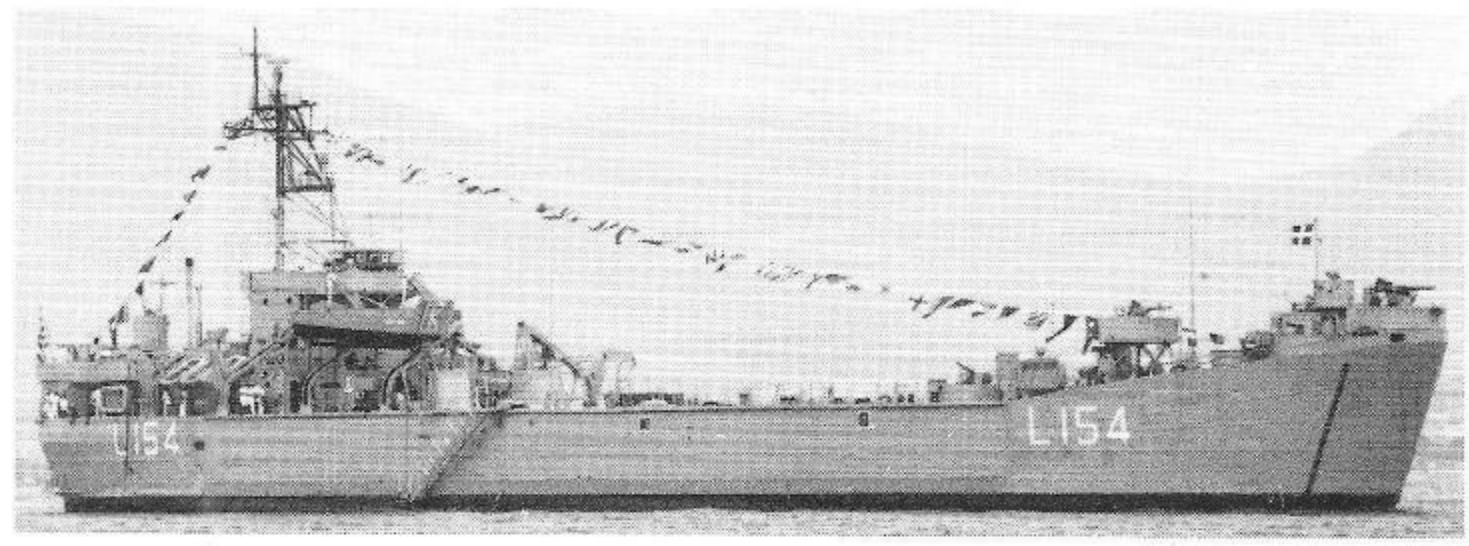
COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca radar
There is one Racal-Decca navigation radar, model not known.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 12-567A diesels, 1.32 MW (1,800 hp)
Shafts: 2



Ikaria *(L 154), the former* Potter County *(LST 1086), which transferred to the Hellenic Navy in 1960* (H & L van Ginderen Collection)

FURTHER INFORMATION

The Greek Navy has received a total of nine LSTs from the US Navy. Four were supplied in 1944 under Lease-Lend. These were followed by three LST 1541 class ships and two LST 542-1152 class.

The intention is that these ships should be replaced by the 'Jason' class, but the slow delivery of the Jasons suggests these old ships may have some life left in them.

US Navy (See Note 1)	Greek Navy	Date of transfer	Fate
LST 33	*Lesvos*	1944	Sunk, Bizerta, 1944
LST 35	*Lemnos*	1944	Stricken 1977
LST 36	*Samos*	1944	Stricken 1977
LST 37	*Khios*	1944	Stricken 1977
LST 325	*Syros* (L 144)	26 May 1964	Extant 1996
LST 389 *(Boone County)*	*Lesbos* (L 172)	9 Aug 1960	Stricken 1994
LST 391 *(Bowman County)*	*Rodos* (L 157)	9 Aug 1960	Extant 1996
LST 1076 *(Page County)*	*Kriti* (L 171)	Mar 1971 (Purchased 1978)	Extant 1996
LST 1086 *(Potter County)*	*Ikaria* (L 154)	9 Aug 1960	Extant 1966

Note
1. Some US Navy LSTs were given names.

TELUK BONE (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Indonesia
Type: LST 1-1152

Class: TELUK BONE

Acquired: 10
Active: 1

Displacement:
standard: 1,679 t
full load: 4,145 t

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 11.6 kts
Range: 11,000 n miles at 10 kts

Complement: 119

SHIPS

TELUK BONE (511)

Builder	American Bridge Co, Ambridge, Pennsylvania, USA
Commissioned (US Navy)	6 Dec 1944 ((LST 839), later named *Iredell County)*
Transferred (Indonesia)	Jun 1961
Purchased (Indonesia)	22 Feb 1979

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total payload:
  Beaching — 377 tonnes
  Ocean-going — 1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: two

AVIATION FACILITIES

- Helicopter can land on foredeck, if not occupied by vehicles or landing craft

AMPHIBIOUS FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 87.8 × 91 m (288 × 30 ft)
- Upper (vehicle) deck:
  area — 500 m²
  maximum total load — 350 tonnes
  maximum individual load — 10 tonnes
- Access to upper deck:
  LST 513-1152 — ramp: 4.27 m (14 ft) wide
- Pontoons: two lashed to ship's sides

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

Normal armament is seven Bofors 40 mm/60 in two twin mountings and three single mountings.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s)(new gun); 850 m/s (2,789 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,637 ft)
Rate of fire: 80 rds/min, (practical); 160 rds/min, (cyclic) for water-cooled weapons
Ammunition: 2.21 kg (4.9 lb)
Mountings
Traverse: Nominal 360° at 30° /s
Elevation: −15 to 85/90° at 24°/s
Crew:
twin mount: 4
quad mount: 11

COMMAND AND CONTROL SYSTEMS

RADAR

AN/SPS-53

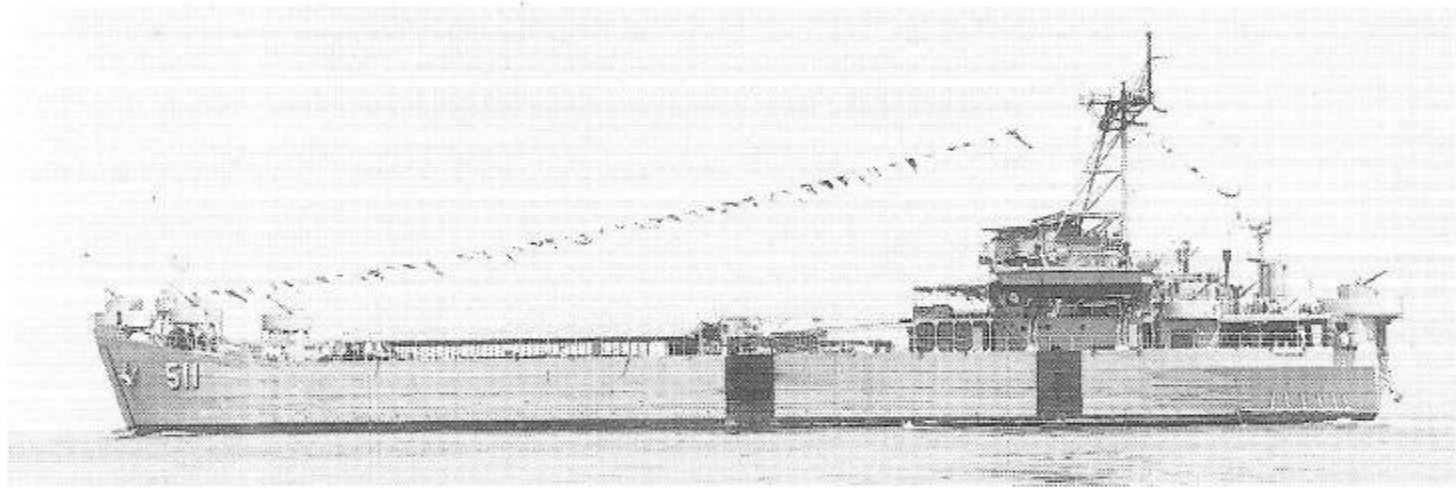
AN/SPS-53 is a Raytheon, I-band, high-resolution search radar which employs a 1.5 m (5.0 ft) slotted array antenna. SPS-53 radars are now to be found only in a few, mainly elderly, warships.

Specifications
AN/SPS-53E
Role: Surface search
Frequency: I band
Beam: 1.6 × 20°
Peak power: 40 kW
Gain: 30 dB
Pulsewidth: 0.5/1.0 µs
PRF: 750/1,500 pps
Scan rate: 15 rpm

Manufacturer/Contractor
Raytheon, USA.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 12-567A diesels, 1.32 MW (1,800 hp)
Shafts: 2



Teluk Bone *(511), believed to be the last of the ex-US Navy LSTs still in service with the Indonesian Navy* (H & L van Ginderen Collection)

FURTHER INFORMATION

Indonesia has a particular requirement for amphibious vessels with a national territory composed entirely of islands and stretching over a vast distance. It has operated a fleet of ex-US Navy LSTs for many years, some being naval vessels and others being operated by the Indonesian Military Sealift Command. Most of these were obtained direct from the USA, but others have come from a number of sources, including one from the Liberian civil register:

These elderly and hard-used ships were in urgent need of replacement, which is why the Indonesians were so keen to buy the entire fleet of ex-DDR 'Frosch' class LSTs. With the arrival in Indonesia of the 'Frosch I' class from Germany, six of the ex-US Navy LSTs were deleted in 1995/96, although four of them are reported to be in reserve and being used as stores until they are scrapped.

USN No	Commissioned	Indonesian name	Transfer	Notes
LST 1128	9 Mar 1945	*Teluk Langsa* (501)		In reserve 1996
LST 616	29 May 1944	*Teluk Bajur* (502)	Jun 1961	Operated by Military Sealift Command
LST 652	1 Jan 1945	*Teluk Kau* (504)		In reserve 1996
LST 356 *(Bledsoe County)*	22 Dec 1942	*Teluk Tomini* (508)		1. Ex-merchant vessel. 2. Operated by Military Sealift Command
LST 678	30 Jun 1944	*Teluk Ratai* (509)		1. Ex-Liberian MV *Inagua Shipper.* 2. In reserve 1996
LST 839 *(Iredell County)*	6 Dec 1944	*Teluk Bone* (511)	Jun 1961	In service 1996
LST 657		*Teluk Manado* (505)	Mar 1960	Stricken 1983
LST 887 *(Lawrence County)*		*Tanjung Nusanie*		Stricken 1974
LST 1090		*Tanjong Radjah*		Stricken 1966
LST 601 *(Clark County)*	25 Mar 1944	*Teluk Saleh* (510)	Jun 1961	In reserve 1996

TELUK AMBOINA (MODIFIED LST 1-1152)

GENERAL SPECIFICATION

Country of Origin: USA
Country of Construction: Japan
Operator: Indonesia
Type: Modified LST 1-1152

Class: TELUK AMBOINA

Purchased: 1
Active: 1

Displacement:
standard: 2,416 t
full load: 4,267 t

Dimensions:
Length: 99.7 m (327 ft)
Beam: 15.3 m (50 ft)
Draught: 4.6 m (15 ft)

Speed: 13.1 kts
Range: 4,000 n miles at 13.1 kts

Complement: 88

SHIPS

TELUK AMBOINA (503)
Builder Sasebo Heavy Industries, Japan

Launched 17 Mar 1961
Commissioned Jun 1961

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total payload:
  Beaching — 377 tonnes
  Ocean-going — 1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: four

AVIATION FACILITIES

- Helicopter can land on foredeck, if not occupied by vehicles or landing craft

AMPHIBIOUS FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 87.8 × 91 m (288 × 30 ft)
- Upper (vehicle) deck:
  area — 500 m²
  maximum total load — 350 tonnes
  maximum individual load — 10 tonnes
- Access to upper deck:
  LST 513-1152 — ramp: 4.27 m (14 ft) wide
- Pontoons: two lashed to ship's sides
- Crane: 30 tonne capacity

WEAPONS SYSTEMS

GUNS

Six 37 mm/63 guns

Russian-designed 70K and W-11-M guns and mountings have been installed in several Indonesian LSTs in recent years. The 37 mm/ 62.8 calibre weapon is an air-cooled, single mounting with an enclosed spring recuperator, while in the twin mounting the barrels are enclosed in separate water jackets with exposed spring recuperators.

Specifications
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 880 m/s (2,887 ft/s)
Traverse: 360°
Elevation: −10 to +85°
Traverse speed: 20°/s
Elevation speed: 15°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.6 lb)

Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,842 ft)
Crew: 6

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MAN V6V 22/30 diesels, 2.52 MW (3,425 hp)
Shafts: 2

FURTHER INFORMATION

Teluk Amboina was built in Japan as war reparations for Indonesia and was launched in 1961. It is an almost identical copy of the US Navy LST 542 type, but with minor differences in dimensions and displacement, and with more powerful engines, although with only marginal improvement in performance. A 30-tonnes crane has been installed forward of the bridge. After some years of service with the navy it now serves with the Military Sealift Command, but would be available to the navy in war.

Teluk Amboina *(503) was built in Japan in 1960-61 as war reparations and is virtually identical with the US LST 542-1152 design, but with improved engines* (H & L van Ginderen Collection)

BI BONG (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Republic of Korea

Class: 1-541 and 542-1152 LST

Active: 7

Displacement:
standard: 1,679 t
full load: 4,145 t

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 11.6 kts
Complement: 80

SHIPS

Class 1-541

BI BONG (LST 673)
Launched 20 Jul 1943
Commissioned (US Navy) 12 Aug 1943 (LST 218)
Transferred (South Korea) May 1955
Purchased (South Korea) 15 Nov 1974

KAE BONG (LST 675)
Launched 7 Nov 1943
Commissioned (US Navy) 20 Dec 1943 ((LST 288), later named *Berkshire County*)
Transferred (South Korea) Mar 1956
Purchased (South Korea) 15 Nov 1974

Class 542-1152

UN BONG (LST 671)
Launched 29 Mar 1944
Commissioned (US Navy) 25 Apr 1944 (LST 1010)
Transferred (South Korea) Feb 1955
Purchased (South Korea) 15 Nov 1974

WEE BONG (LST 676)
Launched 30 Dec 1944
Commissioned (US Navy) 16 Jan 1945 ((LST 849), later named *Johnson County*)
Transferred (South Korea) Jan 1959
Purchased (South Korea) 15 Nov 1974

SU YONG (LST 677)
Launched 17 Nov 1944
Commissioned (US Navy) 11 Dec 1945 ((LST 853), later named *Kane County*)
Transferred (South Korea) Dec 1958
Purchased (South Korea) 15 Nov 1974

BUK HAN (LST 678)
Launched 9 Dec 1944
Commissioned (US Navy) 28 Dec 1944 ((LST 900), later named *Lynn County*)
Transferred (South Korea) Dec 1958
Purchased (South Korea) 15 Nov 1974

HWA SAN (LST 679)
Launched 2 May 1945
Commissioned (US Navy) 29 May 1945 ((LST 1080), later named *Pender County*)
Transferred (South Korea) Oct 1958
Purchased (South Korea) 15 Nov 1974

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total payload:

	LST 1-591	LST 542-1152
Beaching	500 tonnes	377 tonnes
Ocean-going	2,100 tonnes	1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: two, four or six, depending on number of davits fitted

AVIATION FACILITIES

- Helicopter can land on foredeck, if not occupied by vehicles or landing craft

AMPHIBIOUS FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 87.8 × 91 m (288 × 30 ft)
- Upper (vehicle) deck:
  area — 500 m²
  maximum total load — 350 tonnes
  maximum individual load — 10 tonnes
- Access to upper deck:
  LST 1-512 — elevator: 7.24 × 4.27 m (23.75 × 14 ft)
  LST 513-1152 — ramp: 4.27 m (14 ft) wide
- Pontoons: two lashed to ship's sides

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

Eight Bofors 40 mm/60 in two twin and one quad mounting.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s)(new gun); 850 m/s (2,789 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,638 ft)
Rate of fire: 80 rds/min, (practical); 160 rds/min; (cyclic) for water-cooled weapons
Ammunition: 2.21 kg (4.9 lb)

Mountings
Traverse: nominal 360° at 30°/s
Elevation: −15 to 85/90° at 24°/s
Crew:
twin mount: 4
quad mount: 11

Two Oerlikon 20 mm

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min

Wee Bong *(LST 676). Seven of these LSTs remain in service with the RoK Navy.*

Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°
Traverse: 360°

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 12-567A diesels, 1.32 MW (1,800 hp)
Shafts: 2

FURTHER INFORMATION

All these ships were transferred to the RoK Navy between 1955 and 1959, as shown:

US Navy (See Note 1)	Korean Navy (See Note 2)	Date of transfer (See Note 3)	Fate
LST 120		1955-58	Stricken
LST 213		1955-58	Stricken
LST 218	*Bi Bong* (LST 673)	May 1955	In service 1996
LST 227	*Duk Bong* (LST 672)	Mar 1955	Grounded, stricken - 1989
LST 288 *(Berkshire County)*	*Kae Bong* (LST 675)	Mar 1956	In service 1996
LST 343	*Dan Yang*	1955-58	Stricken
LST 378		1955-58	Stricken
LST 380		1955-58	Stricken
LST 388	*Ryong Pi*	1955-58	Stricken
LST 491	*An Tong*	1955-58	Wrecked Jan 1952
LST 536		1955-58	Stricken
LST 594		1955-58	Stricken
LST 595	*Chon Po*	1955-58	Stricken
LST 608	*Ulsan*	1955-58	Stricken
LST 624		1955-58	Stricken
LST 659	*Ryong Hwa*	1955-58	Stricken
LST 805	*Lyung Wha*	1955-58	Stricken
LST 849 *(Johnson County)*	*Wee Bong* (LST 676)	Jan 1959	In service 1996
LST 853 *(Kane County)*	*Su Yong* (LST 677)	Dec 1958	In service 1996
LST 900 *(Lynn County)*	*Buk Han* (LST 678)	Dec 1958	In service 1996
LST 1010	*Un Bong* (LST 671)	Feb 1955	In service 1996
LST 1080 *(Pender County)*	*Hwa San* (LST 679)	Oct 1958	In service 1996

Notes
1. Some US Navy LSTs were given names.
2. Not all Korean designations of the earlier ships have been identified.
3. Where a definite transfer date has not been identified it is given as '1955-58'

The intention is that these ships should be replaced by the Korean-designed and built 'Alligator' class.

SRI BANGGI (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Malaysia
Type: LST 1-1152

Class: SRI BANGGI

Purchased: 3
Active: 2

Displacement:
standard: 1,679 t
full load: 4,145 t

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 11.6 kts
Complement: 128, including 11 officers

SHIPS

SRI BANGGI (A 1501)
Builder Missouri Valley Bridge & Iron Co, Indiana, USA
Commissioned (US Navy) 30 Nov 1944 ((LST 824), later named *Henry County*)
Transferred (Malaysia) 1 Aug 1974
Purchased (Malaysia) 7 Oct 1976

RAJA JAROM (A 1502)
Builder Chicago Bridge & Iron, Seneca, Illinois, USA
Commissioned (US Navy) 19 Feb 1945 ((LST 1123), later named *Sedgewick County*)
Transferred (Malaysia) 1 Aug 1974
Purchased (Malaysia) 7 Oct 1976

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total payload:
  LST 542-1152
  Beaching — 377 tonnes
  Ocean-going — 1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: two

AVIATION FACILITIES

- Helicopter can land on foredeck, if not occupied by vehicles or landing craft

AMPHIBIOUS FACILITIES

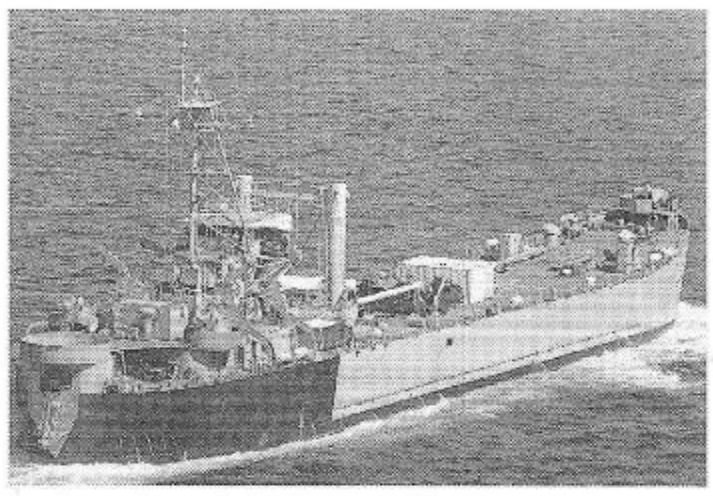
- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 87.8 × 91 m (288 × 30 ft)
- Upper (vehicle) deck:
  area — 500 m²
  maximum total load — 350 tonnes
  maximum individual load — 10 tonnes
- Access to upper deck
  LST 513-1152 — ramp: 4.27 m (14 ft) wide
- Pontoons: two lashed to ship's sides
- Two large derricks have been fitted at the after end of the upper deck
- Kedge anchor

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

Four Bofors 40 mm/60 in one twin and two single mountings. These guns are being progressively reduced: at one stage, these ships had two twin mountings and four singles; then two singles were removed, and more recently one twin.



Raja Jarom *(1502). Note the derricks immediately before the bridge and the empty gun position on the stern* (92 Wing RAAF)

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s) (new gun); 850 m/s (2,789 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,638 ft)
Rate of fire: 80 rds/min, (practical); 160 rds/min, (cyclic) for water-cooled weapons
Ammunition: 2.21 kg (4.9 lb)

Mountings
Traverse: Nominal 360° at 30°/s
Elevation: −15 to 85/90° at 24°/s
Crew:
twin mount: 4
quad mount: 11

RADARS

Raytheon AN/SPS-21C

***Sri Banggi* only.** The Raytheon AN/SPS-21 is an elderly surface search radar operating in the G/H band, with a nominal range of 12 n miles (22 km).

Manufacturer/Contractor
Raythoen, USA.

Sperry AN/SPS-53

***Raja Jarom* only.** The SPS-53 employs a 1.5 m (5.0 ft) slotted array antenna and has a 40 kW peak power.

Specifications
AN/SPS-53E
Role: Surface search
Band: I
Beam: 1.6 × 20°
Peak power: 40 kW
Gain: 30 dB
Pulsewidth: 0.5/1.0 µs
PRF: 750/1500 pps
Scan rate: 15 rpm

Manufacturer/Contractor
Sperry, USA.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 GM 12-567A diesels, 1.32 MW (1,800 hp)
Shafts: 2

FURTHER INFORMATION

The Royal Malaysian Navy (RMN) purchased three LSTs from the US Navy, of which one, the former *Hunterdon County* (LST 838), was operated as *Sri Langkawi* (A 1500) but was stricken in the 1980s. The two remaining LSTs are employed principally on harbour duties as depots for small craft, but retain the capability to be used as amphibious warfare ships, if necessary.

RIO PANUCO (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Mexico
Type: LST 1-1152

Class: RIO PANUCO

Purchased: 3
Active: 3

Displacement
full load: 4,145 t

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 11 kts
Range: 6,000 n miles at 11 kts

Complement: 250

SHIPS

RIO PANUCO (A 01)	
Builder	Bethlehem Steel, Hingham, Massachusetts, USA
Commissioned (US Navy)	8 May 1945 ((LST 1077), later named *Park County*)
Transferred (Mexico)	10 Sep 1971
Purchased (Mexico)	12 Jul 1978

RIO PAPALOAPAN (A 02)	
Builder	Chicago Bridge & Iron Co, Seneca, Illinois, USA
Commissioned (US Navy)	31 Mar 1944 ((LST 602), later named *Clearwater County*)
Transferred (Mexico)	17 Jun 1972

RIO GRIJALVA (A 03)	
Builder	American Bridge Co, Ambridge, Pennsylvania, USA
Commissioned (US Navy)	27 June 1945 ((LST 1095), later *Megara* (ARVA 6)
Purchased (Mexico)	10 Oct 1973

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total payload:
  Beaching — 377 tonnes
  Ocean-going — 1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: two

AVIATION FACILITIES

- Helicopter can land on foredeck, if not occupied by vehicles or landing craft

AMPHIBIOUS FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 87.8 × 91 m (288 ×30 ft)
- Upper (vehicle) deck:
  area — 500 m²
  Maximum total load — 350 tonnes
  maximum individual load — 10 tonnes
- Access to upper deck:
  ramp: 4.27 m (14 ft) wide
- Pontoons: two lashed to ship's sides

WEAPONS SYSTEMS

Bofors 40 mm/60

Eight Bofors 40 mm/60 in two twin and four single mountings.

These guns are being progressively reduced: at one stage, these ships had two twin mountings and four singles; then two singles were removed, and more recently one twin.

Specifications

Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s)(new gun); 850 m/s (2,789 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,638 ft)
Rate of fire: 80 rds/min, (practical); 160 rds/min; (cyclic) for water-cooled weapons
Ammunition: 2.21 kg (4.9 lb)

Mountings
Traverse: Nominal 360° at 30°/s
Elevation: −15 to 85/90° at 24°/s
Crew:
twin mount: 4
quad mount: 11

PROPULSION

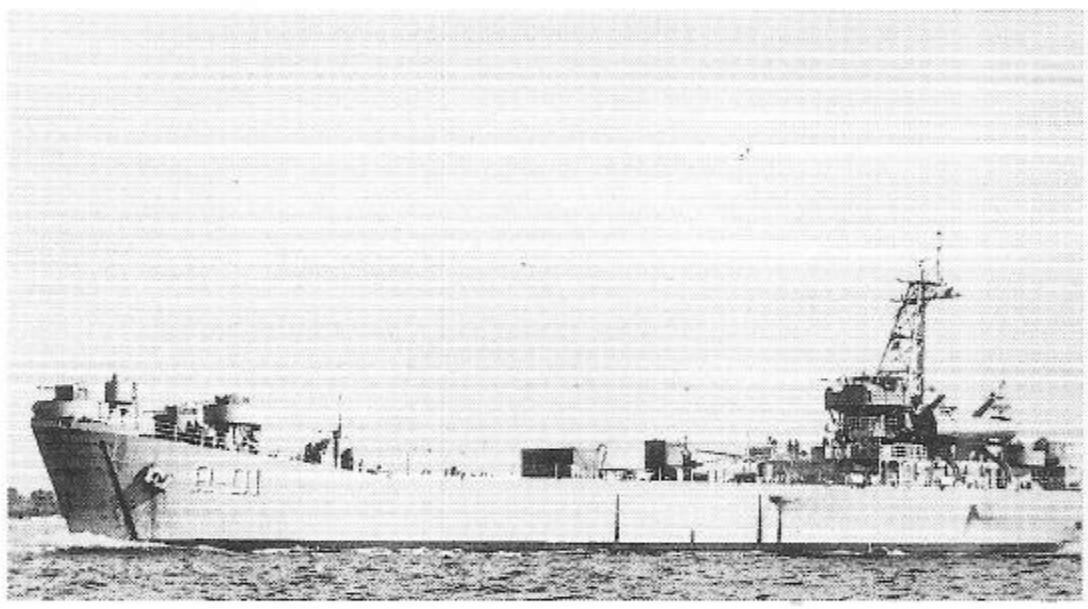
Specifications

System: Diesel
Main machinery: 2 General Motors GM 12-567A diesels, 1.34 MW (1,800 hp)
Shafts: 2

FURTHER INFORMATION

All three are classified as auxiliaries, although they retain their amphibious capabilities. All three ships are used primarily for search and rescue and for disaster relief, and the original intention was that they should have been paid off when the two new auxiliaries, *Rio Usumacinta* and *Rio Coatzacoalcos* were commissioned, but that was more than 10 years ago.

One of the three former US Navy LSTs, *Rio Grijalva* (A 03), actually belonged to a small subgroup which was converted during construction to specialised Aircraft Repair Vessels (Aircraft). This particular ship originally bore the name *Megara* (ARVA 6).



Rio Panuco *(A-01) is one of three ex-US Navy LSTs still operated by the Mexican Navy* (H & L van Ginderen Collection)

Rio Grijalva *(A-03) is still in service, having started as LST 1095 in 1945 then being converted to a repair ship (*Megara *(ARVA 6) and then sold to Mexico as* Vicente Guerrero *(A-05) in 1973, before taking on its present name and pennant number* (H & L van Ginderen Collection)

LAGUNA (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Philippines
Type: 1-1152 (LST)

Class: LAGUNA

Active: 7

Displacement:
standard: 1,646 t
full load: 4,145 t

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 10 kts

Complement: 60-110

SHIPS

Class 1-541

LAGUNA (LT 501)
Commissioned (US Navy) 3 Nov 1943 (LST 230)
Transferred (Philippines) 1976
Recommissioned 8 Aug 1978

SOUTH COTABATO (LT 87)
Commissioned (US Navy) 28 Feb 1944 ((LST 529), later named *Cayuga County*)
Transferred (Philippines) 1976

Class 542-1152

ZAMBOANGA DEL SUR (LT 86)
Commissioned (US Navy) 3 Feb 1945 ((LST 975), later named *Marion County*)
Transferred to Philippines 17 Nov 1975

LANAO DEL NORTE (LT 504)
Commissioned (US Navy) 29 May 1944 (LST 566)
Transferred (Philippines) 1976
Recommissioned 8 Aug 1978

BENGUET (LT 507)
Commissioned (US Navy) 10 May 1944 ((LST 692), later named *Davies County*)
Transferred (Philippines) 1976
Recommissioned 18 Oct 1978

SIERRA MADRE (LT 57) (ex *Dumagat*, AL 57)
Commissioned (US Navy) 14 Jan 1944 ((LST 821), later named *Harnett County*)
Transferred (South Vietnam) 1970 as *My Tho*
Bought by Philippines 5 Apr 1976

KALINGA APAYAO (LT 516) (ex-AE 516)
Commissioned (US Navy) 28 Aug 1944 ((LST 786), later named *Garrett County*)
Transferred (South Vietnam) 1970 (*Can Tho*)
Purchased (Philippines) 5 Apr 1976

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total payload:

	LST 1-591	LST 542-1152
Beaching	500 tonnes	377 tonnes
Ocean-going	2,100 tonnes	1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: two, four or six, depending on number of davits fitted

AVIATION FACILITIES

- Helicopter can land on foredeck, if not occupied by vehicles or landing craft

AMPHIBIOUS FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 87.8 × 91 m (288 × 30 ft)
- Upper (vehicle) deck:
  area — 500 m²
  maximum total load — 350 tonnes
  maximum individual load — 10 tonnes
- Access to upper deck
  LST 1-512 — elevator: 7.24 × 4.27 m (23.75 × 14 ft)
  LST 513-1152 — ramp: 4.27 m (14 ft) wide
- Pontoons: two lashed to ship's sides

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

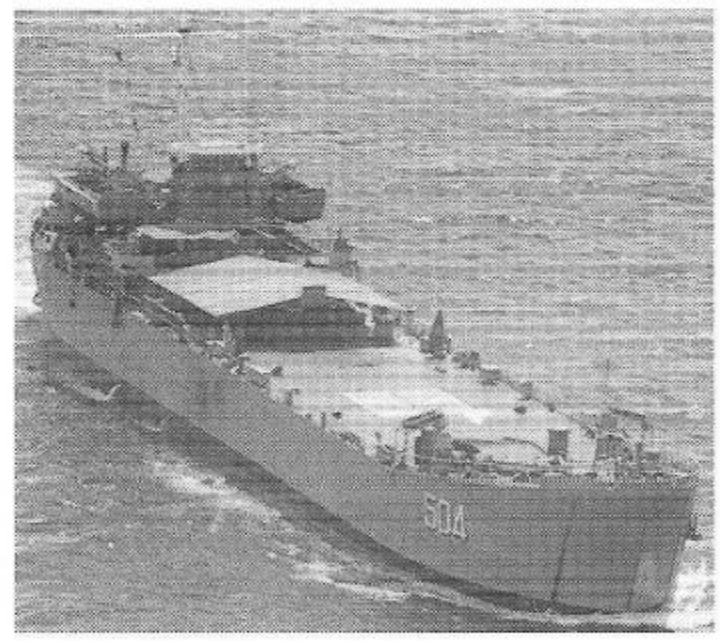
Six Bofors 40 mm/60 in two twin and two single mountings, but may vary between ships.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s) (new gun); 850 m/s (2,789 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,638 ft)
Rate of fire: 80 rds/min, (practical); 160 rds/min, (cyclic) for water-cooled weapons
Ammunition: 2.21 kg (4.9 lb)

Mountings
Traverse: Nominal 360° at 30°/s
Elevation: −15 to 85/90° at 24°/s
Crew:
twin mount: 4
quad mount: 11

Four Oerlikon 20 mm guns (in refitted ships).

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°
Traverse: 360°



Lanao del Norte *(LT 504). Note that all gun mounts have been cleared from the bow area* (Philippines Navy)

COMMAND AND CONTROL SYSTEMS

RADAR

Raytheon SPS-64(V)2

Specifications
Role: Navigation
Band: I
Beam: 1.9 × 22°
Peak power: 20 kW
Gain: 28 dB
Pulsewidth: 0.06/0.5/1.0 µs
PRF: 3,600/1,800/900 pps
Scan rate: 33 rpm

Manufacturer/Contractor
Raytheon, USA.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 GM 12-567A diesels, delivering 1.32 MW (1,800 hp)
Shafts: 2

FURTHER INFORMATION

Some 29 (possibly more) LSTs have been acquired by the Philippines Navy from a variety of sources. Some came direct from the US Navy, while others have come from the JMSDF and South Korean Navy, and a number of South Vietnamese ships were acquired when they brought escapees to the Philippines following the collapse of that country in 1976. Some have been refurbished in the Philippines, while Japanese shipyards refitted a number in the late 1970s, the work including replacement of the frames and plating, new or refurbished engines and electrics, and the provision of four Oerlikon 20 mm guns. All of the latter can be distinguished by their 500-series pennant numbers.

The surviving ships are classed as auxiliary transports (hence their LT pennant numbers) and are used for general cargo work, but they retain their amphibious capabilities.

US Navy	Philippine Navy (See Note 1)	Transfer date	Remarks	Fate
LST 47	*Tarlac* (LT 500)	1976	Refitted in Japan late 1970s	Scrapped ?
LST 75	*Cutabato*	1948	US Navy	Scrapped
LST 222	*Mindoro Occidental* (LT 93)	1972		Scrapped ?
LST 230	*Laguna* (LT 501)		Refitted in Japan late 1970s	In service 1996
LST 287	*Samar Oriental* (LT 902)	1976		Scrapped ?
LST 491	*Lanao del Sur* (LT 503)	1976	Refitted in Japan late 1970s	Scrapped ?
LST 488	*Surigao del Norte* (LT 94)	1972	S Korea	Scrapped
LST 515 *Caddo Parish*	*Bataan* (LT 85) later *Maquindanao* (LT 96)	1969	US Navy	Scrapped
LST 529 *Cayuga County*	*South Cotabato* (LT 87)			In service 1996
LST 546	*Surigao del Sur* (LT 95)	1972	S Korea	Scrapped
LST 566	*Lanao del Norte* (LT 504)	1976	Refitted in Japan late 1970s	In service 1996
LST 607	*Leyte del Sur* (LT 505)	1976	Refitted in Japan late 1970s	Scrapped
LST 689 *Daggett County*	*Davao Oriental* (LT 506)		Refitted in Japan late 1970s	Scrapped
LST 692 *Davies County*	*Benguet* (LT 507)	1976	Refitted in Japan late 1970s	In service 1996
LST 786 *Garrett County*	*Kalinga Aapayao* (LT 516)		Refitted in Japan late 1970s	In service 1996
LST 821	*Sierra Madre* (LT 57)	1976	ex-Vietnam	In service 1996
LST 822 *Harris County*	*Aurora* (LT 508)	1976	Refitted in Japan late 1970s	Scrapped ?
LST 825 *Hickman County*	*Cagayan* (LT 86) later (LT 97)	1969	US Navy	Scrapped
LST 835 *Hillsdale County*	*Cavite* (LT 509)		Refitted in Japan late 1970s	Scrapped
LST 842	*Pampanga*	1948	US Navy	Scrapped
LST 843	*Bulacan* (LT 38)	1948	US Navy	Scrapped ?
LST 848	*Agusan del Sur*	1976	ex-Vietnam	Scrapped ?
LST 865	*Albay* (LT 39)	1948	US Navy	Scrapped ?
LST 875	*Misamis Oriental* (LT 40)	1948	US Navy	Scrapped ?
LST 905 *Madera County*	LT 87 later *Ilocos Norte* (LT 98)	1969	US Navy	Scrapped ?
LST 975	*Zamboanga del Sur* (LT 86)		Vietnam	In service 1996
LST 1064 *Nansemond County*	*Samar del Norte* (LT 510)		Refitted in Japan late 1970s	Scrapped ?
LST 1069 *Orleans Parish*	*Cotabato del Norte* (LT 87)	1976		In service 1996
LST 1072	*Tawi-Tawi* (LT 512)	1976	Refitted in Japan late 1970s	Scrapped ?

EXCELLENCE (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Singapore
Type: LST 1-1152

Class: EXCELLENCE

Purchased: 6

Active: 2
Reserve: 3

Displacement:
standard: 1,679 t
full load: 4,216 t

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 9 kts
Range: 19,000 n miles at 9 kts

Complement: 120 including 15 officers

SHIPS

EXCELLENCE (L 202)

Builder	Chicago Bridge & Iron Co, Seneca, Illinois, USA
Commissioned (US Navy)	28 Jul 1944 (LST 629)
Purchased (Singapore)	4 Jun 1976

INTREPID (L 203)

Builder	Missouri Valley Bridge & Iron Co, Evansville, Indiana, USA
Commissioned (US Navy)	21 July 1944 (LST 579)
Purchased (Singapore)	4 Jun 1976

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total payload:
  Beaching 377 tonnes
  Ocean-going 1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: 2

AVIATION FACILITIES

- Helicopter can land on foredeck, if not occupied by vehicles or landing craft
- *Excellence* only. Flight deck on stern

AMPHIBIOUS FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp.

Intrepid *(L 203). Note the large crane and the box-like structure which has been added in front of the bridge* (H & L van Ginderen Collection)

- Tank deck: 87.8 × 91 m (288 × 30 ft)
- Upper (vehicle) deck:
  area: 500 m²
  maximum total load: 350 tonnes
  maximum individual load: 10 tonnes
- Access to upper deck:
  ramp: 4.27 m (14 ft) wide
- Pontoons: two lashed to ship's sides
- Cranes:
  Excellence: two large derricks
  Intrepid: single crane

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SIMBAD close in weapons system

These LSTs both carry two twin SIMBAD launchers. SIMBAD *(Systeme Integre de Mistral Bitube d'Auto-Defense)* is a French Navy CIWS now being installed, where it is simply replacing the Oerlikon 20 mm guns in the existing mounting. SIMBAD is one of the elements in the *Amelioration de l'Auto-defense Anti-Missile* (Anti-Missile Self-Defence Improvement) programme and is based on the high-velocity Mistral missile, which contains a SAT two-colour (3-5 µm infra-red and ultraviolet) seeker under IR-transparent magnesium fluoride panels. The seeker has a field of view of ±38° and is cooled concurrently with gyro run-up, in approximately 2 seconds. The whole system has a reaction time of as little as 5 seconds and the missile leaves its launch tube with a velocity of 40 m/s (131 ft/s) accelerating rapidly to its maximum speed of Mach 2.5.

SIMBAD is manually operated, with two missile launcher-containers. When the target is designated the operator tracks it, selects a missile and activates the battery/coolant unit to cool the seeker and warm up the missile, while the prelaunch electronics box uses the seeker to determine whether or not the target is within range. If the answer is positive the seeker locks on and the operator receives an audio signal allowing him to launch the missile. If, for some reason, the firing has to be postponed the missile system automatically compensates minor aiming errors and remains ready for launch.

Specifications

Mistral Missile
Length: 1.81 m (5.9 ft)
Diameter: 9.2 cm (3.6 in)
Wing span: 1.9 cm (0.7 in)
Weight: 18.4 kg (40 lb)
Speed: Mach 2.6
Range: 700 m to 5 km
Warhead: HE-1 kg (2.2 lb): tungsten balls — 1.95 kg (4.3 lb)
Booster: 2 SNPE rocket motors

Manufacturer/Contractor

Matra Defense, France.

Bofors 40 mm/60

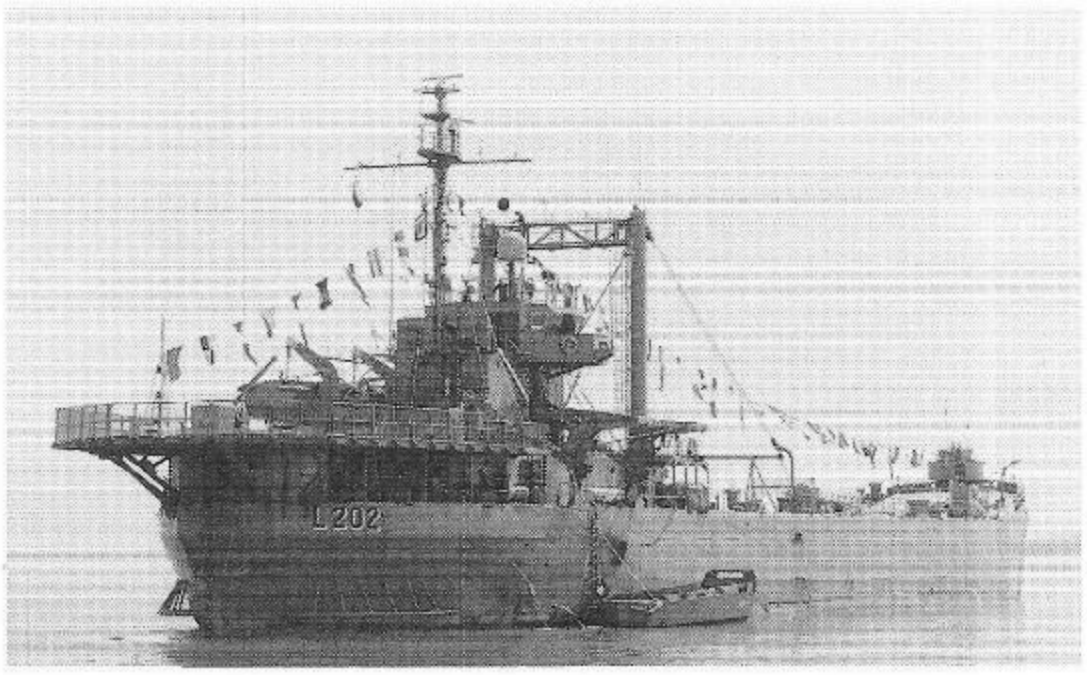
The two ships in service each have one Bofors mounted in the bows.

Specifications

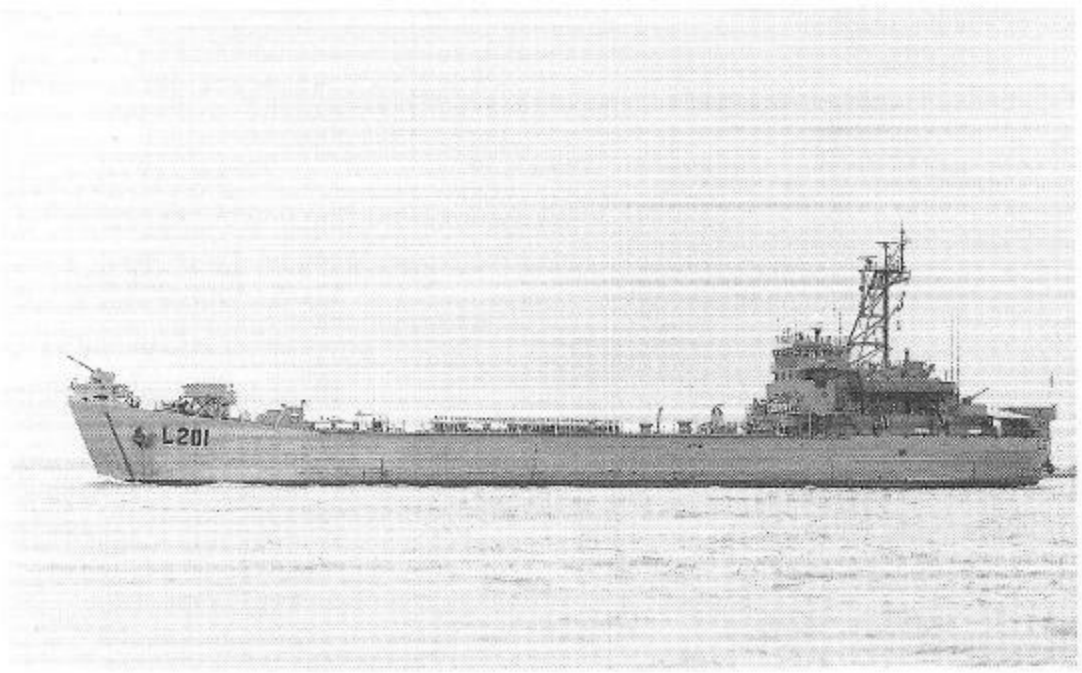
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,889 ft/s) (new gun); 850 m/s (2,788 ft/s) (mid-life)
Range:
  anti-surface: 5.5 n miles (10 km)
  anti-air: 6,900 m (22,632 ft)
Rate of fire:
  practical: 80 rds/min
  cyclic for water-cooled weapons: 160 rds/min
Ammunition weight: 2.21 kg (4.8 lb)

M2HB 12.7 mm machine guns

Six M2HB 12.7 mm machine guns are carried. The



Excellence *(L 202) is the only known example of an ex-US Navy LSL fitted with a stern flight deck* (G Torremans)



Endurance *(L 201) is one of three LSLs in reserve at Tuas* (H & L van Ginderen Collection)

M2HB is a selective short recoil automatic operation weapon with a 1,143 mm long barrel and eight right-hand grooves turning once every 381 mm. Muzzle energy is 1,867 mkp and the weapon uses 110-round belts.

Specifications
M2HB
Calibre: 12.7 mm
Length of barrel: 90 calibres
Gun weight: 38.1 kg (84 lb)

Muzzle velocity: 893 m/s (2,929 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

RADARS

Kelvin-Hughes 14/9
I-Band navigation radar.

IFF
AN/ UPX 12

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU diesels, 1.34 MW (1,800 hp)
Shafts: 2

FURTHER INFORMATION

In all, Singapore has purchased nine LSTs from the US Navy.

The sixth vessel, the former US Navy LST 623, was called *Perseverance* and numbered L 206; both name and number have now been taken by the 'Sir Lancelot' class LSL acquired from the British Navy, via a South African commercial concern, in 1992. The former LST *Perseverance* is being cannibalised for spares.

Note:
1. These three ships were purchased with two others, but were immediately resold on the commercial market. The reasons for, and the arrangements under which this deal was transacted, are not known.
2. The name and number of this ship were removed when it was stricken and allocated to the ex-British 'Sir Lancelot' class LSL when it was commissioned into the Republic of Singapore Navy in 1994.

US Navy	Singapore Navy	Date of transfer	Remarks
LST 117 (Note 1)	Did not enter service	June 1974	Sold commercially
LST 276 (Note 1)	Did not enter service	June 1974	Sold commercially
LST 532 (Note 1)	Did not enter service	June 1974	Sold commercially
LST 613	*Persistence* (L 205)	Purchased — 4 June 1976	In reserve
LST 623	*Perseverance* (L 206) (Note 2)	Purchased — 4 June 1976	Stricken — used for spares
LST 629	*Excellence* (L 202)	Purchased — 4 June 1976	In service 1996
LST 649	*Resolution* (L 204)	Purchased — 4 June 1976	In reserve
LST 759	*Intrepid* (L 203)	Purchased — 4 June 1976	In service 1996
LST 836 *(Holmes County)*	*Endurance* (L 201)	Lent by USN — 1 July 1971 Purchased — 5 December 1975	In reserve

MODERNISATION

The two ships still in service have been modernised, with new electrics and communications, an enclosed bridge and updated command facilities. *Excellence* (L 202) has had a goalpost derrick fitted forward of the bridge, while *Intrepid* (L 202) has a large crane. *Excellence* also has a large helicopter flight deck which extends well beyond the stern. Both have been re-engined and are now powered by MTU diesels.

DEPLOYMENT

Both ships are used as command ships and in support of the army. In peacetime they are used to transport army units on overseas exercises. *Excellence* is also used for occasional training cruises. The three ships in reserve could be returned to service in an emergency.

CHUNG HAI (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Taiwan
Type: LST 1-1152

Class: CHUNG HAI

Acquired: 28
Active: 13

Displacement:
standard: 1,679 t
full load: 3,698 t (1-541 class); 4,145 t (542-1152 class)

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 11.6 kts
Range: 15,000 n miles at 10 kts

Complement: 100-125

SHIPS

CHUNG KUANG (216)
Commissioned (US Navy) 14 Dec 1943 (LST 503)
Transferred (Taiwan) Jun 1960

CHUNG SUO (217)
Commissioned (US Navy) 7 Jan 1943 ((LST 400) named *Bradley County*)
Transferred (Taiwan) Sep 1958

Class 542-1152

CHUNG HAI (201)
Commissioned (US Navy) 29 Jul 1944 (LST 755)
Transferred (Taiwan) Apr 1946

CHUNG HSING (204)
Commissioned (US Navy) 5 May 1944 (LST 557)
Transferred (Taiwan) Mar 1946

CHUNG CHIEN (205)
Commissioned (US Navy) 12 May 1944 (LST 716)
Transferred (Taiwan) Jun 1946

CHUNG SHUN (208) (ex-624)
Commissioned (US Navy) 10 May 1944 (LST 732)
Transferred (Taiwan) Mar 1946

CHUNG YUNG (210) (ex-657)
Commissioned (US Navy) 26 Jun 1944 (LST 574)
Transferred (Taiwan) Mar 1959

CHUNG CHUAN (221) (ex-651)
Commissioned (US Navy) 18 Sep 1944 (LST 1030)
Transferred (Taiwan) Feb 1948

CHUNG FU (223)
Commissioned (US Navy) 11 Dec 1944 ((LST 840) later named *Iron County*)
Transferred (Taiwan) Jul 1958

CHUNG CHIH (226)
Commissioned (US Navy) 6 May 1945 ((LST 1091) named *Sagadahoc County*)
Transferred (Taiwan) Oct 1958

CHUNG MING (227)
Commissioned (US Navy) 13 May 1945 ((LST 1152) named *Sweetwater County*)
Transferred (Taiwan) Oct 1958

CHUNG PANG (230)
Commissioned (US Navy) 15 Jul 1944 (LST 587)
Transferred (Taiwan) Sep 1958

CHUNG YEH (231)
Commissioned (US Navy) 28 May 1945 ((LST 1144) named *Sublette County*)
Transferred (Taiwan) Sep 1961

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total payload:

	LST 1-591	LST 542-1152
Beaching	500 tonnes	377 tonnes
Ocean-going	2,100 tonnes	1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: Two, four or six, depending on number of davits fitted

AVIATION FACILITIES

- Helicopter can land on foredeck, if not occupied by vehicles or landing craft

AMPHIBIOUS FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 87.8 × 91 m (288 × 30 ft)
- Upper (vehicle) deck:
  area: 500 m²
  maximum total load: 350 tonnes
  maximum individual load: 10 tonnes
- Access to upper deck:
  LST 1-512 — elevator: 7.24 × 4.27 m (23.75 × 14 ft)
  LST 513-1152 — ramp: 4.27 m (14 ft) wide
- Pontoons: Two lashed to ship's sides

WEAPONS SYSTEMS

GUNS

Up to 10 Bofors 40 mm/60 in twin and single mountings

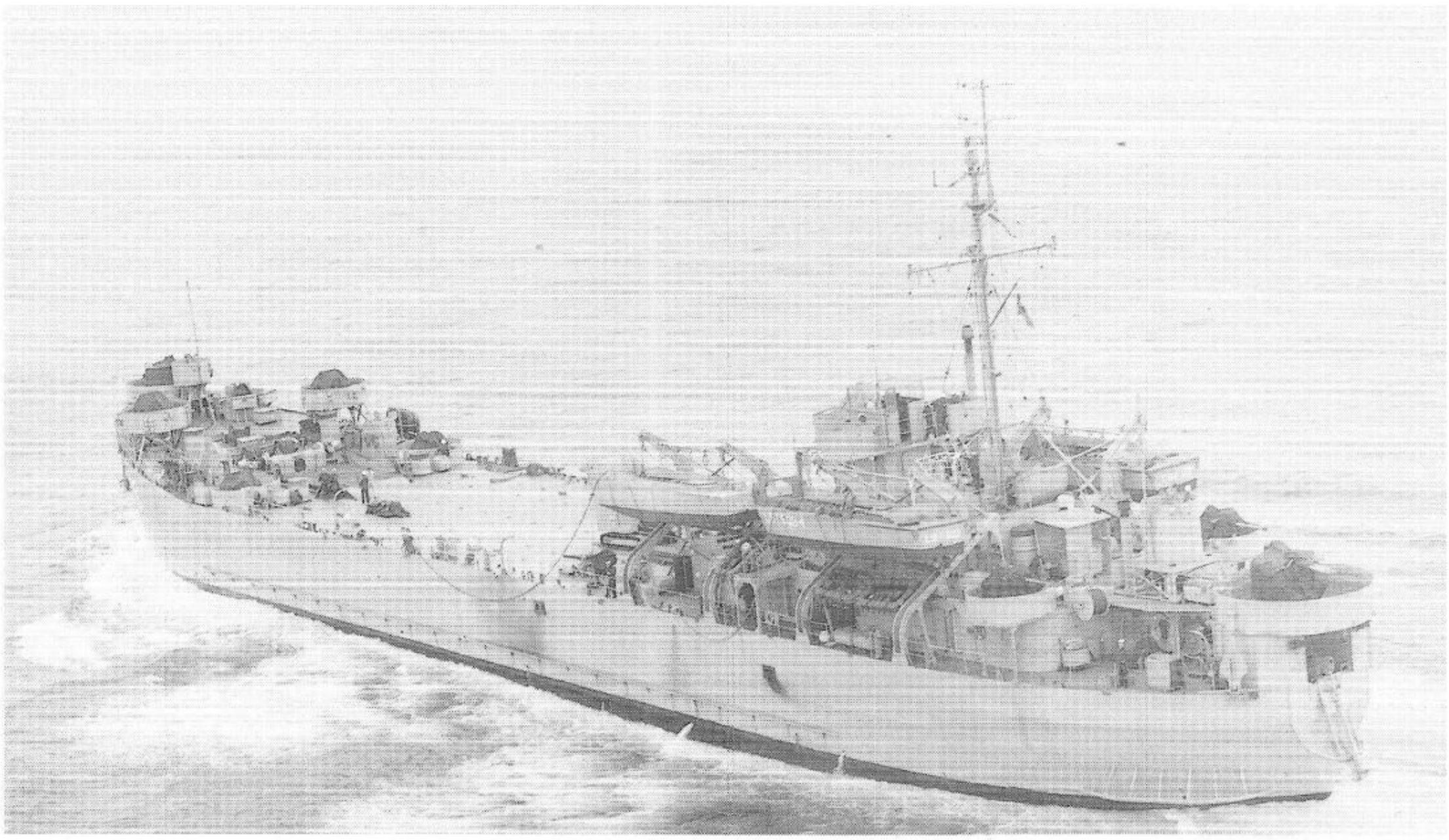
Some vessels have two twin and six single mountings, others have fewer. Where ships are fitted with two ex-US Navy 3 in/50 calibre guns, they have three twin mountings of Bofors 40 mm/60s.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s) (new gun); 850 m/s (2,788 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,632 ft)
Rate of fire:
(practical): 80 rds/min
(cyclic) for water-cooled weapons: 160 rds/min
Ammunition weight: 2.21 kg (4.8 lb)

Two US Navy 3 in (76 mm)/50 calibre guns (on some ships)

Specifications
Gun
Calibre: 76.2 mm (3 in)
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,700 ft/s) (new); 808 m/s (2,650 ft/s) (mid-life)
Range:
anti-surface: 7 n miles (13 km)
anti-air: 8,951 m (29,367 ft)
Ammunition weight: 10.9 kg (24 lb)

Mk 33 Mounting
Traverse: 360 at 30°/s
Elevation: −14 to +85 at 24°/s
Rate of fire: 100 rds/min



Chung Kuang *(216) showing all the characteristics of the classic LST: doors and weapons forward; long, closed tank deck; and machinery, superstructure and the remaining weapons aft. Note the LCVPs on davits; numbers vary between two and six* (H & L van Ginderen Collection)

Several Oerlikon 20 mm in twin or single mountings

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,738 ft/s)
Range:
anti-surface: 1.5 km (0.8 n miles)
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°
Traverse: 360°

COMMAND AND CONTROL SYSTEMS

RADARS

Navigation: US SO 1, 2 or 8; I-Band

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 12-567A diesels, 1.32 MW (1,800 hp)
Shafts: 2

FURTHER INFORMATION

The RoC Navy has received at least 29 ex-US Navy LSTs of various types and at differing times, the initial ships being received during the civil war against the Communists in the late 1940s, at least some of which are still in service with the PLAN as the 'Shan' class. A complete tally of the Taiwanese ships is difficult, mainly because the RoC Navy has, in some cases, allocated the same name to a succession of similar vessels and on at least two occasions, has changed pennant numbers between ships. The complete situation is believed to be:

Notes:
1. In the US Navy, names were allocated to some LSTs only.
2. The Taiwanese ships were originally allocated numbers in the 200-series, but these were changed to the 600 series. Recently, however, the original numbers were returned and are still in current use.

Four other LSTs were received from the United States, which were later converted for other duties. *Chung Shi,* the former US Navy LST 735 *(Dukes County)* was converted in 1964 to be a flagship with the name *Kao Hsiung* (AGC 1). It is still operational (see following entry).

US Navy number/name (Note 1)	Taiwanese name/numbers (Note 2)	Transfer date	Remarks/Fate
LST 279 *(Berkeley County)*	*Chung Chie* (218)	Jun 1960	Stricken 1978
LST 330	*Chung Yu* (215)		Stricken
LST 400 *(Bradley County)*	*Chung Suo* (217, 667)	Sep 1958	In service 1996
LST 503	*Chung Kuang* (216, 616)	Jun 1960	In service 1996
LST 520	*Chung Shu* (228, 642)	Sep 1958	Stricken 1993
LST 535	*Chung Wan* (224, 654)	Sep 1958	Stricken 1993
LST 537	*Chung Ting* (203, 673)	Mar 1946	Stricken 1993
LST 557	*Chung Hsing* (204, 684)	Mar 1946	In service 1996
LST 574	*Chung Yung* (210, 657)	Mar 1959	In service 1996
LST 578	*Chung Pang* (230, 629)	Sep 1958	In service 1996
LST 716	*Chung Chien* (205, 679)	Jun 1946	In service 1996
LST 732	*Chung Shun* (208, 624)	Mar 1946	In service 1996
LST 755	*Chung Hai* (201)	Apr 1946	In service 1996
LST 840 *(Iron County)*	*Chung Fung* (223, 619)	Jul 1958	In service 1996
LST 859 *(Lafayette County)*	*Chung Cheng* (224, 676)	Aug 1958	Stricken 1989
LST 993	*Chung Hsun* (208)		Stricken
LST 945	*Chung Kung* (213)		Stricken
LST 1017	*Chung Chi* (206, 626)	Dec 1946	Stricken 1993
LST 1030	*Chung Chuan* (221, 651)	Feb 1948	In service 1996
LST 1033	*Chung Sheng* (222, 686)	Dec 1947	Stricken
LST 1050	*Chung Lien* (209, 691)	Jan 1947	Stricken 1993
LST 1075	*Chung Cheng* (207)		Stricken
LST 1091 *(Sagadahoc County)*	*Chung Chih* (226, 655)	Oct 1958	In service 1996
LST 1110 *(San Bernadino County)*	*Chung Chiang* (225, 635)	Aug 1958	Stricken 1993
LST 1144 *(Sublette County)*	*Chung Yeh* (231, 699)	Sep 1961	In service 1996
LST 1152 *(Sweetwater County)*	*Chung Ming* (227, 681)	Oct 1958	In service 1996

REPAIR SHIPS

Three LSTs have been used as repair ships. The first started life as US Navy LST 455, but was converted during construction to become a repair ship, as *Achilles* (ARL 41). It was transferred to Taiwan in the late 1940s and was grounded and abandoned as a burned-out hulk in 1949, although it was later salvaged and refitted by the Communist Chinese. *Chung Chuan* (202), the former US Navy LST 1013, was converted to a repair ship ARL 335 to replace the lost ARL 41 and later stricken.

A third vessel, *Sung Shan,* started life as US Navy LST 490, but was modified during construction, and was completed as landing craft repair ship, *Agenor* (ARL 3). It was transferred to France in 1951 for service in Indo-China, then returned to the US and finally transferred to Taiwan in 1957, where it was numbered, first, A 336, and later A 236.

MODERNISATION

All of the class have been extensively refitted in Taiwan, with changed armaments and new engines.

OPERATIONAL

The intention is that these ships should be retired as more of the 'Wan An' and 'Wu Kang' attack transport ships are commissioned.

KAO HSIUNG (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Taiwan
Type: LST 1-1152

Class: KAO HSIUNG

Converted: 1
Active: 1

Displacement:
standard: 1,679 t
full load: 4,145 t

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 11.6 kts
Range: 11,200 n miles at 10 kts

Complement: 195

SHIPS

KAO HSIUNG (LCC 1)

Builder Dravo Corporation, Neville Island, Pennsylvania, USA

Launched 11 Mar 1944
Commissioned (US Navy) 26 Apr 1944 ((LST 735) later named *Dukes County*)

Transferred (Taiwan) May 1957 ((LST 219) (later 663) *Chung Hai*)

Purchased (Taiwan) Nov 1974

AMPHIBIOUS CAPABILITIES

Retains bow doors in working order. LCVP davits have been removed.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60
Ten Bofors 40 mm/60 on five twin Mk 1 mountings.

Specifications
Calibre: 40 mm

Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,889 ft/s) (new gun); 850 m/s (2,788 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,632 ft)

Rate of fire:
(practical): 80 rds/min
(cyclic) for water-cooled weapons: 160 rds/min
Ammunition weight: 2.21 kg (4.8 lb)

COMMAND AND CONTROL SYSTEMS

RADARS

Air search: RCA SPS-12 using D-Band
Long since replaced in US Navy service.

Specifications
Beam: 30 × 3
Peak power: 500 kW
Gain: 25 dB
Pulsewidth: 4/1 ms
PRF: 300-600 pps
Scan rate: 2.5-15 rpm

Raytheon SPS-10
The surface search radar is the Raytheon SPS-10.

Specifications
Band: G/H (4 to 8 GHz)
Beam: 1.5 × 16
Peak power: 500 kW
Gain: 30 dB
Pulsewidth: 0.25/1.3 ms
PRF: 625-650 pps
Scan rate: 15 rpm

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 12-567A diesels, 1.34 MW (1,800 hp)
Shafts: 2

FURTHER INFORMATION

This ship served as a conventional LST for seven years after the transfer from the US Navy, but in 1964 it was converted to a flagship for amphibious operations, renamed and redesignated as AGC, since changed to Command and Control Ship (LCC). The conversion included installation of a lattice mast above the bridge structure, a tripod mast, modified bridge levels to accommodate the flag officer and his staff and four cylindrical antenna mountings on the main deck. It retains some of its amphibious capabilities.

AUNGTHONG (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Thailand

Class: 1-541 and 542-1152 (LST)

Purchased: 5
Active: 5

Displacement:
standard: 1,679 t
full load: 3,698 t (1-541 class); 4,145 t (542-1152 class)

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)

Draught: 4.3 m (14 ft)

Speed: 11.5 kts
Range: 9,500 n miles at 9 kts

Complement: 80 (157 at war)

SHIPS

Class 1-541

AUNGTHONG (711)

Builder	American Bridge Co, Ambridge, Pennsylvania, USA
Commissioned (US Navy)	8 Jan 1944 (LST 294)
Transferred (Thailand)	1950s (date not known)

Class 542-1152

CHANG (712)

Builder	Dravo Corporation, Pittsburgh, Pennsylvania, USA
Laid down	15 Oct 1944
Launched	25 Nov 1944
Commissioned (US Navy)	29 Dec 1944 ((LST 898) later named *Lincoln County*)
Transferred (Thailand)	Aug 1962

PANGAN (713)

Builder	Chicago Bridge & Iron Co, Seneca, Illinois, USA
Commissioned (US Navy)	7 Apr 1945 ((LST 1134) later named *Stark County*)
Transferred (Thailand)	16 May 1966

LANTA (714)

Builder	Chicago Bridge & Iron Co, Seneca, Illinois, USA
Commissioned (US Navy)	9 May 1945 ((LST 1141) later named *Stone County*)
Transferred (Thailand)	12 Mar 1970
Purchased (Thailand)	1 Mar 1979

PRATHONG (715)

Builder	Jefferson Bridging & Machinery Co, Indiana, USA
Commissioned (US Navy)	13 Sep 1944 ((LST 722) later named *Dodge County*)
Transferred (Thailand)	17 Dec 1975

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total payload:

	LST 1-591	LST 542-1152
Beaching	500 tonnes	377 tonnes
Ocean-going	2,100 tonnes	1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: Two, four or six, depending on number of davits fitted

AVIATION

- Helicopter can land on foredeck, if not occupied by vehicles or landing craft

AMPHIBIOUS FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 87.8 × 91 m (288 × 30 ft)
- Upper (vehicle) deck:
  area: 500 m²
  maximum total load: 350 tonnes
  maximum individual load: 10 tonnes
- Access to upper deck:
  LST 1-512 — elevator: 7.24 × 4.27 m (23.75 × 14 ft)
  LST 513-1152 — ramp: 4.27 m (14 ft) wide
- Pontoons: Two lashed to ship's sides
- Kedge anchor
- *Lanta, Prathong, Chang.* Mobile crane on tank deck; 10 tonne capacity

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

Eight Bofors 40 mm/60 two twin and four single mountings, can be mounted, but do not seem always to be carried.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,889 ft/s) (new gun); 850 m/s (2,788 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,632 ft)
Rate of fire:
(practical): 80 rds/min
(cyclic) for water-cooled weapons: 160 rds/min
Ammunition weight: 2.21 kg (4.8 lb)

Oerlikon 20 mm/80

Two Oerlikon 20 mm/80 in all except Chang (2).

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,738 ft/s)
Range:
anti-surface: 0.8 n miles (1.5 km)
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +90

12.7 mm machine guns

***Chang* only.** Two M2HB 12.7 mm machine guns. The M2HB is a selective short recoil automatic operation weapon with a 1,143 mm long barrel and eight right-hand grooves turning once every 381 mm. Muzzle energy is 1,867 mkp and the weapon uses 110-round belts.

Specifications
Calibre: 12.7 mm
Length of barrel: 90 calibres
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,929 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Two Mk 51 gun fire-control systems. Two optical systems.

RADAR

Racal-Decca 1229

The navigation radar is the Racal-Decca Type 1229, with an output of 20 kW. It is equipped with a 2.7 m (8.85 ft) antenna and operates in the I/J-band.

Specifications
Role: Navigation
Band: I/J
Beam: 1.3 × 30°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
PRF: 1,300/650 pps
Scan rate: 25 rpm

Manufacturer/Contractor
Racal Decca.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 12-567A diesels, 1.34 MW (1,800 hp)
Shafts: 2

FURTHER INFORMATION

The Royal Thai Navy has five LSTs which were transferred from the US Navy at irregular intervals between the 1950s and 1975. One ship, *Aungthong* was paid off in 1987 but has been brought back into service. *Chang* was one of a number of LSTs given a reinforced bow and waterline during construction for possible service in the Arctic.

Pangan *(713) (prior to renumbering). Note the 10-tonne crane normally carried by RTN LSTs*

BAYRAKTAR (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Turkey
Type: LST 1-1152

Class: BAYRAKTAR

Active: 2

Displacement:
standard: 1,679 t
full load: 4,145 t (542-1152 class)

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 11 kts
Range: 15,000 n miles at 9 kts

Complement: 125, including 12 officers

SHIPS

BAYRAKTAR (N[L] 120) (ex-N 111)		**Recommissioned**	6 Feb 1964	**Transferred (West Germany)**	1961 (*Bochum* (A 1404))
Builder	Missouri Valley, Evansville, Indiana, USA	**Decommissioned**	28 Sep 1971	**Converted to minelayer**	1962-64
Commissioned (US Navy)	26 Jan 1945 ((LST 1101) later named *Saline County)*	**Transferred (Turkey)**	12 Dec 1976	**Recommissioned**	14 Apr 1964
Transferred (West Germany)	1961 (*Bottrop* (A 1402))	**SANCAKTAR** (N[L] 121)		**Transferred (Turkey)**	13 Dec 1972
Converted to minelayer	1962-1964	**Builder**	American Bridge, Ambridge, USA		
		Commissioned (US Navy)	14 Mar 1945 ((LST 1089) later named *Rice County*)		

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total payload:
  Beaching 377 tonnes
  Ocean-going 1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: six

AVIATION FACILITIES

- Helicopter can land on foredeck, if not occupied by vehicles or landing craft

AMPHIBIOUS FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 87.8 × 91 m (288 × 30 ft)
- Upper (vehicle) deck:
  area: 500 m²
  maximum total load: 350 tonnes
  maximum individual load: 10 tonnes
- Access to upper deck:
  ramp: 4.27 m (14 ft) wide
- Pontoons: Two lashed to ship's sides
- Stern kedge anchor

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

Six Bofors 40 mm/60 in two twin and two single mountings.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,889 ft/s) (new gun); 850 m/s (2,788 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,632 ft)
Rate of fire:
(practical): 80 rds/min
(cyclic) for water-cooled weapons: 160 rds/min
Ammunition weight: 2.21 kg (4.8 lb)

MINES

Four rails.

COMMAND AND CONTROL SYSTEMS

RADAR

Kelvin Hughes 14/9

These ships have the widely used Kelvin Hughes 14/9 navigation radar, operating in the I-band.

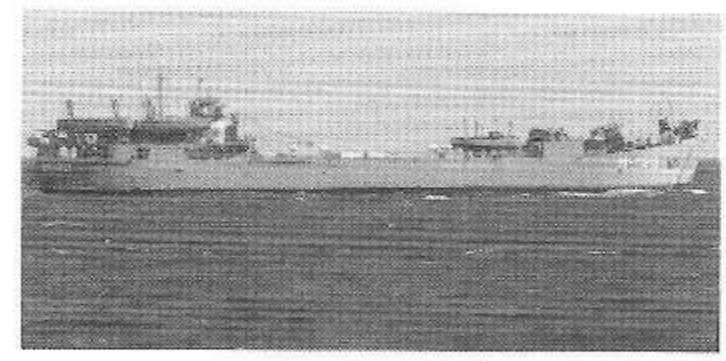
PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 12-567A diesels, 1.34 MW (1,800 hp)
Shafts: 2

FURTHER INFORMATION

These two ships were part of a group of seven LSTs purchased by the Federal German Navy (FGN) from the USA in 1961. Three of these were then taken in hand for conversion to minelayers, the work involving welding the bow doors together, removing the bow ramp, and installing minelaying gear. Work on one ship was suspended (and the ship later sold for scrap) but two were completed as *Bochum* (N 120) and *Bottrup* (N 121) and they served in this role with the FGN from 1964 to 1971.

They were then decommissioned, refitted as LSTs and transferred to Turkey. They served as LSTs for a few years, but were then once again outfitted for the minelaying role, in which they still serve.



Bayraktar *(N^{L} 120) is a dual-role ship being fitted for both minelaying and for amphibious transport* (Turkish Navy)

QUI NONH (LST 1-1152)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Vietnam
Type: LST 1-1152

Class: QUI NONH

Active: 3

Displacement:
full load: 3,698 t (1-541 class); 4,145 t (542-1152 class)

Dimensions
Length: 100 m (328 ft)
Beam: 15.3 m (50 ft)
Draught: 4.3 m (14 ft)

Speed: 11 kts
Range: 6,000 n miles at 10 kts

Complement: 110

SHIPS

Class 1-541

QUI NONH (HQ 501)

Builder	Jeffersonville B & M Co, Jeffersonville, Indiana, USA
Launched	23 Nov 1943
Commissioned (US Navy)	8 Jan 1944 ((LST 509) later named *Bullock County*)
Transferred (South Vietnam)	1 Apr 1970
Captured (North Vietnam)	1975/76

Class 542-1152

VUNG TAU (HQ 503)

Builder	Chicago Bridge & Iron Co, Seneca, Illinois, USA
Launched	14 Mar 1944
Commissioned (US Navy)	15 May 1944 ((LST 603) later named *Cochino County*)
Transferred (South Vietnam)	Jul 1969
Captured (North Vietnam)	1975/76

DA NANG (HQ 505)

Builder	Bethlehem Steel Co, Hingham, Massachusetts, USA
Launched	15 Aug 1944
Commissioned (US Navy)	9 Sep 1944 ((LST 938) later named *Maricopa County*)
Transferred (South Vietnam)	Jul 1962
Captured (North Vietnam)	1975/76

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 200 approximately
- Tanks: 10-30, depending on size
- Total payload:

	LST 1-591	LST 542-1152
Beaching	500 tonnes	377 tonnes
Ocean-going	2,100 tonnes	1,900 tonnes

SHIP-SHORE LIFT

- LCVPs: Two, four or six, depending on number of davits fitted

AVIATION FACILITIES

- Helicopter can land on foredeck, if not occupied by vehicles or landing craft

AMPHIBIOUS FACILITIES

- Twin, vertically hinged clamshell doors with internal ramp
- Tank deck: 87.8 × 91 m (288 × 30 ft)
- Upper (vehicle) deck:
  area: 500 m²
  maximum total load: 350 tonnes
  maximum individual load: 10 tonnes
- Access to upper deck:
  LST 1-512 – elevator: 7.24 × 4.27 m (23.75 × 14 ft)
  LST 513-1152 – ramp: 4.27 m (14 ft) wide
- Pontoons: Two lashed to ship's sides

WEAPONS SYSTEMS

GUNS

Four 37 mm/63 cannon

There are four 37 mm/63 cannon. These are probably Russian-supplied weapons, with a 62.8 calibre weapon in an open, locally controlled mount.

Specifications
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 880 m/s (2,886 ft/s)

Traverse: 360° at 20°/s
Elevation: −10 to +85° at 15°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,840 ft)
Crew: 6

Qui Nonh *(HQ 501), one of three ex-US Navy LSTs seized by North Vietnamese forces in 1975 and impressed into the Vietnamese Navy* (T Hollingsbee)

COMMAND AND CONTROL SYSTEMS

RADAR

There may be a navigational radar; type unknown.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 12-567A diesels, 1.34 MW (1,800 hp)
Shafts: 2

FURTHER INFORMATION

During the Vietnam War, six LSTs were supplied by the USA to the navy of South Vietnam, which served until that country's collapse. Two escaped to the Philippines, where they were eventually absorbed into the Philippines Navy, while the other four were captured by the North Vietnamese Army as it overran the south. One of those has been discarded, possibly for use as a source of spares, but the remaining three are still in service, albeit they are reported to be in a poor state.

The six LSTs supplied to South Vietnam and their fate are shown below:

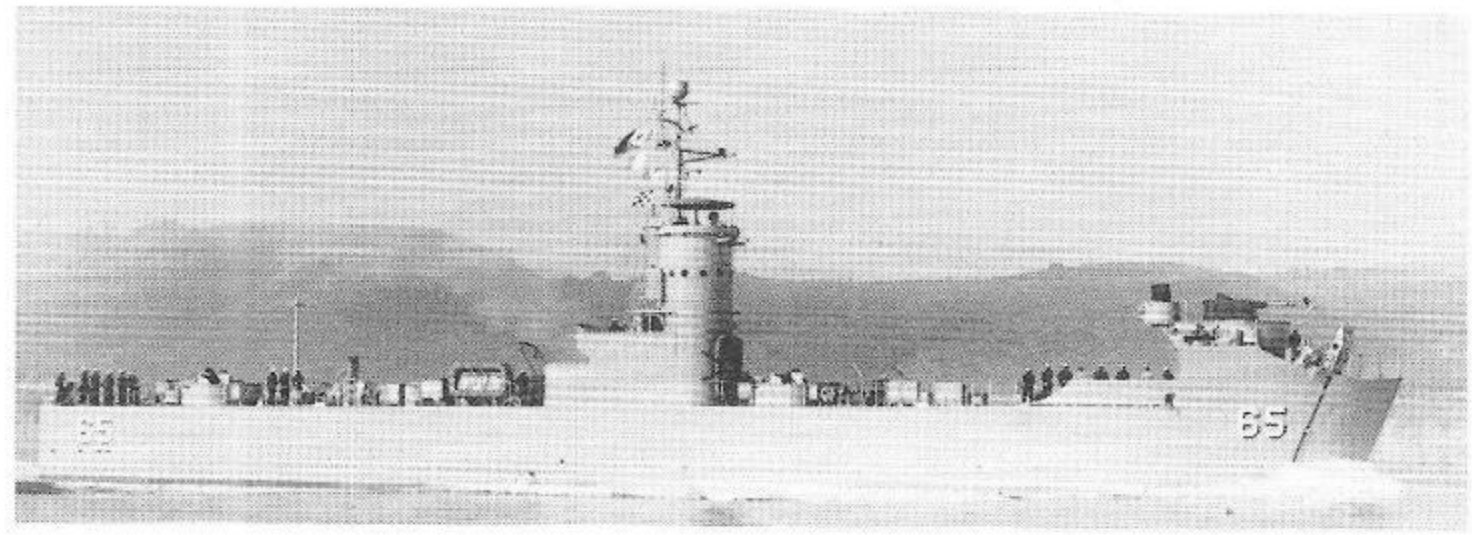
USN	Transferred to South Vietnam		Fate at fall of South Vietnam		Current status
	Name (number)	Date of transfer	Event	Disposal	
LST 975 *(Marion County)*	*Cam Ranh* (HQ 500)	1962	Escaped to Philippines	Philippines Navy *Zamboanga del Sur* (LT 86)	In service
LST 938 *(Maricopa County)*	*Da Nang* (HQ 501)	1962	Captured by North Vietnam	Vietnamese Navy HQ 505	In service
LST 529 *(Cayuga County)*	*Thi Ngai* (HQ 502)	1963	Escaped to Philippines	Philippines Navy *South Cotabato* (LT 87)	In service
LST 603 *(Cochino County)*	*Vung Tau* (HQ 503)	1969	Captured by North Vietnam	Vietnamese Navy HQ 503	In service
LST 509 *(Bullock County)*	*Qui Nonh* (HQ 504)	1970	Captured by North Vietnam	Vietnamese Navy HQ 501	In service
LST 484 *(Jerome County)*	*Hua Trang* (HQ 505)	1970	To North Vietnam	Believed scrapped	–

LSM 1

OVERVIEW

Like the Class 1-1152 tank landing ships, the 'LSM 1' medium landing ships are survivors of a class built in the hundreds during the Second World War. The design was a combination of the LSTs and the stern-loading LCT Mk 6 landing craft, and was originally designated the LCT Mk 7. The ships were designed to work with the ocean-going LCI(L)s, carrying five medium or three heavy tanks, or six LVTs, or nine DUKWs, to a maximum load of 165 tonnes to maintain the landing draught. The tank deck ran the length of the ship, but did not have a stern gate; the Ro-Ro idea was to come later. They would also hold 48 troops, including two officers, while the bulk of the troops, 200 at a time, travelled in the LCI(L)s. In their original form, they carried one 40 mm and four 20 mm mounts (or sometimes just six 20 mm). The mounts were in pairs, one on each side at bow and stern especially high at the bow to overcome the ramp, with another pair just in front of the small bridge with the starboard mounting further forward than the port one. The ships had minimal armour-plating around the guns, the conning station and on the sides of the pilothouse.

Like the LSTs, they were built to varying standards by shipyards, heavy engineering works and other companies across the USA, many of them with little experience of shipbuilding. Some of the LSMs were converted during wartime to serve as rocket ships (LSM (R) for support of amphibious forces in the Mediterranean. 525 LSMs were completed, and another 59 were converted to LSM(R).



The classic LSM 1, instantly recognisable by its unique tall, circular bridge. It also has a long, open tank deck and clamshell bow doors (H & L van Ginderen Collection)

The survivors from World War Two faded rather more quickly from the scene than the LSTs because their size made them less amenable to conversion to cargo carrying. Relatively few of them survived in the US Navy fleet for more than a few years, though some saw service in Korea in the early 1950s and a small number lasted long enough to be given names in 1955.

Many found their way into foreign navies, but their numbers have been steadily decreasing over the past decade and there are now just 15 known survivors, with a further two on non-amphibious duties: one is on mine-laying duties: for the Turkish Navy, the other, a gift from Argentina in 1982, is operated as an auxiliary by the navy of Paraguay, a country without a seaboard.

IPOPLOIARHOS ROUSSEN (LSM 1)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Greece
Type: LSM 1

Class: IPOPLOIARHOS ROUSSEN

Displacement:
beaching: 754 t
full load: 1,112 t

Dimensions
Length: 62.1 m (203.5 ft)
Beam: 10.4 m (34.2 ft)
Draught: 2.5 m (8.3 ft)
Beaching draught: 1.1 m (3.5 ft) forward; 2.2 m (7 ft) aft

Speed: 13.2 kts
Range: 4,900 n miles at 12 kts

Complement: 60

SHIPS

IPOPLOIARHOS ROUSSEN (L 164)
Builder Charleston Navy Yard, Charleston, USA
Commissioned (US Navy) 13 Aug 1945 (LSM 399)
Transferred to Greece 3 Nov 1958

IPOPLOIARHOS KRYSTALIDIS (L 165)
Builder Brown Shipbuilding, Houston, Texas, USA
Commissioned (US Navy) 7 Dec 1945 (LSM 541)
Transferred to Greece 30 Oct 1958

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 48 (two officers, 46 men)
- Vehicles: 5 light tanks or 6 LVT
- Max payload: 165 tonnes

SHIP-SHORE LIFT

- None, unless LVT embarked.

AMPHIBIOUS FACILITIES

- Clamshell doors and internal ramp 4.27 m (14 ft) wide
- Tank deck 43.6 × 5.5 m (143 × 18 ft) (unobstructed)
- Kedge anchor at stern

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

Two 40 mm/60 automatic cannon in a single twin mounting for air defence roles which may also be used to engage surface targets. Although described as a 60 calibre weapon it is, in fact, a 56.25 calibre gun.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,889 ft/s) (new gun); 850 m/s (2,788 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,632 ft)
Rate of fire: 60 rds/min (practical), 120 rds/min (cyclic)
Ammunition weight: 2.21 kg (4.8 lb)

Oerlikon 20 mm cannon

Eight Oerlikon 20 mm cannon.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,738 ft/s)
Range:
anti-surface: 0.8 n miles (1.5 km)
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

Mounting
Elevation: −15 to +90°
Total weight: 497 kg (1,095 lb) (including shield)

COMMAND AND CONTROL SYSTEMS

RADAR

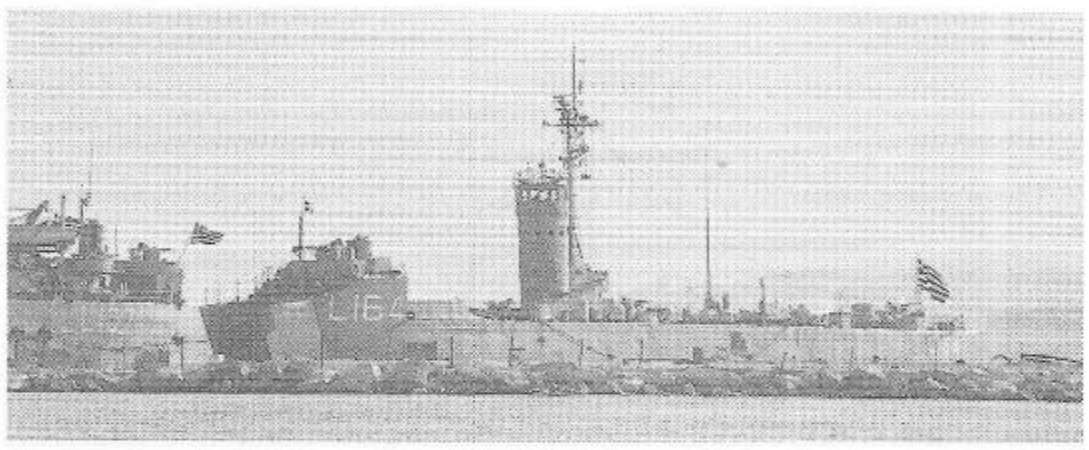
Racal-Decca
One Racal-Decca, I-band, navigation radar is carried; type unknown.

PROPULSION

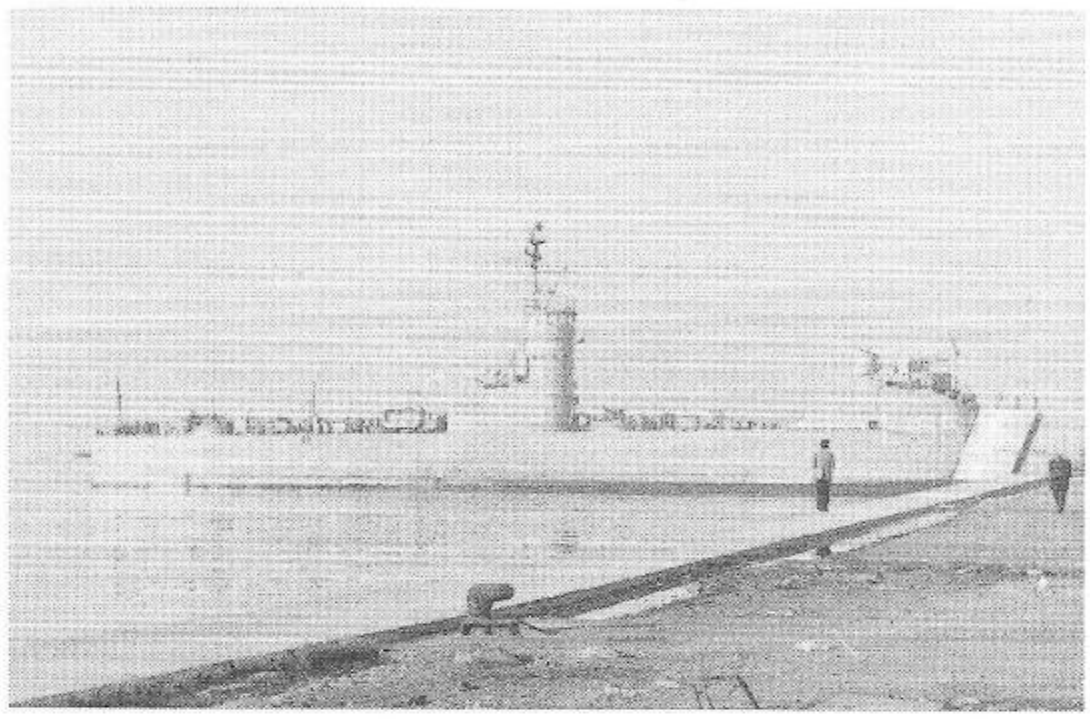
Specifications
System: Diesel
Main machinery:
***Ipoploiarhos Roussen* (L 164) only:** 2 General Motors GM 16-278A diesels, 2.24 kW (3,000 hp)
***Ipoploiarhos Krystalidis* (L 165) only:** 2 Fairbanks-Morse 38D8-⅛-10 diesels, 2.64 MW (3,540 hp) sustained
Shafts: 2

FURTHER INFORMATION

These are the last two survivors of a group of six handed over in two separate ceremonies in Autumn 1958. All were named after wartime Greek naval heroes. (Note: *ipoploiarhos* = lieutenant).



Ipoploiarhos Roussen *(L 164) is one of the two remaining LSM 1s in the Hellenic Navy. The unique cylindrical conning tower was designed to enable the bridge staff to see over the guns on the forecastle* (H & L van Ginderen Collection)



Ipoploiarhos Krystalidis *(L 165) (now stricken) showing the large bow doors* (H & L van Ginderen Collection)

KO MUN

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Korea, South
Type: LSM 1

Class: KO MUN

Acquired:
Active: 7

Displacement:
beaching: 754 t
full load: 1,112 t

Dimensions
Length: 62.1 m (203.5 ft)
Beam: 10.4 m (34.2 ft)
Draught: 2.5 m (8.3 ft)

Beaching draught: 1.1 m (3.5 ft) forward; 2.2 m (7 ft) aft

Speed: 13.2 kts
Range: 4,900 n miles at 12 kts

Complement: 75

SHIPS

KO MUN (LSM 655)
Builder Brown Shipbuilding, Houston, Texas, USA
Commissioned (US Navy) 1 Jul 1944 as LSM 30
Transferred on lease (South Korea) 1956
Purchased 15 Nov 1974

PI AN (LSM 656)
Builder Brown Shipbuilding, Houston, Texas, USA
Commissioned (US Navy) 28 Oct 1944 as LSM 96
Transferred on lease (South Korea) 1956
Purchased 15 Nov 1974

WOL MI (LSM 657)
Builder Brown Shipbuilding, Houston, Texas, USA
Commissioned (US Navy) 17 Aug 1944 as LSM 57
Transferred on lease (South Korea) 1956
Purchased 15 Nov 1974

KI RIN (LSM 658)
Builder Brown Shipbuilding, Houston, Texas, USA
Commissioned (US Navy) 14 Jun 1944 as LSM 19
Transferred on lease (South Korea) 1956
Purchased 15 Nov 1974

NUNG RA (LSM 659)
Builder Brown Shipbuilding, Houston, Texas, USA
Commissioned (US Navy) 7 Oct 1944 as LSM 84
Transferred on lease (South Korea) 1956
Purchased 15 Nov 1974

SIN MI (LSM 661)
Builder Pullman Standard Car Co, Chicago, Illinois, USA
Commissioned (US Navy) 21 Jul 1944 (LSM 316)
Transferred on lease (France) late 1940s (L 9014)
Returned to USA early 1950s

Transferred on lease (South Korea) 1956
Purchased 15 Nov 1974

UL RUNG (LSM 662)
Builder Brown Shipbuilding, Houston, Texas, USA
Commissioned (US Navy) 12 Jun 1944 as LSM 17
Transferred on lease (France) late 1940s (L 9017)
Returned to USA early 1950s
Transferred on lease (South Korea) 1956
Purchased 15 Nov 1974

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 48 (two officers, 46 men)
- Vehicles: 5 light tanks or 6 LVT
- Max payload: 165 tonnes

SHIP-SHORE LIFT

- None, unless LVT embarked.

AMPHIBIOUS FACILITIES

- Clamshell doors and internal ramp 4.27 m (14 ft) wide
- Tank deck 43.6 × 5.5 m (143 × 18 ft) (unobstructed)
- Kedge anchor at stern

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

Two 40 mm/60 automatic cannon in a single twin mounting for air defence roles which may also be used to engage surface targets. Although described as a 60 calibre weapon it is, in fact, a 56.25 calibre gun.

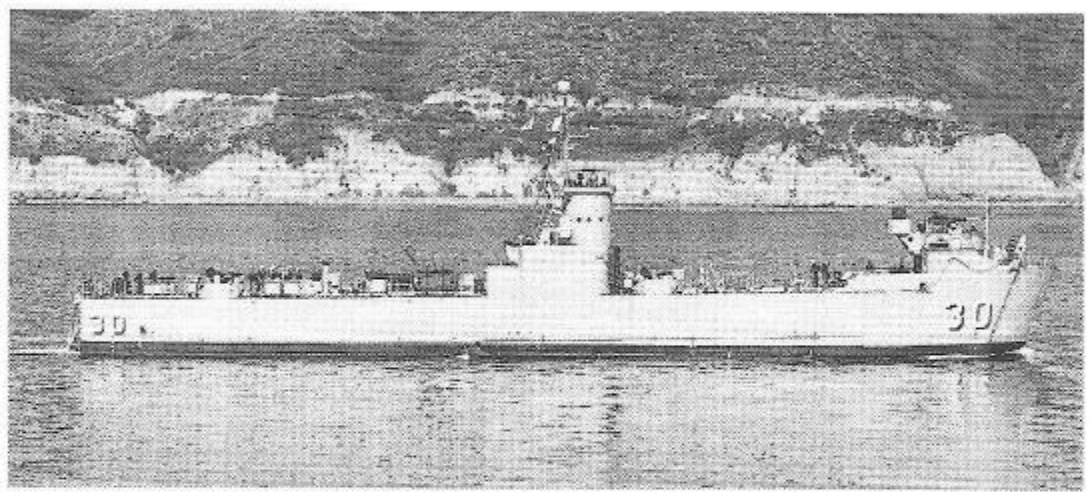
Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,889 ft/s) (new gun); 850 m/s (2,788 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,632 ft)
Rate of fire: 60 rds/min (practical), 120 rds/min (cyclic)
Ammunition weight: 2.21 kg (4.8 lb)

Oerlikon 20 mm cannon

Eight Oerlikon 20 mm cannon.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,738 ft/s)
Range:
anti-surface: 0.8 n miles (1.5 km)
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

Mounting
Elevation: −15 to +90°
Total weight: 497 kg (1,095 lb) (including shield)



Ko Mun *(LSM 655), one of eleven LSM 1s to serve with the RoK Navy, of which seven, including* Ko Mun *remain. This particular ship was first commissioned on 1 July 1944 and is thus in its 52nd year of service* (H & L van Ginderen Collection)

Pi An *(LSM 656)*

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Fairbanks-Morse 38D8-1/8-10 diesels, 2.64 MW (3,540 hp) sustained
Shafts: 2

AVIATION

None.

FURTHER INFORMATION

A total of 11 LSMs was transferred from the USA to South Korea in 1955/56. The last two to arrive, the present *Sin Mi* and *Ul Rung,* had earlier seen service with the French in Indo-China, serving as French Navy Nos L 9014 and L 9017 respectively.

MEI CHIN (LSM)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Taiwan
Type: LSM 1

Class: MEI CHIN

Displacement:
beaching: 754 t
full load: 1,112 t

Dimensions
Length: 62 m (203.5 ft)
Beam: 10.4 m (34.2 ft)
Draught: 2.5 m (8.3 ft)

Speed: 13 kts
Range: 2,500 n miles at 12 kts

Complement: 65-75

SHIPS

MEI CHIN (341)
Builder Charleston Navy Yard, Charlestone, South Carolina, USA
Commissioned (US Navy) 26 Jul 1944 (LSM 155)
Transferred to China (Taiwan) 1946

MEI SUNG (347)
Builder n/k
Commissioned (US Navy) 28 Mar 1946 (LSM 457)
Transferred to China (Taiwan) 1946

MEI PING (353)
Builder Brown Shipbuilding, Houston, Texas, USA
Commissioned (US Navy) 23 Feb 1945 (LSM 471)
Transferred (Taiwan) 1956

MEI LO (356)
Builder Brown Shipbuilding, Houston, Texas, USA
Commissioned (US Navy) 11 Jan 1945 (LSM 362)
Transferred (Taiwan) 1962

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

Two 40 mm/60 automatic cannon in a single twin mounting for air defence roles which may also be used to engage surface targets. Although described as a 60 calibre weapon it is, in fact, a 56.25 calibre gun.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,889 ft/s) (new gun); 850 m/s (2,788 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,632 ft)
Rate of fire:
(practical): 60 rds/min
(cyclic): 120 rds/min
Ammunition weight: 2.21 kg (4.8 lb)

Oerlikon 20 mm cannon

Four or eight Oerlikon 20 mm cannon.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,738 ft/s)
Range:
anti-surface: 0.8 n miles (1.5 km)
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

Mounting
Elevation: −15 to +90°
Total weight: 497 kg (1,095 lb) (including shield)

COMMAND AND CONTROL SYSTEMS

RADAR

SO 8

SO-8 is an I-band surface search/navigation radar.

PROPULSION

Specifications
System: Diesel
Main machinery:
***Mei Chin* (341) and *Mei Sung* (347) only:** 4 GM 16-278 A diesels, 2.24 MW (3,000 hp)
***Mei Ping* (353) and *Mei Lo* (356) only:** 2 Fairbanks-Morse 38D8-⅛-10 diesels, 2.64 MW (3,540 hp) sustained
Shafts: 2

FURTHER INFORMATION

The Republic of China Navy (RoCN) has received 16 LSMs from the US Navy, some as early as 1946. Four now survive and of the other 12 one was hit by artillery fire from mainland China in 1958 and had to be beached on Quemoy Island and abandoned, and the remainder were stricken in the early 1970s.

It appears that, as with other RoCN vessels, some names and numbers have been changed over the years, resulting in some confusion.

The remaining four ships have been extensively rebuilt in Taiwan and have several unique features including a square bridge, which has replaced the characteristic round pilothouse.

KUT (LSM)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Thailand
Type: LSM 1

Class: Kut

Purchased: 3
Active: 2

Displacement:
standard: 754 t
full load: 1,124 t

Dimensions
Length: 62 m (203.5 ft)
Beam: 10.5 m (34.5 ft)
Draught: 3 m (9.9 ft)

Speed: 12.5 kts
Range: 4,500 n miles at 12.5 kts

Complement: 91, including six officers

SHIPS

KUT (731)
Builder Pullman Standard Car Co, Chicago, Illinois, USA
Commissioned (US Navy) 10 Jan 1945 (LSM 338)
Transferred (Thailand) October 1946
Commissioned (US Navy) 17 Mar 1945 (LSM 469)
Transferred (Thailand) 25 May 1962

KRAM (732)
Builder Brown Shipbuilding Co, Houston, Texas, USA

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 48 (two officers, 46 men)
- Vehicles: 5 light tanks or 6 LVT
- Max payload: 165 tonnes

SHIP-SHORE LIFT

- None, unless LVT embarked.

AMPHIBIOUS FACILITIES

- Clamshell doors and internal ramp 4.27 m (14 ft) wide
- Tank deck 43.6 × 5.5 m (143 × 18 ft) (unobstructed)
- Kedge anchor at stern

WEAPONS SYSTEMS

Bofors 40 mm/60

Two 40 mm/60 automatic cannon in a single twin mounting for air defence roles which may also be used to engage surface targets. Although described as a 60 calibre weapon it is, in fact, a 56.25 calibre gun.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s) (new gun); 850 m/s (2,789 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,638 ft)
Rate of fire:
(practical): 60 rds/min
(cyclic): 120 rds/min
Ammunition: 2.21 kg (4.8 lb)

Oerlikon 20 mm cannon

Four or eight Oerlikon 20 mm cannon.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,773 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

Mounting
Elevation: −15 to +90°
Total weight: 497 kg (1,096 lb) (including shield)

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Mk 51 Mod 2 optical director

In *Kram* (732) only.

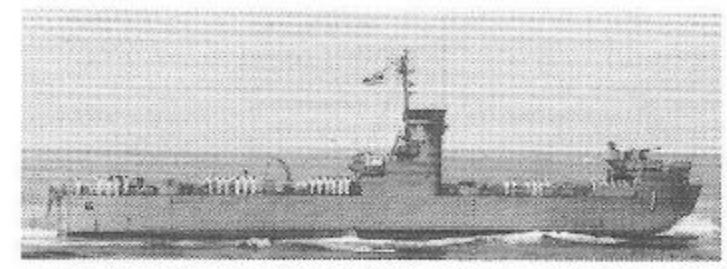
RADARS

Raytheon AN/SPS-5

In *Kram* (732) only. AN/SPS-5 is a Raytheon H-band (6,400 MHz) surface search and navigation radar. It was introduced into US Navy service during the early 1950s and was fielded in at least five variants.

Raytheon 1500B

The 1500B is an I-band, navigation radar. it is the export version of the US Navy's AN/SPS-35 and AN/SPN-21 radar family, used primarily in small craft from the mid-1950s.



Kut of the RTN. At the time of this picture it was designated 'LSM 1' but has since been renumbered '731'

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Fairbanks-Morse 38D8-1/8-10 diesels, 2.64 MW (3,540 hp) sustained
Shafts: 2

FURTHER INFORMATION

Three LSMs have been transferred to the Royal Thai Navy (RTN); two in October 1946 and the third in May 1962. *Phai* (ex-LSM 333) was stricken in 1990 but two are still in service.

TERREBONNE PARISH

OVERVIEW

The first US Navy post-war LSTs were just two ships: *Talbot County* (LST 1153) and *Tallahatchie County* (LST 1154), which were commissioned in 1947 and 1949, respectively. They offered greater comforts and increased cargo-carrying capacity, but were driven by Westinghouse steam turbines, and their operational lives were relatively short. They were followed by the very similar, but diesel-powered, 'Terrebonne Parish' class, of which 15 were launched between 1952 and 1954.

Like LSTs 1153 and 1154, the 'Terrebonne Parish' class had extra cargo/troop-carrying capacity, a powered vehicle turntable, greater capacity ramps, hydraulic bow doors, and carried side-slung pontoon causeways. The class still, however, failed to reach the required amphibious squadron speed of 20 kts, and although it achieved a respectable 15 years' service as a front-line ship in the US Navy, it was rapidly overtaken in terms of both speed and capacity. By the early 1970s, virtually the whole class had been relegated to more general cargo carrying duties from which many of them were sold into foreign navies and seven are still operational.

Ship	Pennant Number	Launched	Fate	New name	Fate
Terrebonne Parish	LST 1156	1952	1971 – to Spain	*Velasco* (L 11)	1994 – stricken
Terrell County	LST 1157	1952	1971 – to Greece	*Inouse* (L 104)	Extant 1997
Tioga County	LST 1158	1953	stricken	–	–
Tom Green County	LST 1159	1953	1972 – to Spain	*Conde de Venadito* (L13)	1990 – stricken
Traverse County	LST 1160	1953	1984 – to Peru	*Eten* (DT 144)	Extant 1997
Vernon County	LST 1161	1952	1973 – to Venezuela	*Amazonas* (T 51)	stricken 1993
Wahkiakum County	LST 1162	1953	stricken	–	–
Waldo County	LST 1163	1953	1984 – to Peru	*Pisco* (DT 142)	deleted 1995 (cannibalised for spares
Walworth County	LST 1164	1953	1984 – to Peru	*Paita* (DT 141)	Extant 1997
Washoe County	LST 1165	1953	1984 – to Peru	*Calao* (DT 143)	Extant 1997
Washtenaw County	LST 1166	1952	1973 – converted to MCMV 1973 – stricken	–	–
Westchester County	LST 1167	1953	1974 – to Turkey	*Serdar* (L 402)	Extant 1997
Wexford County	LST 1168	1953	1971 – to Spain	stricken	–
Whitfield County	LST 1169	1953	1977 – to Greece	*Kos* (L 116)	Extant 1997
Windham County	LST 1170	1954	1973 – to Turkey	*Ertugrul* (L 401)	Extant 1997

INOUSE (TERREBONNE PARISH)

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Greece
Type: Terrebonne Parish (LST)

Class: INOUSE

Purchased: 2
Active: 2

Displacement:
light: 2,590 t
full load: 5,800 t

Dimensions
Length: 117.1 m (384 ft)
Beam: 16.8 m (55 ft)
Draught: 5.2 m (17 ft)

Speed: 15 kts
Range: 15,000 n miles at 9 kts

Complement: 115

SHIPS

INOUSE (L 104)

Builder	Bath Iron Works Corporation, Bath, Maine, USA
Launched	6 Dec 1952
Commissioned (US Navy)	19 Mar 1953 (*Terrell County* (LST 1157))
Sold (Greece)	17 March 1977

KOS (L 116)

Builder	Christy Corporation, Sturgeon Bay, Wisconsin, USA
Launched	22 Aug 1953
Commissioned (US Navy)	14 Sep 1954 (*Whitfield County* (LST 1169))
Sold (Greece)	17 March 1977

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 400
- Cargo: 2,000 tonnes

SHIP-SHORE LIFT

- Four LCVPs

AMPHIBIOUS FACILITIES

- Two clamshell, vertically hinged doors
- Kedge anchor at stern

WEAPONS SYSTEMS

GUNS

US Navy 76 mm (3 in)/50 guns

There are three twin, open mountings: two on the forecastle and one above the stern, aft. The weapons use 50 calibre Mk 22 barrels in the Mk 33 twin-barrel mounting, and can be either under local or remote control. Each mount has a Mk 51 Mod 5 gun fire-control system.

Specifications

Gun
Calibre: 76.2 mm (3 in)
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,700 ft/s) (new); 808 m/s (2,651 ft/s) (mid-life)
Range: 7 n miles (13 km)
Altitude: 8,951 m (29,367 ft)
Ammunition: 10.9 kg (24.0 lb)

Mk 33 Mounting
Traverse: 360° at 30°/s
Elevation: −14/15 to +85° at 24°/s
Rate of fire: 100 rds/min

Rheinmetall Rh-20 20 mm cannon

These ships mount three Rheinmetall Rh-202 20 mm cannon.

Specifications

Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445 – 4,101 ft/s)
Traverse: 360°
Elevation: −10 to +55°
Crew: 1-2
Range: 1 n mile (1.85 km)
Rate of fire: 800-1000 rds/min

Manufacturer/Contractor
Rheinmetall, Germany.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Mk 63 Gun Fire Control System (GFCS)

There are two Mk 63 GFCS, which consist of an antenna assembly fitted to the gun mounting, a manned Mk 29 optical sight and below-decks equipment. The radar is the Mk 34.

RADARS

Raytheon AN/SPS-10

The surface search radar is the Raytheon AN/SPS-10 G/H-band (4 to 8 GHz) radar which was introduced into US Navy service during late 1953.

Manufacturer/Contractor
Raytheon, USA.

Mk 34

The Mk 34 I/J-band radar is the search/tracking element of the Mk 63 GFCS. It has a 76.2 cm (30 in) dish which elevates between −15 and +85° and produces a 3 × 3° spiral scan beam for target acquisition and a 0.75° conical scan beam for target tracking. Range against large air targets is approximately 13.5 n miles (25 km) with an accuracy of 200 m (656 ft) in bearing and 2.25° in elevation. Peak power is 35 kW and pulse duration is 0.3 µs with a PRF of 1,800 pps.

Racal-Decca

There is one Racal-Decca, I-band navigational radar.

PROPULSION

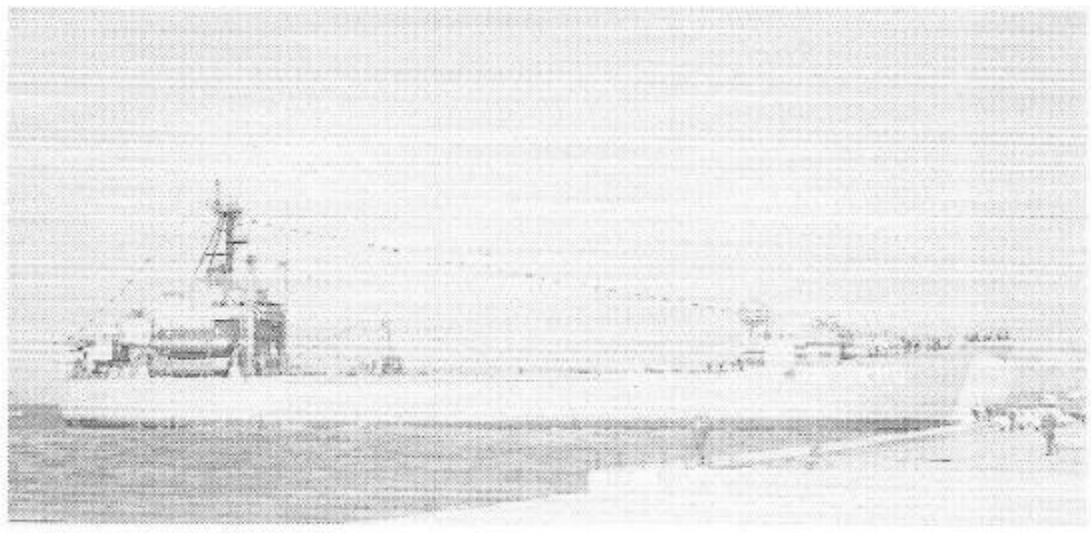
Specifications

System: Diesel
Main machinery: 4 General Motors GM 16-278A diesels, 4.48 MW (6,000 hp)
Shafts: 2
Propellers: Controllable pitch

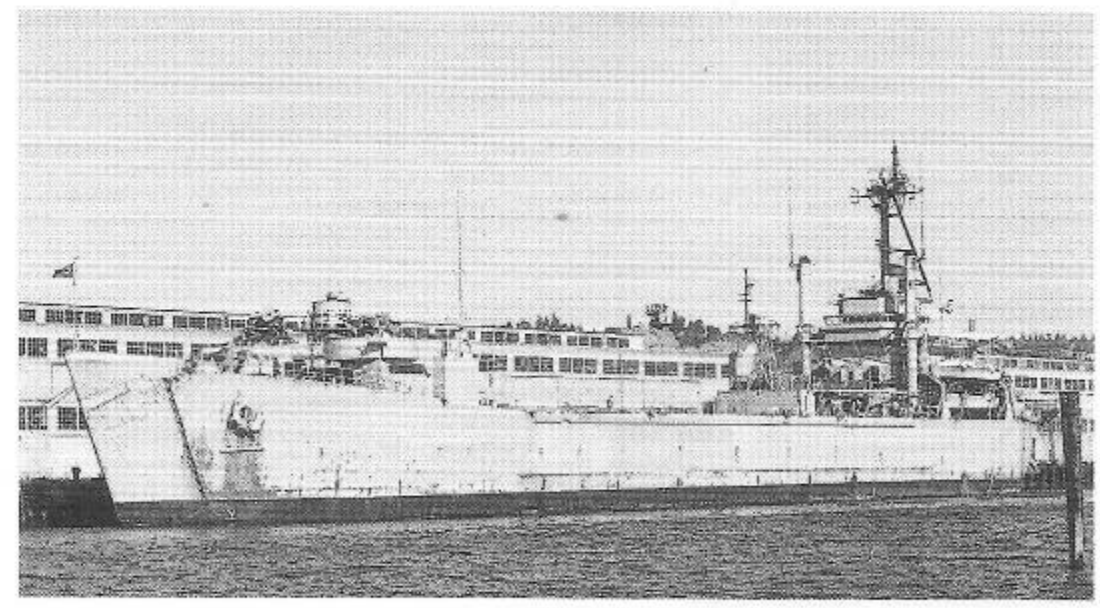
FURTHER INFORMATION

These two ships were purchased on 17 March 1977 and were modernised following arrival in Greece. It was originally intended to buy a further two, but this did not happen.

The Greek Navy is taking delivery, very slowly, of its own 'Jason' class of LSTs, but the intention is that the Jasons should replace the '1-1152' class LSTs before the Terrebonne Parish ships. These two ships, therefore, appear to have several more years of service ahead of them.



Kos *(L116) was formerly the US Navy's* Whitfield County *(LST 1169) and was transferred to the Hellenic Navy in March 1977* (H & L van Ginderen Collection)



Turkish LST Serdar *(L402)* (H & L van Ginderen Collection)

PAITA (TERREBONNE PARISH)

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Peru
Type: Terrebonne Parish (LST)

Class: PAITA

Purchased: 3
Active: 3

Displacement:
standard: 2,590 t
full load: 5,800 t

Dimensions
Length: 117.1 m (384 ft)
Beam: 16.8 m (55 ft)
Draught: 5.2 m (17 ft)

Speed: 15 kts
Range: 15,000 n miles at 9 kts

Complement: 116

SHIPS

PAITA (DT 141)		**CALLAO** (DT 143)		**ETEN** (DT 144)	
Builder	Ingalls Shipbuilding, Pascagoula, Mississippi, USA	**Builder**	Ingalls Shipbuilding, Pascagoula, Mississippi, USA	**Builder**	Bath Iron Works, Bath, Maine, USA
Launched	18 May 1953	**Launched**	14 Jul 1953	**Launched**	3 Oct 1953
Commissioned (US Navy)	26 Oct 1953 (*Walworth County* (LST 1164))	**Commissioned**	30 Nov 1953 as *Washoe County* (LST 1165)	**Commissioned (US Navy)**	19 Dec 1953 (*Traverse County* (LST 1160))
Leased (Peru)	7 Aug 1984	**Leased (Peru)**	7 Aug 1984	**Leased (Peru)**	7 Aug 1984
Recommissioned	4 Mar 1985	**Recommissioned**	4 Mar 1985	**Recommissioned**	4 Mar 1985

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 395 troops
- 2,000 tonnes

Hangar: None
Helicopter: Aircraft likely to operate from these ships include Agusta 109A and four Bell 206B assault helicopters of the Marine Corps

SHIP-SHORE LIFT

- 4 LCVP on davits

AVIATION FACILITIES

Specifications
Flight deck: On foredeck

AMPHIBIOUS FACILITIES

- Clamshell, vertically hinged bow doors
- Kedge anchor at stern

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

There are three quadruple 40 mm Bofors Mk 2 mountings. The Mk 2 mounting has two pairs of guns 1.524 m (5.0 ft) apart, with a 7.5 hp training motor on the right-hand side of the mounting at the trainer's feet and a 5 hp elevation motor at the feet of the gunlayer who also controls the operation of both pairs of guns. The guns are also slaved in elevation. There is a US Mk 51 Mod 2 optical gun fire-control system with each mounting.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s) (new gun); 850 m/s (2,789 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,637 ft)
Rate of fire: 80 rds/min (practical); 160 rds/min (cyclic) for water-cooled weapons
Ammunition: 2.21 kg (4.9 lb)

Mountings
Traverse: Nominal 360° at 30° /s
Elevation: −15 to 85/90° at 24°/s
Crew:
twin mount: 4
quad mount: 11

COMMAND AND CONTROL SYSTEMS

RADAR

Raytheon AN/SPS-10

Specifications
Frequency: G/H-band (4 to 8 GHz)

Role: Surface search radar
Max power: 500 kW
Pulse repetition frequency: 625-660 pps
Navigation: I-Band

Manufacturer/Contractor
Raytheon, USA.

PROPULSION

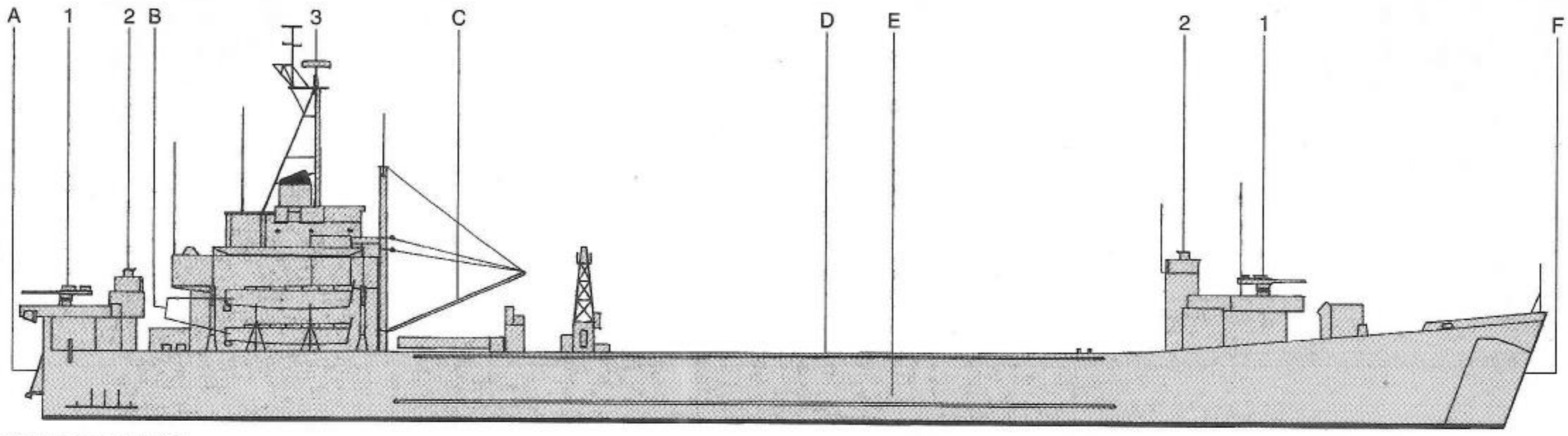
Specifications
System: Diesel
Main machinery: 4 General Motors GM 16-278A diesels, 4.48 MW (6,000 hp)
Shafts: 2

FURTHER INFORMATION

All four ships were taken out of commission by the US Navy in 1972 and were transferred to Military Sealift Command, for which they were disarmed. They were then put into reserve for a short period before being leased to Peru. They were refurbished by Todd Shipyard, San Francisco, USA, prior to delivery, but the US weapons were not restored and the weapons now mounted were fitted after they arrived in Peru.

The four ships were acquired from the USA in 1984 on a five year lease, which was extended for a further five years in 1989 and for yet another five years in 1994. Three ships remain operational, while the fourth, *Pisco* (DT 142) (ex-*Waldo County* (LST 1163)), is now being used as a source of spares to keep the other three going.

ERTUGRUL (TERREBONNE PARISH)



Terrebonne Parish
Amphibious A *Kedge anchor* **B** *LCVP (four)* **C** *Derricks (two)* **D** *Helicopter/vehicle deck* **E** *Tank deck* **F** *Clamshell bow doors with internal ramp*

General 1 *US Navy (twin) 76 mm (3 in)/50 gun (three)* **2** *GFCS Mk 63* **3** *Raytheon AN/SPS-10 surface search radar*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Turkey
Type: Terrebonne Parish (LST)

Class: ERTUGRUL

Acquired: 2
Active: 2

Displacement:
standard: 2,590 t
full load: 5,800 t

Dimensions
Length: 117.1 m (384 ft)
Beam: 16.8 m (55 ft)
Draught: 5.2 m (17 ft)

Speed: 15 kts
Range: 15,000 n miles at 9 kts

Complement: 163, including 14 officers

SHIPS

ERTUGRUL (L 401)
Builder Christy Corporation, Sturgeon Bay, Wisconsin, USA
Launched 22 May 1954
Commissioned (US Navy) 15 Dec 1954 (*Windham County* (LST 1170))
Leased (Turkey) 3 Oct 1973
Purchased (Turkey) 6 Aug 1987

SERDAR (L 402)
Builder Christy Corporation, Sturgeon Bay, Wisconsin, USA
Launched 18 Apr 1953
Commissioned (US Navy) 10 Mar 1954 (*Westchester County* (LST 1167))
Leased (Turkey) 24 Feb 1975
Purchased (Turkey) 6 Aug 1987

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 395 troops
- 2,200 tonnes of cargo

SHIP-SHORE LIFT

- Four LCVPs in davits

AVIATION FACILITIES

Specifications
Flight deck: The foredeck has been strengthened and can be used by helicopters
Hangar: None

AMPHIBIOUS FACILITIES

- Two large clamshell, vertically hinged doors
- Kedge anchor at stern

WEAPONS SYSTEMS

GUNS

US Navy 76 mm (3 in)/50 guns
There are three twin, open mountings, two on the forecastle and one above the stern, aft. The weapons use 50 calibre Mk 22 barrels in the Mk 33 twin-barrel mounting, and can be either under local or remote control. Each mount has a Mk 63 gun fire-control system.

Specifications
Gun
Calibre: 76.2 mm (3 in)
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,700 ft/s) (new); 808 m/s (2,651 ft/s) (mid-life)
Range: 7 n miles (13 km)
Altitude: 8,951 m (29,367 ft)
Ammunition: 10.9 kg (24.0 lb)

Mk 33 Mounting
Traverse: 360° at 30°/s
Elevation: −14/15 to +85° at 24°/s
Rate of fire: 100 rds/min

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca 1226
The Type 1226 navigation radar is part of the Solid State series with output of 20 kW. They have 30 cm (12 in) PPI (Plan Position Indicator) displays and come with 1.83 m (6.0 ft) antennas.

Specifications
Type 1226
Role: Navigation
Band: I
Range: 48 n miles (81 km)
Beam: 1.2°
Peak power: 25 kW

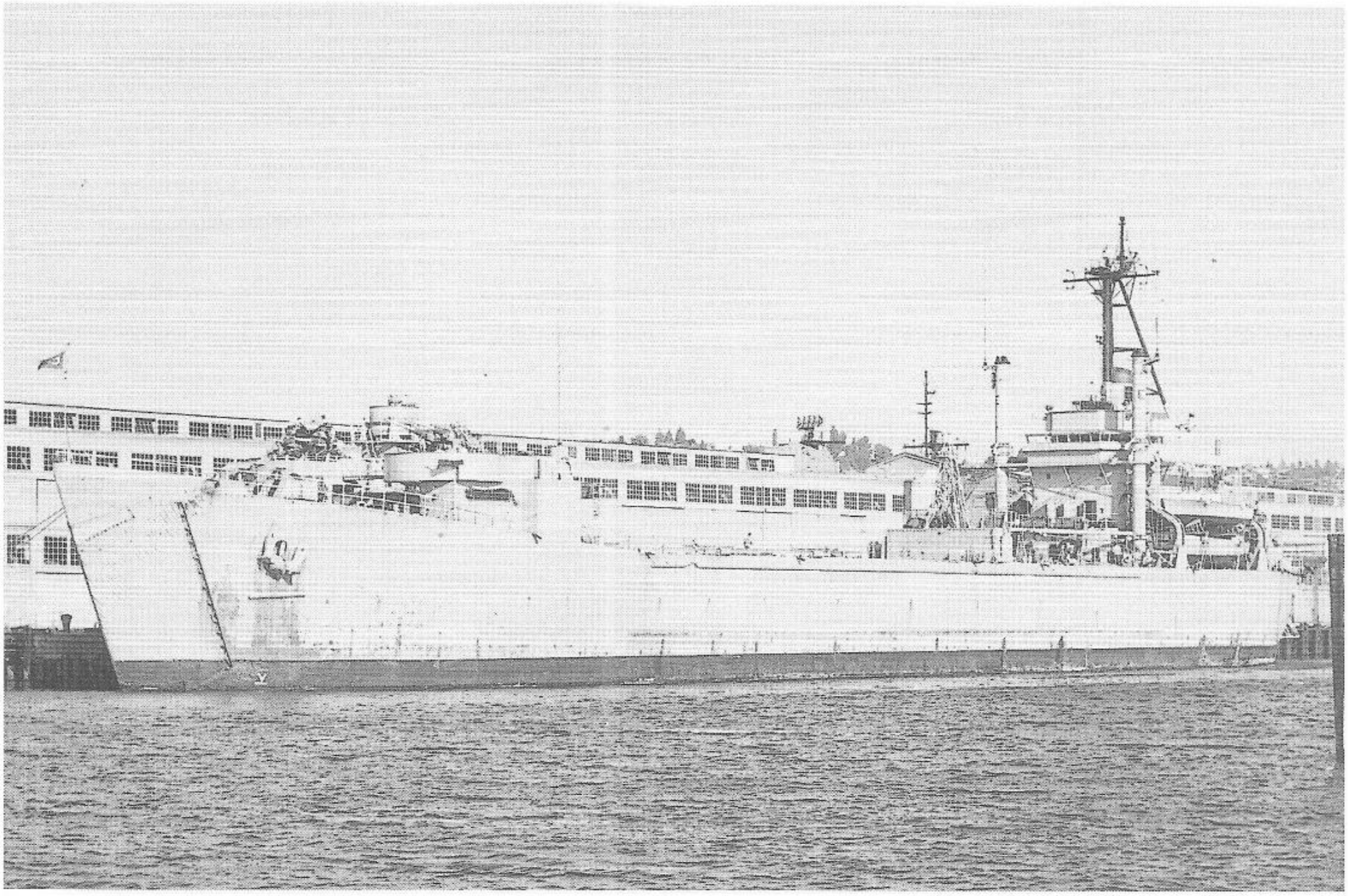
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm

Manufacturer/Contractor
Racal-Decca, UK.

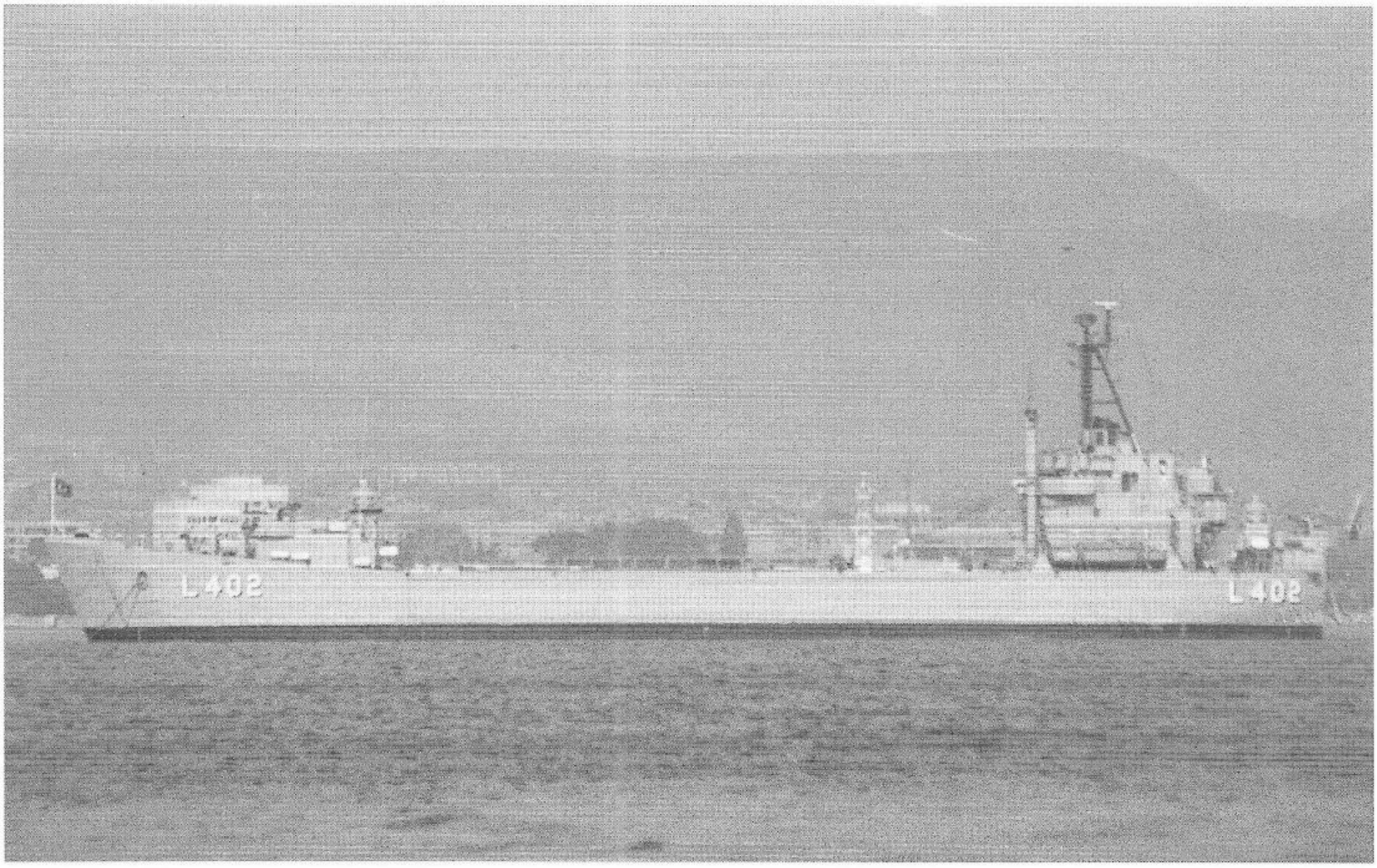
PROPULSION

Specifications
System: Diesel
Main machinery: 4 General Motors GM 16-278A diesels, 4.48 MW (6,000 hp)

Shafts: 2
Propellers: Controllable pitch



Serdar *(L 402) in 1975 at the time of being taken over by Turkey* (H & L van Ginderen Collection)



Serdar *(L 402) in 1995*

DE SOTO COUNTY

OVERVIEW

This was the first class of LSTs to be built for the US Navy after the end of the Second World War. They were larger and slightly faster than the wartime LSTs — despite more than twice the horsepower — and were considered the 'ultimate' in terms of conventional LST design with the traditional clamshell bow door configuration. The impression of luxury extended to air conditioning in the crew's quarters and the accommodation for troops. The speed achieved — 17 knots, still well short of the required 20 knots — was the result of using six diesel engines; initially, six Nordburgs, then the first four of the class were refitted with Fairbanks-Morse diesels, and the others with Cooper Bessemer engines, all giving 14,400 hp and 17.5 knots.

It had been planned to build sixteen ships, but the contract for the second group was never let, while the contract for the second ship in the first series was cancelled. Thus, the 'De Soto' class was just seven strong.

Increasing demands for higher speeds for faster deployment of troops meant that the working lives of the 'De Soto County' class ships were among the shortest of all US Navy amphibious craft. From the first launch in 1956 to the placing of the whole class into reserve took fewer than 16 years.

Six of the seven were transferred to foreign navies: two went to Italy, two to Greece, and one each to Brazil and Mexico. All have been scrapped except for the one Brazilian ship. The one that remained in US service was converted to a tender for 'Asheville' class patrol boats in the Mediterranean but was stricken in 1977.

There was, however, a surprising post-script to the De Soto County story when, more than a decade after the launch of the last US ship of the class, a modified version of the same design was produced for the Argentine Navy by the AFNE yard at Santiago. The *Cabo San Antonio* then took a further decade to be commissioned, but achieved its place in history when it carried the main Argentine assault force that invaded the Falkland (Malvinas) Islands in 1982. Though at sea in 1994, it is now thought to be non-operational.

CABO SAN ANTONIO (DE SOTO COUNTY)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Argentina
Type: De Soto County (LST)

Class: CABO SAN ANTONIO

Built: 1
Active: 1 (see 'Further Information')

Displacement:
standard: 4,164 t
full load: 8,000 t

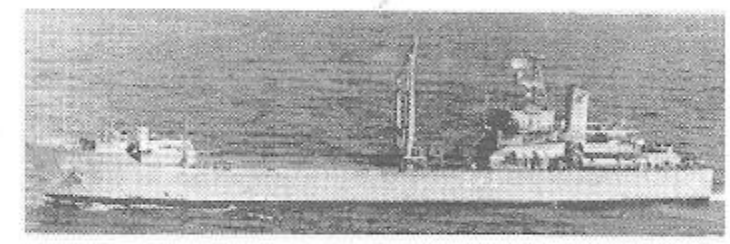
Dimensions:
Length: 144 m (472.3 ft)
Beam: 21 m (68.9 ft)
Draught: 3 m (9.8 ft)

Speed: 16 kts
Complement: 124

SHIPS

CABO SAN ANTONIO (Q 42)
Builder AFNE, Rio Santiago, Argentina
Launched 1968
Commissioned 2 Nov 1978

Cabo San Antonio *(Q 42) was built in Argentina to a slightly modified* De Soto County *design. It carried the vanguard of the invasion force for the landings on the Falkland (Malvinas) Islands in 1982*
(Argentine Navy)



AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 700 troops
- 23 medium tanks

SHIP-SHORE LIFT

- Eight LCVPs (each 36 troops or 3.5 tonnes)

AVIATION FACILITIES

Specifications
Flight deck: The foredeck has been strengthened and can be used to operate CH-47 Chinook helicopters.
Hangar: None

AMPHIBIOUS FACILITIES

- Clamshell bow doors with internal ramp
- Stülcken 60-tonnes heavy lift gear fitted
- Kedge anchor at stern

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60
The ship is armed with three quadruple 40 mm Bofors Mk 2 mountings. The Mk 2 mounting has two pairs of guns 1.524 m (5.0 ft) apart, with a 7.5 hp training motor on the right-hand side of the mounting at the trainer's feet and a 5 hp elevation motor at the feet of the gunlayer who also controls the operation of both pairs of guns. The guns are also slaved in elevation. There is a US Mk 51 Mod 2 optical gun fire-control system with each mounting.

Specifications
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s) (new gun); 850 m/s (2,789 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,637 ft)
Rate of fire: 80 rds/min (practical); 160 rds/min (cyclic) for water-cooled weapons
Ammunition: 2.21 kg (4.9 lb)

Mountings
Traverse, nominal: 360° at 30°/s
Elevation: −15 to 85/90° at 24°/s
Crew:
two mount: 4
quad mount: 11

Oerlikon 20 mm
Four Oerlikon 20 mm guns in two twin mountings.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca 1226

The Type 1226 navigation radar is part of the Solid State series with output of 20 kW. They have 30 cm (12 in) PPI (Plan Position Indicator) displays and come with 1.83 m (6.0 ft) antennas.

Specifications
Type 1226
Role: Navigation
Band: I
Range: 48 n miles (81 km)
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

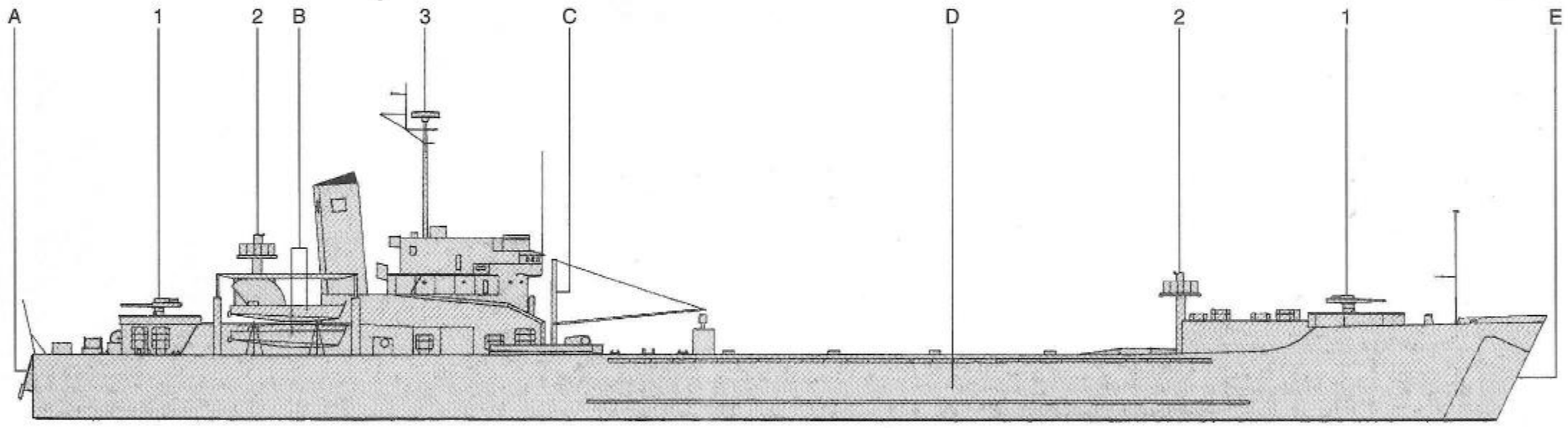
Specifications
System: Diesel
Main machinery: 6 diesels, 10.2 MW (13,700 hp)
Shafts: 2

FURTHER INFORMATION

The differences between the *Cabo San Antonio* and the original US-built De Soto County design are very small. The Argentine ship is more heavily armed and there are two 60 tonnes Stülcken heavy-lift cranes immediately forward of the superstructure (although the other surviving vessel in the class, the Brazilian *Duque de Caxias*, has also had this lifting gear fitted.)

Cabo San Antonio was the main unit in the amphibious task force taking part in Operation Rosario, the Argentine invasion of the Falkland Islands on 2 April 1982. The ship is based at Puerto Belgrano and although seen at sea in 1994 may well now be non-operational.

DUQUE DE CAXIAS (DE SOTO COUNTY)



Duque de Caxias
Amphibious A *Kedge anchor* **B** *LCVP (four)* **C** *Stülcken 60 tonne lifting gear* **D** *Tank deck* **E** *Clamshell doors with internal ramp*

General 1 *US Navy twin 76 mm (3 in)/50 guns (three)* **2** *Mk 51 Mod 5 GFCS* **3** *Raytheon SPS-21 surface search radar*

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Brazil
Type: De Soto County (LST)

Class: DUQUE DE CAXIAS

Purchased: 1
Active: 1

Displacement:
standard: 4,230 t
full load: 7,929 t

Dimensions
Length: 135.6 m (445 ft)
Beam: 18.9 m (62 ft)
Draught: 5.3 m (17.5 ft)

Speed: 16.5 kts
Range: 13,000 n miles at 10 kts

Complement: 175 including 11 officers

SHIPS

DUQUE DE CAXIAS (G 26)		**Transferred on lease**	
Builder	Avondale, New Orleans, USA	**(Brazil)**	15 Jan 1973
		Purchased (Brazil)	11 Feb 1980
Launched	12 Oct 1956		
Commissioned (US Navy)	8 Nov 1957 (*Grant County* (LST 1174))		

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 575 troops
- 75 tonnes of equipment

SHIP-SHORE LIFT

- Four LCVPs (carried on davits)

AVIATION FACILITIES

Specifications
Flight deck: Platform on foredeck

Hangar: None
Helicopters: Can be used by any current type of Brazilian troop-carrying helicopter: UH-14 Aerospatiale AS 332F1 Super Puma/AS 532 Cougar; UH-12 Aerospatiale AS 350B/350BA Ecureuil; UH-13 Aerospatiale AS 355F2 Ecureuil 2 or UH-6B Bell JetRanger III

AMPHIBIOUS FACILITIES

- Clamshell bow doors with internal ramp
- Has a Stülcken 60-tonnes heavy lifting gear fitted
- Kedge anchor at stern

WEAPONS SYSTEMS

GUNS

US Navy 76 mm (3 in/50 calibre) guns
There are three twin, open mountings; two on the forecastle and one aft. The weapons use 50 calibre Mk 22 barrels in the Mk 33 twin-barrel mounting, and can be either under local or remote control. Each mount has a Mk 51 Mod 5 gun fire-control system.

Specifications
Gun
Calibre: 76.2 mm (3 in)
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,700 ft/s) (new); 808 m/s (2,651 ft/s) (mid-life)
Range: 7 n miles (13 km)
Altitude: 8,951 m (29,367 ft)
Ammunition: 10.9 kg (24.0 lb)

Mk 33 Mounting
Traverse: 360° at 30°/s
Elevation: −14/15 to +85° at 24°/s
Rate of fire: 100 rds/min

COMMAND AND CONTROL SYSTEMS

RADARS

Raytheon AN/SPS-21
The surface search radar is the Raytheon AN/SPS-21. This elderly equipment operates in the G/H band and has a nominal range of 12 n miles (22 km).

Racal-Decca
There is one Racal-Decca navigation radar, type unknown.

PROPULSION

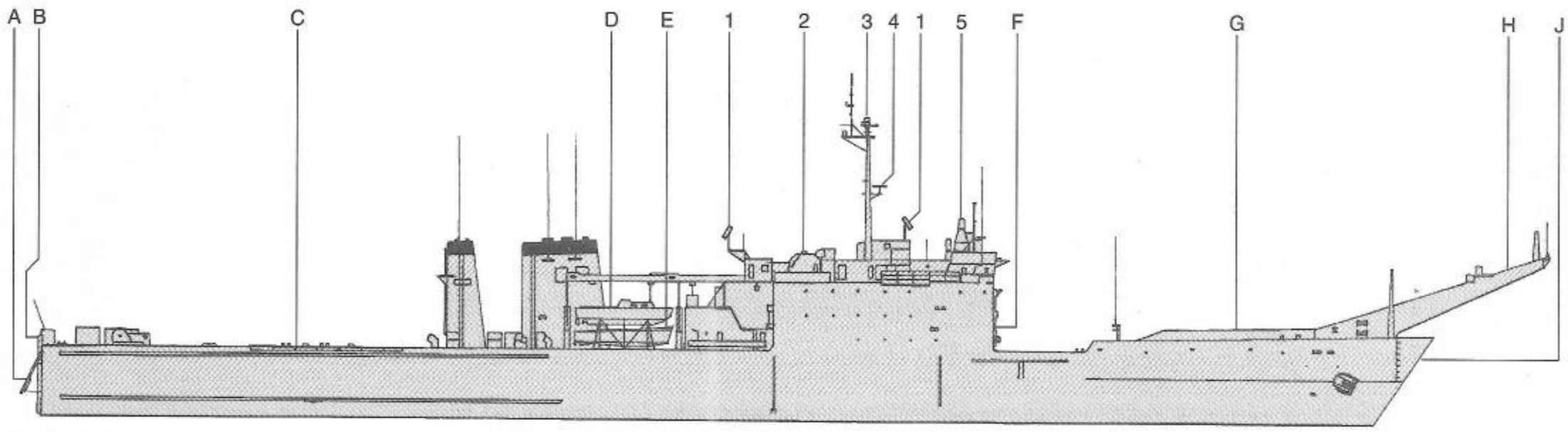
Specifications
System: Diesel
Main machinery: 4 Fairbanks-Morse 38D8⅛-12 diesels, 6.34 MW (8,500 hp) sustained

Shafts: 2
Propellers: Controllable pitch

Brazilian Navy landing ship Duque de Caxias *is the former US Navy* Grant County *(LST 1174)* (H & L van Ginderen Collection)

NEWPORT

OVERVIEW



Newport class
Amphibious A *Kedge anchor* **B** *Stern door* **C** *Flight deck* **D** *LCPL* **E** *LCVP* **F** *Passageway to rear deck* **G** *Aluminium alloy landing ramp* **H** *Derrick arms ('horns')* **J** *Opening bow sections*

General 1 *WSC-3 Satcom antenna* **2** *US Navy twin 76 mm (3 in) gun (removed in most)* **3** *Raytheon AN/SPS-67(V) surface search radar* **4** *Canadian-Marconi LN-66 navigation radar* **5** *Hughes Mk 15 Phalanx 20 mm CIWS*

The US Navy's post-Second World War aim of achieving an amphibious task force speed of 20 knots was finally achieved with the 'Newport' class LSTs. The offloading capability of these ships was, however, only achieved by replacing the classic tank landing ship's clamshell bow doors by a unique arrangement, which achieved a pointed bow but at the expense of considerable complexity, in which the bows are dominated by two large derrick arms (usually known as 'horns'). On beaching, two small clamshell doors at the top of the bows fold back, and the derrick arms are then used to swing a 40-tonnes 34 m (112 ft) long aluminium ramp forward and on to the beach.

Other new features included an internal ramp just forward of the superstructure which allows vehicles to go down to the tank deck, which has a total area of 5,300 m² (19,000 sq ft). On the main deck, vehicles can drive from one end of the ship to the other through an opening in the superstructure, and a 9.1 m (30 ft) diameter turntable with a capacity of 75 tonnes at either end allows them to be turned without needing to reverse. On the tank deck, there is a stern gate which allows loading and unloading of amphibious tractors into the water, on to landing craft or on to a pier.

A total of 20 was built, all being launched in a four-year period from the beginning of 1968 to the end of 1971. The first three were built at the Philadelphia Naval Shipyard, the remaining 17 at National Steel and Shipbuilding at San Diego in California. A further seven were planned for the 1971 fiscal year, but were deferred and then cancelled. The usual US Navy practice of naming LSTs after counties or parishes was suspended for the first 13 of the class, which were named after towns, but was resumed for the final seven.

The Newports have proved particularly durable and popular, and 14 ships of the 17 still in the active fleet in 1991 were employed in the Gulf War. Further, when the Department of Defense decided to dispose of them there has been no shortage of enthusiastic potential buyers from around the world. The US Congress, however, has been keen to retain a basic capability, at least until the new generation of LPD ships is available, even going to the extent of holding up delivery of some of the ships to their new owners, until a Sentate vote on 7 August 1994 allowed the sales to proceed.

So, two remain in service in the US Navy, and a further four are in a 'reduced operating status', which means they could be ready for service within 180 days.

As originally constituted, the class was:

Ship Name	Ship No	Laid down	Launched	Commissioned	Fate
Newport	LST 1179	1 Nov 1966	3 Feb 1968	7 Jun 1969	Decommissioned 1992
Manitowoc	LST 1180	1 Feb 1967	4 Jun 1969	24 Jan 1970	Earmarked for Taiwan, 1996
Sumter	LST 1181	14 Nov 1967	13 Dec 1969	20 Jun 1970	Earmarked for Taiwan, 1996
Fresno	LST 1182	16 Dec 1967	28 Sep 1968	22 Nov 1969	US Navy reserve; at 180 days notice
Peoria	LST 1183	22 Feb 1968	23 Nov 1968	21 Feb 1970	Decommissioned 1994
Frederick	LST 1184	13 Apr 1968	8 Mar 1969	11 Apr 1970	Remains in US Navy service
Schenectady	LST 1185	2 Aug 1968	24 May 1969	13 Jun 1970	Decommissioned 1993
Cayuga	LST 1186	28 Sep 1968	12 Jul 1969	8 Aug 1970	Leased to Brazil, 1994
Tuscaloosa	LST 1187	23 Nov 1968	6 Sep 1969	24 Oct 1970	In reserve; at 180 days notice
Saginaw	LST 1188	24 May 1969	7 Feb 1970	23 Jan 1971	Sold to Australia, 1994
San Bernardino	LST 1189	12 Jul 1969	28 Mar 1970	27 Mar 1971	Transferred to Chile, 1995
Boulder	LST 1190	6 Sep 1969	22 May 1970	4 Jun 1971	In reserve; at 180 days notice
Racine	LST 1191	13 Dec 1969	15 Aug 1970	9 Jul 1971	In reserve; at 180 days notice
Spartanburg County	LST 1192	7 Feb 1970	11 Nov 1970	1 Sep 1971	Sold to Malaysia, 1994
Fairfax County	LST 1193	28 Mar 1970	19 Dec 1970	16 Oct 1971	Sold to Australia, 1994
La Moure County	LST 1194	22 May 1970	13 Feb 1971	18 Dec 1971	Remains in US Navy service
Barbour County	LST 1195	15 Aug 1970	15 May 1971	12 Feb 1972	Decommissioned 1992
Harlan County	LST 1196	7 Nov 1970	24 Jul 1971	8 Apr 1972	Leased to Spain, 1995
Barnstable County	LST 1197	19 Dec 1970	2 Oct 1971	27 May 1972	Leased to Spain, 1994
Bristol County	LST 1198	13 Feb 1971	4 Dec 1971	5 Aug 1972	Transferred to Morocco, 1994

NEWPORT

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: USA

Class: NEWPORT (LST)

Built: 20
Active: 2

Displacement:
standard: 5,054 t
full load: 8,450 t

Dimensions
Length: 159.2 m (522.3 ft)
Beam: 21.2 m (69.5 ft)
Draught: 5.3 m aft (17.5 ft)

Speed: 20 kts
Range: 2,500 n miles at 14 kts

Complement: 257 including 13 officers

SHIPS

FREDERICK (LST 1184)

Builder	National Steel & Shipbuilding, San Diego, California, USA
Laid down	13 Apr 1968
Launched	8 Mar 1969
Commissioned	11 Apr 1970

LA MOURE COUNTY (LST 1194)

Builder	National Steel & Shipbuilding, San Diego, California, USA
Laid down	22 May 1970
Launched	13 Feb 1971
Commissioned	18 Dec 1971

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 400 including 20 officers
- Cargo:
  Port to port — 2,000 tonnes
  Beaching — 500 tonnes

- Vehicles: Sample loads
  Tank deck
  23 AAV-7A1 APG, or
  29 M60 main battle tanks, or
  41—2.5 ton truck equivalents
  Upper deck:
  29—2.5 tonne truck equivalents

SHIP-SHORE LIFT

- LCVP: three
- LCP: one

AVIATION FACILITIES

Flight Deck: 15.65 × 15.46 m (51.4 × 51 ft) (242 m²) (2,621 sq ft)
Hangar: None
Helicopters: CH-46 or UH-1
Possible aircraft types include UH-14 Aerospatiale AS 332F1 Super Puma/AS 532 Cougar; UH-12 Aerospatiale AS 350B/350BA Ecureuil; UH-13 Aerospatiale AS 355F2 Ecureuil 2 or UH-6B Bell JetRanger III

AMPHIBIOUS FACILITIES

- Aluminium ramp 34 m (111.5 ft) long (75 tonne capacity)
- Stern door
- Four pontoon sections can be carried lashed to ship's sides
- Two 75 tonne capacity turntables in tank deck
- Cranes: two 10 tonne capacity

WEAPONS SYSTEMS

GUNS

Hughes Mk 15 CIWS Phalanx

Close in weapon system developed to provide fast reaction to submarine-launched anti-ship missiles. It is a 'closed loop' system, which tracks both the target and the stream of rounds, and consists of the Mk 16 weapon group, the Mk 339 local and Mk 340 remote-control panels as well as a remote indicator panel.

The weapons group is based on a barbette assembly with electronics enclosure to the rear. The group takes up 5.5 m² (59.2 sq ft) space on deck and is on a 150 mm (6 in) thick platform. The gun is a six-barrelled 20 mm M61A1 Vulcan capable of extremely high firing rates. Original Block 0 systems installed in the early 1980s are gradually to be uprated to Block 1. Fitted to US Navy Newports from early 1980s onwards.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire:
Block 0; Block 1 Baseline 0: 3,000 rds/min
Block 1 Baseline 1: 4,500 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)

Mounting:
Weight:
Block 0: 5.42 t
Block 1: 6.18 t
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

Satcom: SSR-1 receiver, WSC-3 transceiver (uhf)

RADARS

Raytheon AN/SPS-67(V)1

The AN/SPS-67(V)1 is a solid-state G/H-band equipment designed to replace the 30-year old AN/SPS-10 surface search radar. The antenna of the older radar is retained as an interim measure but will be replaced eventually.

Performance of the SPS-67 is improved through the addition of a very narrow pulse mode for better navigation and improved resolution of small targets at short ranges. Long and medium modes are used in open sea for detection of long- and medium-range targets. Performance is further improved by a digital video clutter suppressor and an interference suppressor.

Specifications
Frequency: G-band (5.4-5.8 GHz)
Azimuth beamwidth: 1.5°
Elevation beamwidth: 12°-67(V)1; 31°-67(V)2 & 3
Pulsewidth: 0.1; 0.25; 1.0 µs
Peak power: 280 kW
Scan period: 4 s-67(V)1; 2/4 s-67(V)2 & 3
Instrumented range: 104 km
Track initiation: Automatic
Track file size: 128 (expandable)
MTBF: >600 h

Manufacturer/Contractor
Raytheon, USA.

Canadian Marconi LN-66

***Frederick* (LST 1184) only.** Designed for the short-range navigation role the 12 kW set consists of a 0.9 m (3.0 ft) radome, 1.5 or 2.4 m (4.9 or 7.9 ft) antenna, a solid-state transmitter/receiver, 25 cm (9.8 in) display, and a true bearing unit.

Specifications
Frequency: I-band (9,375 +-30 MHz)
Peak power: 12 kW
Rotation speed: 22 ±2.2 rpm
Pulsewidth: 0.5; 0.9 µs
PRF: 800/1,250; 2,500 Hz
Weight:
antenna: 9.7 kg (21.4 lb)
transmitter/receiver: 13.4 kg (29.5 lb)
display: 22.9 kg (50.5 lb)

Manufacturer/Contractor
Canadian Marconi Company, Kanata, Ontario, Canada.

Raytheon CRP 3100 Pathfinder

***La Moure County* only.** The AN/SPS-64 Mariners Pathfinder radar is a surface search and navigation radar

with raster scan bright display indicators, supplied in I/J-band (9,375-9,420 MHz) or E/F-band (3,030 MHz) versions with a choice of relative, true motion and collision avoidance displays. Plan position indicator displays of 30 cm (11.8 in) and 41 cm (16 in) are the basic configuration.

Specifications
Frequency range: I-band (9,375 ±25 MHz)
Peak power: 10, 25 and 50 kW
Range: 18.3 m-118.5 km
Pulsewidth: 0.06, 0.5, 1 µs
PRF: 3,600, 1,800, 900 pps

Manufacturer/Contractor
Raytheon Marine Company, Hudson, New Hampshire, USA.

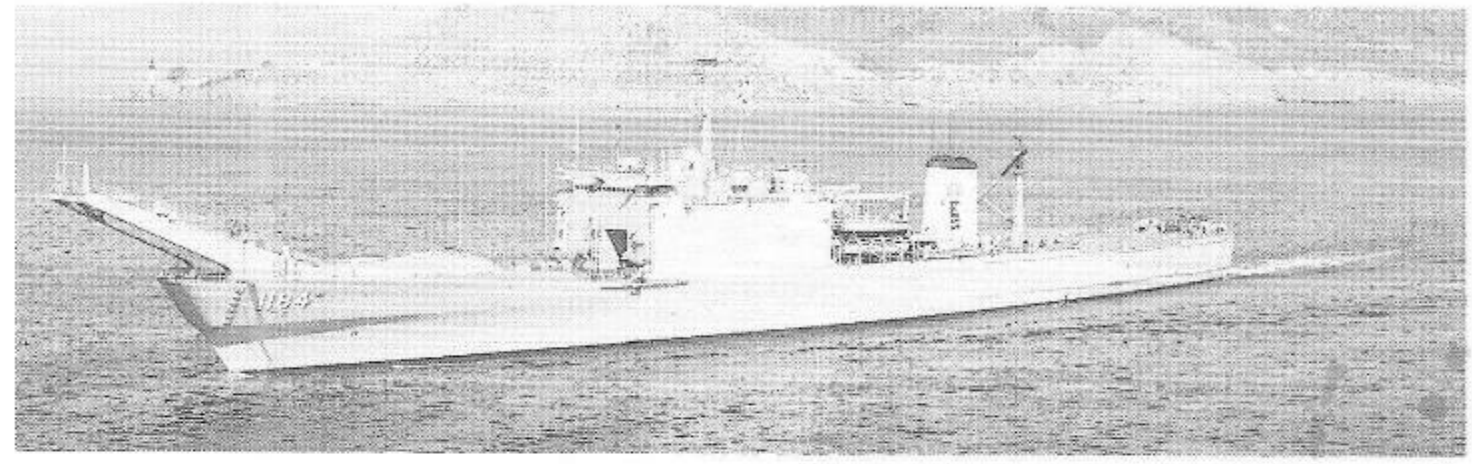
PROPULSION

Specifications
System: Diesel
Main machinery: 6 ALCO 16-251 diesels, 12.3 MW (16,500 hp) sustained

Shafts: 2
Propellers: Controllabe pitch
Bow thruster: 1—800 bhp bow thruster

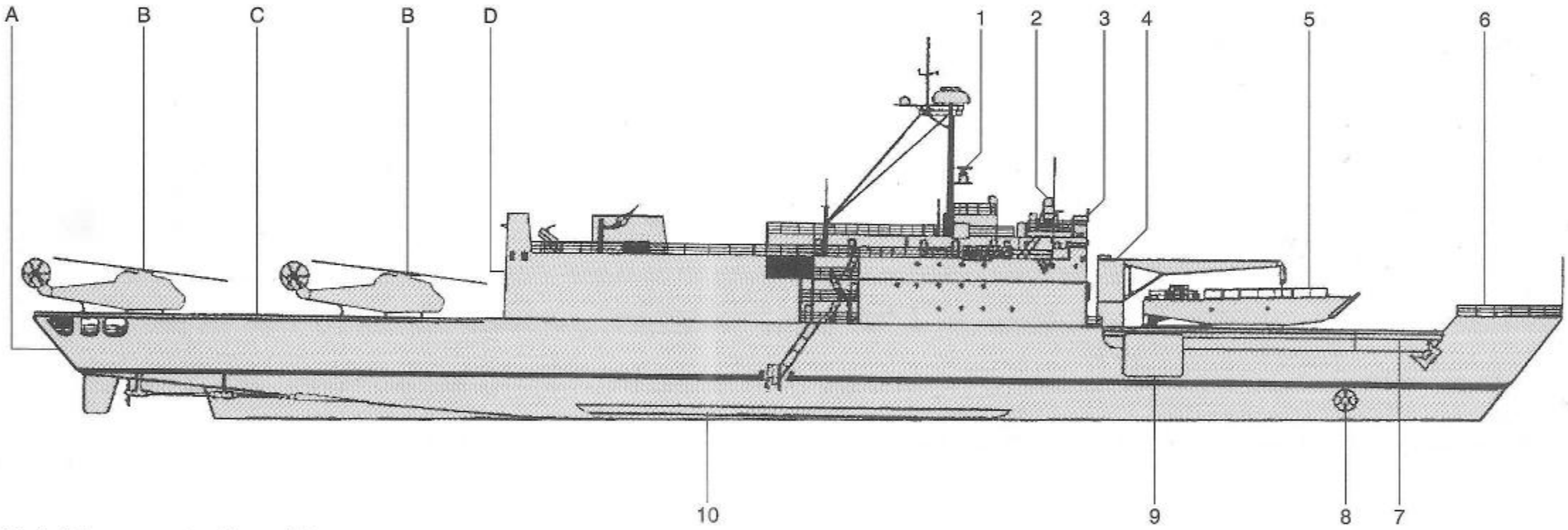
FURTHER INFORMATION

Only two of this class remain in operational service with the US Navy: *Frederick* (LST 1184) is based at San Diego and *La Moure County* (LST 1194) at Little Creek, Virginia. Four others, *Fresno* (LST 1182), *Tuscaloosa* (LST 1187), *Boulder* (LST 1190) and *Racine* (LST 1191) are in reduced operating status and could be made ready within 180 days.



Frederick *(LST 1184) is one of two 'Newport' class LSTs remaining in full operational service with the US Navy* (US Navy)

KANIMBLA (NEWPORT)



Kanimbla conversion (Australia)
Amphibious A *Stern gate* **B** *Helicopters (four SH-60 Black Hawk or SH-3 Sea King)* **C** *Flight deck* **D** *Hangar (limited maintenance facilities)*

General 1 *Kelvin Hughes Type 1007 navigation radar* **2** *Hughes Mk 15 CIWS (FFBNW)* **3** *Second bridge (for training)* **4** *70-tonne crane* **5** *LCM 8 (two)* **6** *New forecastle (horns, ramps removed)* **7** *Bulwark cut back* **8** *Bow thruster* **9** *New entry port onto tank deck* **10** *New bilge keels*

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Australia
Type: Newport (LST)

Class: KANIMBLA

Purchased: 2
Active: 2

Displacement:
standard: 5,054 t
full load: 8,585 t

Dimensions
Length: 159.2 m (522.3 ft)
Beam: 21.2 m (69.5 ft)
Draught: 5.3 m aft (17.5 ft); 3.5 m forward (11.5 ft)

Speed: 20 kts
Range: 14,000 n miles at 15 kts

Complement: 180, including 12 officers

SHIPS

KANIMBLA (L 51)

Builder	National Steel & Shipbuilding, San Diego, California, USA
Laid down	24 May 1969
Launched	7 Feb 1970
Commissioned (US Navy)	23 Jan 1971 (*Saginaw* (LST 1,188))
Sold (Australia)	25 Aug 1994
Recommissioned (RAN)	29 Aug 1994

MANOORA (L 52)

Builder	National Steel & Shipbuilding, San Diego, California, USA
Laid down	28 Mar 1970
Launched	19 Dec 1970
Commissioned (US Navy)	16 Oct 1971 (*Fairfax County* (LST 1193))
Sold to Australia	27 Sep 1994
Recommissioned	25 Nov 1994

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 450 including 25 officers
- Cargo: 2,000 tonnes
- Vehicles:
  Tank deck — 29 main battle tanks or equivalent
  upper deck — available only if not being used for LCMs or helicopter

SHIP-SHORE LIFT

- Two LCM 8 on foredeck
- Two 7.2 m (23.6 ft) RHIB

AVIATION FACILITIES

- Flight deck: New flight deck aft 48 × 21 m (158 × 69 ft)
- Flight deck: Flight deck forward available only if LCMs or vehicles not carried.
- Hangar: New shelter at after end of superstructure to accommodate four SH-60 Black Hawk helicopters
- Helicopters: Four SH-60 or SH-3

AMPHIBIOUS FACILITIES

- Stern gate
- New entry port and ramp on starboard side to enable vehicles to embark/disembark from jetty into tank deck (possible)
- Elevator between aft flight deck and No 3 Deck cargo spaces (possible)

Note: Bow ramp and horns are removed

WEAPONS SYSTEMS

Hughes Mk 15 CIWS Phalanx
Fitted for but not with.

COMMAND AND CONTROL SYSTEMS

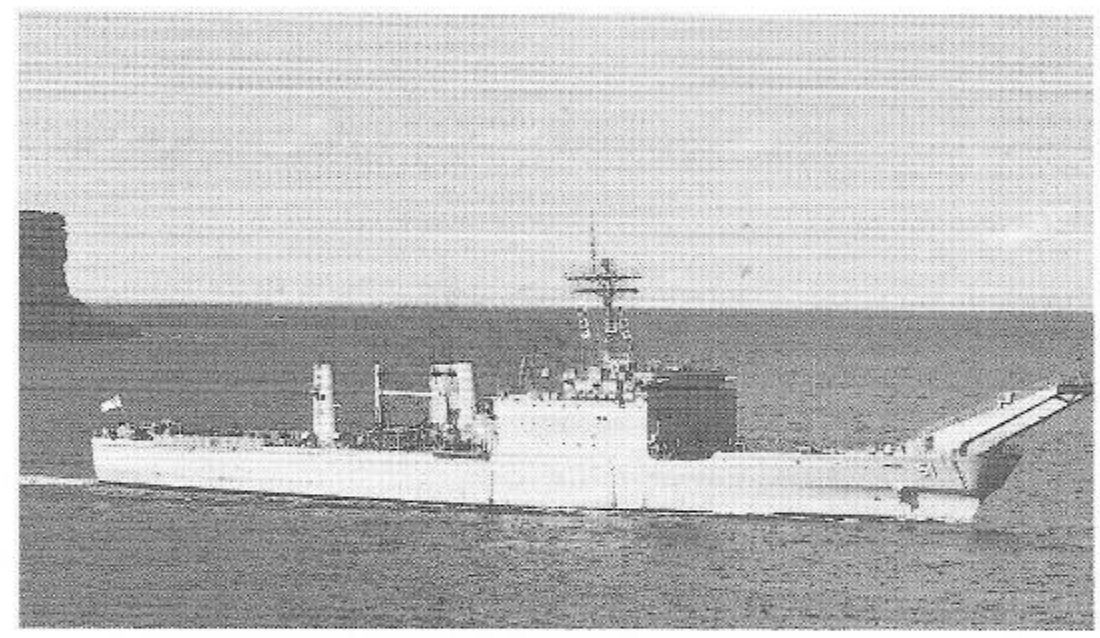
RADARS

Kelvin Hughes 1007
As part of the work being carried out in Australia the AN/SPS-10 and AN/SPS-64 radars have been removed and replaced by a Kelvin Hughes Type 1007 radar, with an integrated IFF system.

Specifications
Role: Navigation/surface search
Band: H/I (9,410 MHz)
Beam: 1.0 × 18°/0.75 × 18°
Peak power: 25 kW
Pulsewidth: 0.08/0.3/0.8 µs
PRF: 1,600/800/400 pps
Scan rate: 26 rpm

Manufacturer/Contractor
Kelvin Hughes, UK.

Kanimbla *(L 51) and* Manoora *(L 52) in Australia in 1994 before the first round of modifications. Note the Hughes Mk 15 CIWS and WSC-3 satellite antennas* (H & L van Ginderen Collection)



Kanimbla *(L 51) after initial modifications. The Mk 15 CIWS and US satellite antennas have been removed, but more fundamental modifications are to follow* (H & L van Ginderen Collection)

PROPULSION

Specifications
System: Diesel
Main machinery: 6 ALCO 16-251 diesels, 12.3 MW (16,500 hp) sustained
Shafts: 2
Propellers: Controllable pitch
Bow thruster: 1—800 bhp bow thruster

FURTHER INFORMATION

PROGRAMME

These two ships were acquired as outright purchases from the US Navy in 1994 to replace the LSL *Tobruk* and the training ship *Jervis Bay* (the latter is a converted ro-ro cargo ship.) It is intended to sell *Tobruk* to help finance the conversion of these ships, although a buyer has yet to be found.

CONVERSION

These ships have been acquired to provide a combination of amphibious transport for the Australian Army and training ships for the RAN, designated THSS. The ships will be able to accommodate and operate up to four Army UH-60 Black Hawks or naval SH-3 Sea King helicopters. In addition, the flight decks are designed to be strong enough to handle Army CH-47 Chinook helicopters. The ships will also will carry two LCM 8 and two RIBs. The work involves establishing a third landing spot forward, with a hangar, the removal of the characteristic 'horns' and the installation, for the training role, of a classroom and improved medical facilities.

The work to be done on the ship was put out to tender in the form of 'Capability Packages' (CP). Tenderers were required to cost the CPs to determine how many can be fulfilled within the existing price ceiling and time allowance, and how those put off until later would be completed. There are 14 CPs in all, of which priority is being allotted to CPs 0, 1, 2 and 8:

CP 0. Replace existing radars with Kelvin Hughes KH 1007, remove the derrick arms and ramp machinery, remove existing ships boats and lifting gear and replace by two 7.3 m (24 ft) RIBs and davits.
CP 1. Fit forward flight deck and two helicopter spots aft.
CP 2. Increase aviation fuel storage and modify existing onboard fuel system to cope with the new flight deck arrangements.
CP 3. Provide a helicopter hangar for four UH-60 aircraft, with minimal maintenance facilities.
CP 4. Provide medical facilities, including initial wound surgery and a small hospital.
CP 5. Install 70 tonnes crane on foredeck to enable LCM 8s to be launched and recovered in Sea State 2.
CP 6. Provide three dual-use compartments for employment as training facilities when the ship is in the training role and as Joint Force HQ in the amphibious role.
CP 7. No details available.
CP 8. Modify accommodation to enable mixed-gender crewing, expand eating areas and install 650 bunks (450 of which are for the embarked force).
CP 9. Install an elevator to allow movement of vehicles, helicopters and cargo between the aft flight deck and

the hold on No 3 Deck. CP 9 would also include the provision of multi-use compartments in the hangar which would reduce the number of helicopters to three.

CP 10. Install a side door and ramp from No 3 Deck to enable troops and vehicles to embark/disembark from a jetty.

CP 11. Replace existing ship's boilers and install additional water production plant.

CP 12. Revise the sewage system to meet new international and national standards.

CP 13. Obtain, configure and install a basic command, control and communications fit to support a Joint Force headquarters.

CP 14. Install a training bridge.

The conversion has been politically controversial, and though the contract for the conversion was provisionally awarded to the Forgacs Shipbuilding yard at Newcastle, New South Wales, early in 1996, it was delayed until after the Australian general election and not signed by the new government until May 1996.

In the mean time, investigation of the condition of the two ships revealed that additional and essential work will be needed, which will raise the conversion costs from $55 million to an estimated $75-85 million. Cost had already been a factor in decisions not to fit a vehicle lift aft or a side door, though both these features are to be designed into the conversion for possible retrofitting.

MATTOSO MAIA (NEWPORT)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Brazil
Type: Newport (LST)

Class: MATTOSO MAIA

Purchased: 1
Active: 1

Displacement:
light: 4,975 t
full load: 8,450 t

Dimensions
Length: 159.2 m (522.3 ft)
Beam: 21.2 m (69.5 ft)
Draught: 5.3 m aft (17.5 ft)

Speed: 20 kts
Range: 2,500 n miles at 14 kts

Complement: 257 including 13 officers

SHIPS

MATTOSO MAIA (G 28)

Builder	National Steel & Shipbuilding, San Diego, California, USA	**Laid down**	28 Sep 1968
		Launched	12 Jul 1969
		Commissioned (US Navy)	8 Aug 1970 (*Cayuga* (LST 1186))
		Transferred (Brazil) (lease)	26 Aug 1994
		Recommissioned	30 Aug 1994

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 400 including 20 officers
- Cargo:
  Port to port — 2,000 tonnes
  Beaching — 500 tonnes
- Vehicles: Sample loads
  Tank deck
  23 AAV-7A1 APG, or
  29 M60 main battle tanks, or
  41—2.5 ton truck equivalents
  Upper deck:
  29—2.5 tonne truck equivalents

SHIP-SHORE LIFT

- LCVP: three
- LCP: one

AVIATION FACILITIES

Flight Deck: 15.65 × 15.46 m (51.4 × 51 ft) (242 m²) (2,621 sq ft)
Hangar: None
Helicopters: CH-46 or UH-1
Possible aircraft types include UH-14 Aerospatiale AS 332F1 Super Puma/AS 532 Cougar; UH-12 Aerospatiale AS 350B/350BA Ecureuil; UH-13 Aerospatiale AS 355F2 Ecureuil 2 or UH-6B Bell JetRanger III

AMPHIBIOUS FACILITIES

- Aluminium ramp 34 m (111.5 ft) long (75 tonne capacity)
- Stern door
- Four pontoon sections can be carried lashed to ship's sides
- Two 75 tonne capacity turntables in tank deck
- Cranes: two 10 tonne capacity

WEAPONS SYSTEMS

GUNS

US Navy 76 mm (3 in/50 calibre) guns

The ship is fitted for but not with (FFBNW) two twin 76 mm (3 in/50 calibre) guns.

Hughes Mk 15 CIWS Phalanx

One Mk 15 CIWS is installed on the bridge roof. The weapons group is based on a barbette assembly with electronics enclosure to the rear. The gun is a six-barrelled 20 mm M61A1 Vulcan capable of very high firing rates.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire:
Block 0; Block 1 Baseline 0: 3,000 rds/min
Block 1 Baseline 1: 4,500 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)

Mounting:
Weight:
Block 0: 5.42 t
Block 1: 6.18 t
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

COMMAND AND CONTROL SYSTEMS

RADARS

Raytheon SPS-67(V)

The AN/SPS-67(V) is a solid-state G/H-band equipment designed to replace the 30-year old SPS-10 surface search radar, but which in this installation retained the antenna of the older radar.

Specifications
Frequency: G-band (5.4-5.8 GHz)
Azimuth beamwidth: 1.5 × 12°
Pulsewidth: 0.1; 0.25; 1.0 µs
Peak power: 280 kW
Scan period: 4 s-67(V)1; 2/4 s-67(V)2 & 3
Instrumented range: 104 km

Mattosa Maia *(G 28)* (Brazilian Navy)

Manufacturer/Contractor
Raytheon, USA.

Canadian Marconi LN-66

Specifications
Frequency: I-band (9,375 ±30 MHz)
Peak power: 12 kW
Rotation speed: 22 ±2.2 rpm

Pulsewidth: 0.5; 0.9 µs
PRF: 800/1,250; 2,500 Hz

Manufacturer/Contractor
Canadian Marconi Company, Kanata, Ontario, Canada.

PROPULSION

Specifications
System: Diesel
Main machinery: 6 ALCO 16-251 diesels, 12.3 MW (16,500 hp) sustained

Shafts: 2
Propellers: Controllable pitch
Bow thruster: 800 bhp

VALDIVIA (NEWPORT)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Chile
Type: Newport (LST)

Class: VALDIVIA

Leased: 1
Active: 1
Possible acquisition: 1

Displacement:
standard: 5,054 t
full load: 8,450 t

Dimensions
Length: 159.2 m (522.3 ft)
Beam: 21.2 m (69.5 ft)
Draught: 5.3 m (17.5 ft) (aft)

Speed: 20 kts
Range: 2,500 n miles at 14 kts

Complement: 257 including 13 officers

SHIPS

VALDIVIA (93)

Builder	National Steel & Shipbuilding, San Diego, California, USA	**Laid down**	12 Jul 1969
		Launched	28 Mar 1970
		Commissioned (US Navy)	27 Mar 1971 (*San Bernardino* (LST 1189))
		Recommissioned (Chilean Navy)	30 Sep 1995

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 400 including 20 officers
- Cargo:
  Port to port — 2,000 tonnes
  Beaching — 500 tonnes
- Vehicles: Sample loads
  Tank deck
  23 AAV-7A1 APG, or
  29 M60 main battle tanks, or
  41—2.5 ton truck equivalents
  Upper deck:
  29—2.5 tonne truck equivalents

SHIP-SHORE LIFT

- LCVP: three
- LCP: one

AVIATION FACILITIES

Flight Deck: 15.65 × 15.46 m (51.4 × 51 ft) (242 m²) (2,621 sq ft)
Hangar: None
Helicopters: CH-46 or UH-1
Aircraft likely to be used include Nurtanio (Aerospatiale) NAS 332SC Cougar, MBB BO 105C, Bell 206B JetRanger

AMPHIBIOUS FACILITIES

- Aluminium ramp 34 m (111.5 ft) long (75 tonne capacity)
- Stern door
- Four pontoon sections can be carried lashed to ship's sides
- Two 75 tonne capacity turntables in tank deck
- Cranes: two 10 tonne capacity

WEAPONS SYSTEMS

GUNS

Hughes Mk 15 CIWS Phalanx
One Mk 15 CIWS is installed on the bridge roof. The weapons group is based on a barbette assembly with electronics enclosure to the rear. The gun is a six-barrelled 20 mm M61A1 Vulcan capable of very high firing rates.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire:
Block 0; Block 1 Baseline 0: 3,000 rds/min
Block 1 Baseline 1: 4,500 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)

Mounting:
Weight:
Block 0: 5.42 t
Block 1: 6.18 t
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

COMMAND AND CONTROL SYSTEMS

RADARS

Raytheon AN/SPS-67

Specifications
Frequency: G-band (5.4-5.8 GHz)
Azimuth beamwidth: 1.5°
Elevation beamwidth: 12°
Pulsewidth: 0.1; 0.25; 1.0 µs
Peak power: 280 kW
Scan period: 4 s
Instrumented range: 104 km

Manufacturer/Contractor
Raytheon, USA.

Canadian Marconi LN-66

Specifications
Frequency: I-band (9,375 ±30 MHz)
Peak power: 12 kW
Rotation speed: 22 ±10%
Pulsewidth: 0.5; 0.9 µs
PRF: 800/1,250; 2,500 Hz

Manufacturer/Contractor
Canadian Marconi Company, Kanata, Ontario, Canada.

PROPULSION

Specifications
System: Diesel
Main machinery: 6 ALCO 16-251 diesels, 12.3 MW (16,500 hp) sustained

Shafts: 2
Propellers: Controllable pitch
Bow thruster: 800 bhp bow thruster

FURTHER INFORMATION

A second of the class may be acquired, if one should become available.

SRI INDERAPURA (NEWPORT)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Malaysia
Type: Newport (LST)

Class: SRI INDERAPURA

Purchased: 1
Active: 1

Displacement:
standard: 5,054 t
full load: 8,450 t

Dimensions
Length: 159.2 m (522.3 ft)
Beam: 21.2 m (69.5 ft)
Draught: 5.3 m aft (17.5 ft)

Speed: 20 kts
Range: 2,500 n miles at 14 kts

Complement: 257 including 13 officers

SHIPS

SRI INDERAPURA (1505)		**Laid down**	7 Feb 1970	**Sold to Malaysia**	16 Dec 1994
Builder	National Steel & Shipbuilding, San Diego, California, USA	**Launched**	11 Nov 1970	**Arrived in Malaysia**	June 1995
		Commissioned (US Navy)	1 Sep 1971 (*Spartanburg County* (LST 1192))		

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 400 including 20 officers
- Cargo:
  Port to port — 2,000 tonnes
  Beaching — 500 tonnes

- Vehicles: Sample loads
  Tank deck
  23 AAV-7A1 APG, or
  29 M60 main battle tanks, or
  41—2.5 ton truck equivalents
  Upper deck:
  29—2.5 tonne truck equivalents

SHIP-SHORE LIFT

- LCVP: three
- LCP: one

AVIATION FACILITIES

Flight Deck: 15.65 × 15.46 m (51.4 × 51 ft) (242 m²) (2,621 sq ft)
Hangar: None
Helicopters: Malaysian Navy operates only Westland Wasp at the moment

AMPHIBIOUS FACILITIES

- Aluminium ramp 34 m (111.5 ft) long (75 tonne capacity)
- Stern door
- Four pontoon sections can be carried lashed to ship's sides
- Two 75 tonne capacity turntables in tank deck
- Cranes: two 10 tonne capacity

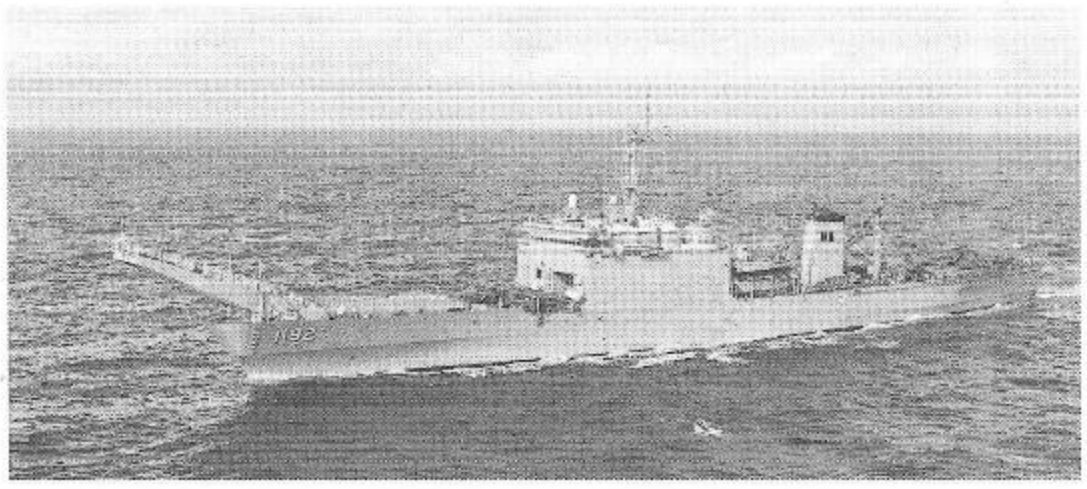
WEAPONS SYSTEMS

GUNS

Hughes Mk 15 CIWS Phalanx
One Mk 15 CIWS is installed on the bridge roof. The weapons group is based on a barbette assembly with electronics enclosure to the rear. The gun is a six-barrelled 20 mm M61A1 Vulcan capable of very high firing rates.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire:
Block 0; Block 1 Baseline 0: 3,000 rds/min
Block 1 Baseline 1: 4,500 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)

Mounting:
Weight:
Block 0: 5.42 t
Block 1: 6.18 t
Traverse: 310° at 126° /s
Elevation: −25 to +85° at 92°/s



Spartanburg County *(LST 1192) while serving with the US Navy. This was the state in which the ship was handed over to the Royal Malaysian Navy and, as far as is known, there are no plans to make any major changes* (US Navy/PHC J Hilton)

Sri Inderapura *(1505) in service with the RMN* (H & L van Ginderen Collection)

COMMAND AND CONTROL SYSTEMS

RADARS

Raytheon AN/SPS-67

Specifications
Frequency: G-band (5.4-5.8 GHz)
Azimuth beamwidth: 1.5°
Elevation beamwidth: 12°
Pulsewidth: 0.1; 0.25; 1.0 µs
Peak power: 280 kW
Scan period: 4 s
Instrumented range: 104 km

Manufacturer/Contractor
Raytheon, USA.

Canadian Marconi LN-66

Specifications
Frequency: I-band (9,375 ±30 MHz)
Peak power: 12 kW
Rotation speed: 22 ±10%
Pulsewidth: 0.5; 0.9 µs
PRF: 800/1,250; 2,500 Hz

Manufacturer/Contractor
Canadian Marconi Company, Kanata, Ontario, Canada.

PROPULSION

Specifications
System: Diesel
Main machinery: 6 ALCO 16-251 diesels, 12.3 MW (16,500 hp) sustained
Shafts: 2
Propellers: Controllable pitch
Bow thruster: 800 bhp bow thruster

SIDI MOHAMMED BEN ABDALLAH (NEWPORT)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Morocco
Type: Newport (LST)

Class: SIDI MOHAMMED BEN ABDALLAH

Grant aid: 1
Active: 1

Displacement:
standard: 5,054 t
full load: 8,450 t

Dimensions
Length: 159.2 m (522.3 ft)
Beam: 21.2 m (69.5 ft)
Draught: 5.3 m aft (17.5 ft)

Speed: 20 kts
Range: 2,500 n miles at 14 kts

Complement: 257 including 13 officers

SHIPS

SIDI MOHAMMED BEN ABDALLAH (407)

Builder	National Steel & Shipbuilding, San Diego, California, USA
Laid down	13 Feb 1971
Launched	4 Dec 1971
Commissioned (US Navy)	5 Aug 1972 (*Bristol County* (LST 1198))
Transferred (Morocco)	16 Aug 1994

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 400 including 20 officers
- Cargo:
  Port to port — 2,000 tonnes
  Beaching — 500 tonnes

- Vehicles: Sample loads
  Tank deck
  23 AAV-7A1 APG, or
  29 M60 main battle tanks, or
  41—2.5 ton truck equivalents
  Upper deck:
  29—2.5 tonne truck equivalents

SHIP-SHORE LIFT

- LCVP: three
- LCP: one

AVIATION FACILITIES

Flight Deck: 15.65 × 15.46 m (51.4 × 51 ft) (242 m²) (2,621 sq ft)
Hangar: None
Helicopters: There are currently no helicopters operational with the Moroccan Navy

AMPHIBIOUS FACILITIES

- Aluminium ramp 34 m (111.5 ft) long (75 tonne capacity)
- Stern door
- Four pontoon sections can be carried lashed to ship's sides
- Two 75 tonne capacity turntables in tank deck
- Cranes: two 10 tonne capacity

WEAPONS SYSTEMS

GUNS

Hughes Mk 15 CIWS Phalanx

One Mk 15 CIWS is installed on the bridge roof. The weapons group is based on a barbette assembly with electronics enclosure to the rear. The gun is a six-barrelled 20 mm M61A1 Vulcan capable of very high firing rates.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379)
Rate of fire:
Block 0; Block 1 Baseline 0: 3,000 rds/min
Block 1 Baseline 1: 4,500 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)
Mounting:
Weight:
Block 0: 5.42 t
Block 1: 6.18 t
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

COMMAND AND CONTROL SYSTEMS

RADARS

Raytheon AN/SPS-67

Specifications
Frequency: G-band (5.4-5.8 GHz)
Azimuth beamwidth: 1.5°
Elevation beamwidth: 12°
Pulsewidth: 0.1; 0.25; 1.0 µs
Peak power: 280 kW
Scan period: 4 s
Instrumented range: 104 km

Manufacturer/Contractor
Raytheon, USA.

Canadian Marconi LN-66

Specifications
Frequency: I-band (9,375 ±30 MHz)
Peak power: 12 kW
Rotation speed: 22 ±10%
Pulsewidth: 0.5; 0.9 µs
PRF: 800/1,250; 2,500 Hz

Manufacturer/Contractor
Canadian Marconi Company, Kanata, Ontario, Canada.

PROPULSION

Specification
System: Diesel
Main machinery: 6 ALCO 16-251 diesels, 12.3 MW (16,500 hp) sustained
Shafts: 2
Propellers: Controllable pitch
Bow thruster: 800 bhp bow thruster

FURTHER INFORMATION

The ship was handed over to the Moroccan Navy in 1994 and by late 1995 was reported to be non-operational.

HERNAN CORTES (NEWPORT)

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Spain
Type: Newport (LST)

Class: HERNAN CORTES

Purchased: 2
Active: 2

Displacement:
standard: 5,054 t
full load: 8,450 t

Dimensions
Length: 159.2 m (522.3 ft)
Beam: 21.2 m (69.5 ft)
Draught: 5.3 m aft (17.5 ft)

Speed: 20 kts
Range: 2,500 n miles at 14 kts

Complement: 257 including 13 officers

SHIPS

HERNAN CORTES (L 41)		**Transferred to Spain (50 month lease)**	Apr 1955	**Laid down**	7 Nov 1970
Builder	National Steel & Shipbuilding, San Diego, California, USA	**Recommissioned (Spanish Navy)**	26 Aug 1994	**Launched**	24 Jul 1971
Laid down	19 Dec 1970			**Commissioned (US Navy)**	8 Apr 1972 (*Harlan County* (LST 1196))
Launched	2 Oct 1971	**PIZARRO** (L 42)			
Commissioned (US Navy)	27 May 1972 (*Barnstable County* (LST 1197))	**Builder**	National Steel & Shipbuilding, San Diego, California, USA	**Transferred to Spain (50 month lease)**	Apr 1955
				Recommissioned (Spanish Navy)	14 Apr 1995

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 400 including 20 officers
- Cargo:
  Port to port — 2,000 tonnes
  Beaching — 500 tonnes
- Vehicles: Sample loads
  Tank deck
  23 AAV-7A1 APG, or
  29 M60 main battle tanks, or
  41—2.5 ton truck equivalents
  Upper deck:
  29—2.5 tonne truck equivalents

SHIP-SHORE LIFT

- LCVP: three
- LCP: one

AVIATION FACILITIES

Flight Deck: 15.65 × 15.46 m (51.4 × 51 ft) (242 m²) (2,621 sq ft)
Hangar: None
Helicopters: CH-46 or UH-1
Normally embarks three AB 212

AMPHIBIOUS FACILITIES

- Aluminium ramp 34 m (111.5 ft) long (75 tonne capacity)
- Stern door
- Four pontoon sections can be carried lashed to ship's sides
- Two 75 tonne capacity turntables in tank deck
- Cranes: two 10 tonne capacity

WEAPONS SYSTEMS

GUNS

Hughes Mk 15 CIWS Phalanx
One Mk 15 CIWS is installed on the bridge roof. The weapons group is based on a barbette assembly with electronics enclosure to the rear. The gun is a six-barrelled 20 mm M61A1 Vulcan capable of very high firing rates.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire:
Block 0; Block 1 Baseline 0: 3,000 rds/min
Block 1 Baseline 1: 4,500 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)

Mounting:
Weight:
Block 0: 5.42 t
Block 1: 6.18 t
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

Oerlikon 20 mm

Two single Oerlikon 20 mm guns are mounted amidships.

Specifications

Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Raytheon AN/SLQ-32(V)1

AN/SLQ-32 is a Raytheon-developed electronic warfare package providing, in its basic (V)1 level, warning, identification and direction-finding of incoming radar-guided anti-ship missiles.

Manufacturer/Contractor

Raytheon, USA.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are two Mk 36 SRBOC (Super Rapid Bloom Off-board Countermeasures) systems consisting of launcher, launcher control, power supplies, ready service lockers and munitions. The Mk 137 launcher has six 130 mm (5 in) fixed tubes arranged in parallel rows at angles of 45 and 60°. The firing circuits use electromagnetic induction to initiate the propelling charges in the cartridges. The prime cartridge is the Mk 182 Torch with chaff payload.

Specifications

Launcher dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Launcher weight: 173 kg (381 lb)
Mk 182 cartridge dimensions: 1,209 × 130 mm (47.5 × 5 in)
Cartridge weight: 22.7 kg (50 lb)

COMMAND AND CONTROL SYSTEMS

RADARS

Raytheon AN/SPS-67

Specifications

Frequency: G-band (5.4-5.8 GHz)
Azimuth beamwidth: 1.5°
Elevation beamwidth: 12°
Pulsewidth: 0.1; 0.25; 1.0 µs
Peak power: 280 kW
Scan period: 4 s
Instrumented range: 104 km

Manufacturer/Contractor

Raytheon, USA.

Canadian Marconi LN-66

Specifications

Frequency: I-band (9,375 ±30 MHz)
Peak power: 12 kW
Rotation speed: 22 ±10%
Pulsewidth: 0.5; 0.9 µs
PRF: 800/1,250; 2,500 Hz

Manufacturer/Contractor

Canadian Marconi Company, Kanata, Ontario, Canada.

PROPULSION

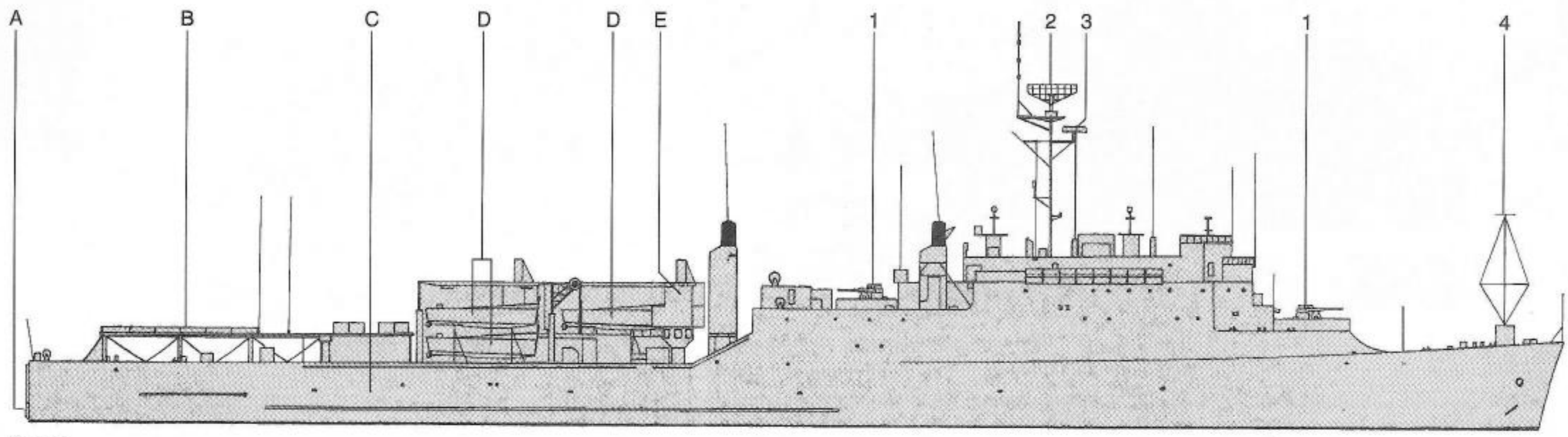
Specifications

System: Diesel
Main machinery: 6 ALCO 16-251 diesels, 12.3 MW (16,500 hp) sustained
Shafts: 2
Propellers: Controllable pitch
Bow thruster: 800 bhp bow thruster

FURTHER INFORMATION

Various modernisations are under consideration including replacing Mk 15 CIWS by Meroka, and installing Scot 3 Satcom.

CEARÁ (THOMASTON)



Ceará
Amphibious A *Stern gate* **B** *Helicopter landing deck (formed from temporary panels)* **C** *Docking well* **D** *LCVP* **E** *Crane (50 tonne capacity)*

General 1 *US Navy twin 76 mm/30 guns (three)* **2** *Raytheon SPS-10 surface search radar* **3** *Raytheon CRP-3100 navigation radar* **4** *HF antenna*

GENERAL SPECIFICATIONS

Country of Origin: USA
Operator: Brazil
Type: Thomaston (LSD)

Class: CEARÁ

Purchased: 2
Active: 2

Displacement:
standard: 6,880 t
full load: 12,150 t

Dimensions:
Length: 155.5 m (510 ft)
Beam: 25.6 m (84 ft)
Draught: 5.8 m (19 ft)

Speed: 22.5 kts
Range: 10,000 n miles at 18 kts

Complement: 345, including 20 officers.

SHIPS

CEARÁ (G 30)

Builder	Ingalls, Pascagoula, Mississippi, USA
Laid down	11 Apr 1955
Launched	12 Jun 1956
Commissioned (US Navy)	14 Dec 1956 (*Hermitage* (LSD 34))
Recommissioned (Brazilian Navy)	28 Nov 1989

RIO DE JANEIRO (G 31)

Builder	Ingalls, Pascagoula, Mississippi, USA
Laid down	11 Oct 1954
Launched	20 Jan 1956
Commissioned (US Navy)	24 Aug 1956 (*Alamo* (LSD 33))
Recommissioned (Brazilian Navy)	21 Nov 1990

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 340
- Vehicles: 975 m² (10,500 sq ft) parking space
- Cargo: 7,400 tonnes

SHIP-SHORE LIFT

- 21 LCM 6 or three LCU and six LCM, or 50 LVTs
- 30 LVT on upper deck
- 2 LCVP, 2 LCPL on davits

AVIATION FACILITIES

Specifications
Flight deck: The flight deck is made up from removable panels
Hangar: There is no hangar and no aircraft maintenance facilities
Helicopters: Helicopters likely to operate from these ships include UH-14 (Aerospatiale AS 332F1/532 Super Puma/Cougar; UH-12 (Aerospatiale AS 350B and 350 BA Ecureuil); UH-13 (Aerospatiale AS 355F2 Ecureuil 2)

AMPHIBIOUS FACILITIES

- Docking well. 119.2 × 14.6 m (391 × 48 ft)
- Two 50 tonne cranes

WEAPONS SYSTEMS

GUNS

US Navy 76 mm (3 in)/50 guns
There are three twin mountings: one in 'B'position and two in the waist. The weapons use 50 calibre Mk 22 barrels 3.81 m (12.5 ft) long in the Mk 33 twin-barrel, open mounting, and can be either under local or remote control.

Specifications
Gun
Calibre: 76.2 mm (3 in)
Length of barrel: 50 calibres
Muzzle velocity: 823 m/s (2,700 ft/s) (new); 808 m/s (2,651 ft/s) (mid-life)
Range: 7 n miles (13 km)
Altitude: 8,951 m (29,367 ft)
Ammunition: 10.9 kg (24 lb)

Mk 33 Mounting
Traverse: 360° at 30°/s
Elevation: −14/15 to +85° at 24°/s
Rate of fire: 100 rds/min

COMMAND AND CONTROL SYSTEMS

RADARS

Raytheon SPS-10

Specifications
Frequency: G/H-band (4 to 8 GHz)
Role: Surface search radar
Max power: 500 kW
Pulse repetition frequency: 625-660 pps

Manufacturer/Contractor
Raytheon, USA.

Raytheon CRP 3100 Pathfinder

Specifications
Role: Navigation
Frequency range: I-band (9,375 ±25 MHz)
Peak power: 50 kW
Range: 118.5 km
Pulsewidth: 0.06, 0.5, 1 µs
PRF: 3,600, 1,800, 900 pps

Manufacturer/Contractor
Raytheon, USA.

PROPULSION

Specifications
System: Steam
Main machinery: 2 Babcock & Wilcox boilers, 40.8 kg/cm² (580 psi); 2 General Electric turbines, 17.9 MW (24,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The 'Thomaston' class was the US Navy's first post-war LSD design and among the first amphibious vessels to meet the criterion for a 20 knots speed. Eight ships were built between 1953 and 1957, all by Ingalls Shipbuilding of Pascagoula, Mississippi, and named after historic American sites:

Ship	No	Launched	Commissioned	Withdrawn
Thomaston	LSD 28	9 Feb 1954	17 Sep 1954	Decommissioned 1984
Plymouth Rock	LSD 29	7 May 1954	24 Jan 1955	Decommissioned 1983
Fort Snelling	LSD 30	16 Jul 1954	24 Jan 1955	Decommissioned 1984
Point Defiance	LSD 31	28 Sep 1954	31 Mar 1955	Decommissioned 1983
Spiegel Grove	LSD 32	10 Nov 1955	8 Jun 1956	Decommissioned 1989
Alamo	LSD 33	20 Jan 1956	24 Aug 1956	Transferred to Brazil
Hermitage	LSD 34	12 Jun 1956	17 Dec 1956	Transferred to Brazil
Monticello	LSD 35	10 Aug 1956	29 Mar 1957	Decommissioned 1985

These ships were popular with the US Marine Corps, which resisted their retirement vigorously and though they were replaced across the 1980s by the 'Whidbey Island' class, several of them lingered in reserve for some years after being decommissioned. Finally, as shown in the table, two were transferred to Brazil and the remainder scrapped.

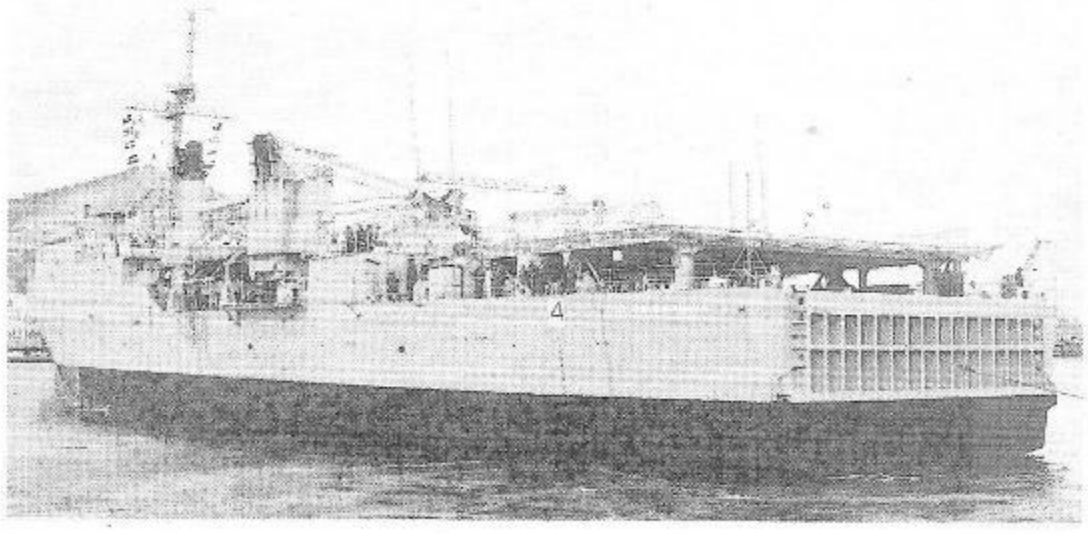
For Brazil, the two ships came as a welcome bonus, as it had been intending to build its own 4,500 tonne LST; instead, the two Thomastons were acquired, initially on five year leases.

DESIGN

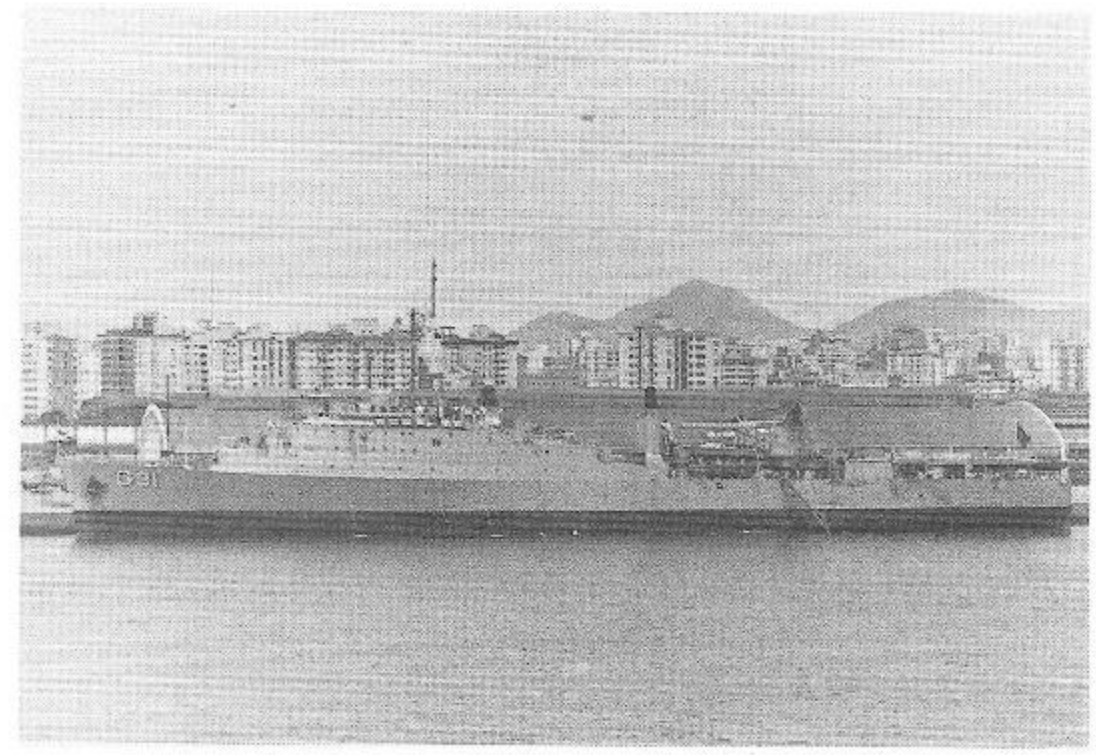
The 'Thomaston' class was a distinct improvement on the wartime LSDs, being larger and more seaworthy, with a much larger docking well which could accommodate three LCUs. There is a vehicle deck, but this lacks direct access to the docking well.

The 'Thomaston' class was originally armed with 16 US Navy 76 mm (3 in)/50 calibre guns in eight Mk 33 twin mountings, which were progressively reduced to 12, and then to six. Phalanx CIWS and SRBOC chaff launchers were installed during their US Navy service, but were removed from these ships before the transfer to Brazil. Other items such as the AN/SPS-6 air search radar and the satellite communications equipment (OE-82 antenna, SSR-1 receiver and WSC-3 transceiver) were also removed before the transfer.

The first four of the class had a full load displacement of 11,450 tonnes; the final four had full load displacement of 12,345 tonnes.

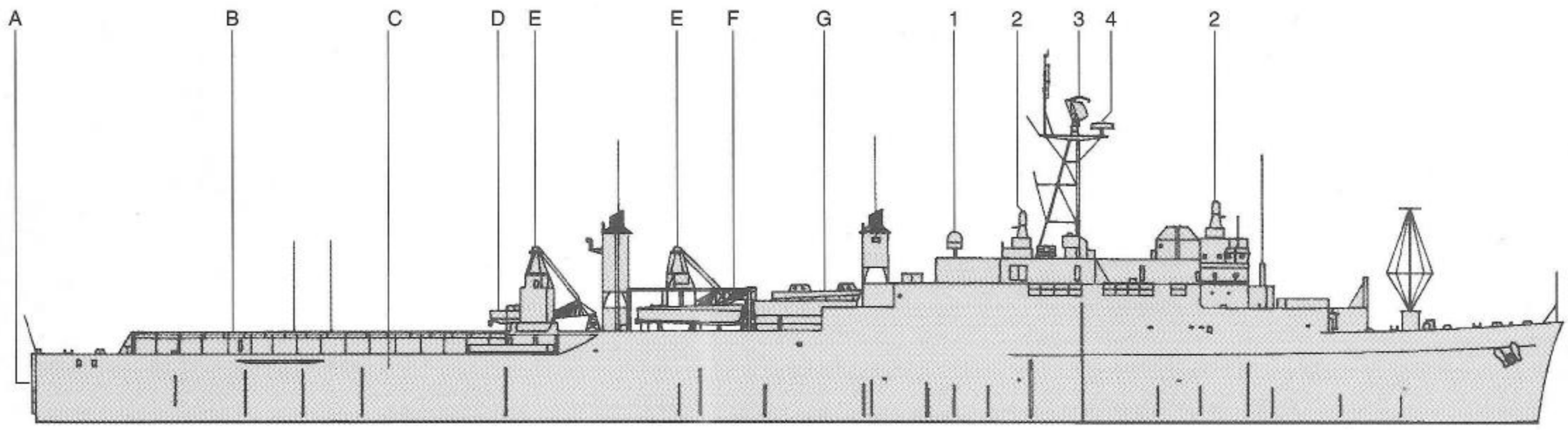


Rio de Janeiro *(G 31) is one of two ex-US Navy 'Thomaston' class LSDs serving with the Brazilian Navy. Note the stern gate and the helicopter flight deck which is formed from removable panels* (H & L van Ginderen Collection)



Rio de Janeiro *(G 31)* (Robert Pabst)

ANCHORAGE



Anchorage
Amphibious A *Stern gate* **B** *Flight deck (removable)* **C** *Docking well* **D** *LCPL* **E** *Crane; 50 tonnes capacity* **F** *LCVP* **G** *LCM 6*

General 1 *Satcom* **2** *Hughes Mk 15 Phalanx 20 mm CIWS* **3** *Lockheed SPS-40B air search radar* **4** *Raytheon SPS-10F surface search radar*

GENERAL SPECIFICATIONS

Operator: USA
Type: Dock Landing Ship (LSD)

Class: ANCHORAGE

Built: 5
Active: 5

Displacement:
standard: 8,738 t
full load: 13,919 t

Dimensions
Length: 168.6 m (553.3 ft)
Beam: 25.6 m (84 ft)
Draught: 6 m (20 ft)

Speed: 22 kts
Range: 14,800 n miles at 14 kts

Complement: 374, including 24 officers

SHIPS

ANCHORAGE (LSD 36)

Builder	Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down	13 Mar 1967
Launched	5 May 1968
Commissioned	15 Mar 1969

PORTLAND (LSD 37)

Builder	General Dynamics, Quincy, Massachusetts, USA
Laid down	21 Sep 1967
Launched	20 Dec 1969
Commissioned	3 Oct 1970

PENSACOLA (LSD 38)

Builder	General Dynamics, Quincy, Massachusetts, USA
Laid down	12 Mar 1969
Launched	11 Jul 1970
Commissioned	27 Mar 1971

MOUNT VERNON (LSD 39)

Builder	General Dynamics, Quincy, Massachusetts, USA
Laid down	29 Jan 1970
Launched	17 Apr 1971
Commissioned	13 May 1972

FORT FISHER (LSD 40)

Builder	General Dynamics, Quincy, Massachusetts, USA
Laid down	15 Jul 1970
Launched	22 Apr 1972
Commissioned	9 Dec 1972

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 366 troops, including 18 officers
- Total vehicle storage space, 1,394 m² (15,800 sq ft)
- Upper deck: one LCM 6 on deck; two LCPLs and one LCVP on davits. A further 15 LVT tractors can be stowed on a mezzanine deck

SHIP-SHORE LIFT

- Dock: three LCUs or four LCACs or 18 LCM 6 or nine LCM 8 or 52 LVTs

AMPHIBIOUS FACILITIES

- Docking well 131.1 × 15.2 m (430 × 50 ft)
- Two 50 tonnes capacity cranes

AVIATION FACILITIES

Specifications
Flight deck: Aft, constructed from removable panels
Hangar: None
Aviation fuel: 90 tonnes

WEAPONS SYSTEMS

GUNS

Hughes Mk 15 CIWS Phalanx
Two Mk 15 CIWS are installed, one on the bridge roof, the other atop the superstructure abaft the mast. The weapons group is based on a barbette assembly with electronics enclosure to the rear. The gun is a six-barrelled 20 mm M61A1 Vulcan capable of very high firing rates. Original Block 0 systems installed in the early 1980s are gradually to be uprated to Block 1.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire:
Block 0; Block 1 Baseline 0: 3,000 rds/min
Block 1 Baseline 1: 4,500 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)
Mounting:
Weight:
Block 0: 5.42 t
Block 1: 6.18 t
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

25 mm Mk 38 automatic cannon (Sea Snake)
There are two single Mk 88 mountings for Mk 38 25 mm cannon (Sea Snake). The Mk 88 mounting is replacing

20 mm mountings in many US Navy warships and is designed to engage surface and shore targets in low- and mid-intensity operational environments at ranges up to 1.33 n miles (2.5 km). The M-242 is a single barrel, externally powered weapon which incorporates a rotating bolt mechanism driven by a chain drive. The weapon has been designed to allow the barrel to recoil separately from the receiver, which reduces the available travel as the bolt also has to move, the travelling distance being 12.7 mm. The Mk 38 can fire single shots or 175 rds/min and features twin shoulder braces and an optical Aimpoint sight. The weapon weighs 110.5 kg (243 lb) and is 2.74 m (9.0 ft) long, 0.32 m (1.0 ft) wide and 0.37 m (1.2 ft) high while the barrel is 2.30 m (7.5 ft) long. The peak recoil force is 4,536 kg (10,000 lb) in the naval version but with a McDonnell Douglas muzzle brake modification and recoil damper this can be reduced to 2,721.5 kg (6,001 lb). The barrel life is in excess of 13,000 rounds while the demonstrated reliability of the weapon is 22,000 rounds between stoppages.

Specifications

Calibre: 25 mm
Length of barrel: 81 calibres
Muzzle velocity: 1,100 m/s (3,609 ft/s)
Traverse: 300°
Elevation: −20 to +55°
Weight: 596.5 kg (1,315 lb) (loaded)
Crew: 1 (often supported by a spotter)
Range: 1.33 n miles (2.47 km)
Rate of fire: 175 rds/min (max)
Ammunition: 184 g HEI-T

M2HB 12.7 mm machine guns

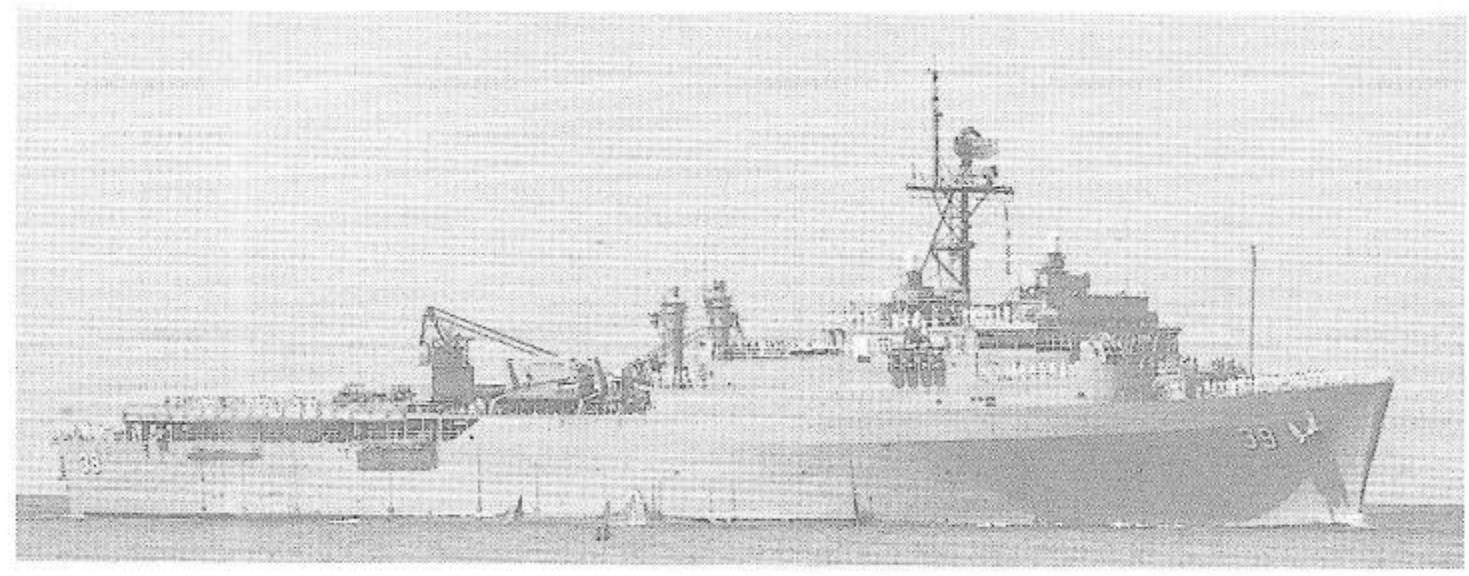
Six M2HB 12.7 mm machine guns are carried. The M2HB is a selective short recoil automatic operation weapon with a 1,143 mm (45 in) long barrel and eight right-hand grooves turning once every 381 mm. Muzzle energy is 1,867 mkp and the weapon uses 110-round belts.

Specifications

M2HB
Calibre: 12.7 mm
Length of barrel: 190 calibres
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

Fort Fisher *(LSD 40) in 1978, showing the original armament which included twin 76 mm (3 in) guns, and no Phalanx CIWS* (US Navy/PH2 P J Salesi)

Fort Fisher *(LSD 40) in October 1996 with 76 mm guns removed* (H & L van Ginderen Collection)



Mount Vernon *(LSD 39) in 1991, with both twin 76 mm/50 guns and Mk 15 CIWS* (US Navy/OS2 J Bouvia)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Raytheon AN/SLQ-32(V)1

AN/SLQ-32 is a Raytheon-developed electronic warfare package providing, in its basic (V)1 level, warning, identification and direction-finding of incoming radar-guided anti-ship missiles. 'Anchorage' class is likely to receive the upgraded AN/SLQ-32(V)2, which adds early warning, identification and direction-finding of radars associated with the targeting and launch of the missiles.

Manufacturer/Contractor

Raytheon, USA.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are four Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) systems consisting of launcher, launcher control, power supplies, ready service lockers and munitions. The Mk 137 launcher has six 130 mm (5 in) fixed tubes arranged in parallel rows at angles of 45 and 60°. The firing circuits use electromagnetic induction to initiate the propelling charges in the cartridges. The prime cartridge is the Mk 182 Torch with chaff payload.

Specifications

Launcher dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Launcher weight: 173 kg (381 lb)
Mk 182 cartridge dimensions: 1,209 × 130 mm (47.5 × 5 in)
Cartridge weight: 22.7 kg (50 lb)

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

Satcom
SRR-1
WSC-3 (UHF)

RADARS

	AN/SPS-40B/C (Note 1)	AN/SPS-67 (Notes 1,2)	AN/SPS-64(V)9 (Note 3)	LN 66 (Note 3)
Manufacturer	Lockheed	Norden	Raytheon	Canadian Marconi
Role	2D air search	Air/surface search	Navigation	Navigation
Frequency	UHF (400-450 MHz in 10 channels)	G (5.4-5.8 GHz)	I	I-band (9,375 MHz ±30 MHz)
Beam	10 × 19°	1.5 × 31°	1.9 × 22°	
Peak power	225 kW	280 kW	20 kW	12 kW
Gain	21 dB		20 dB	
Pulsewidth	3 µs	0.1; 0.25; 1.0 µs	0.06/0.5/1.0 µs	0.5/0.9 µs
PRF	300 pps		3,600/1,800/900 pps	800/1,250/2,500 pps
Scan rate	7.5/15 rpm		33 rpm	22 rpm ±10%

Notes
1. Some ships have AN/SPS-40B, others AN/SPS-67(V)1
2. AN/SPS-67(V)1 has replaced AN/SPS-10F
3. Some ships have AN/SPS-64(V)9, others LN-66

PROPULSION

Specifications
System: Steam
Main machinery: 2 Foster-Wheeler boilers (Combustion Engineering in LSD 36); 42.3 kg/cm² (600 psi); 467°C; 2 De Laval turbines, 18 MW (24,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The five-strong 'Anchorage' class was a product of the amphibious programme of the 1960s. The 'Thomaston' class Landing Ships, Dock (LSD), had been built in the 1950s and the two 'Raleigh' and 'Austin' classes, which were designed and built in parallel, reflected changing views of the nature of amphibious operations within the US military.

The designation of the 'Austin' class as 'amphibious transport, dock (LPD)' was significant and indicated a change in emphasis from the traditional 'mother ship' role of the LSDs to the rapid deployment of amphibious task forces, with a ship which carried a 'balanced load'. The LPD concept was, however, ahead of its time, and the ordering of the five 'Anchorage' class ships was recognition that there was still a role for the traditional LSD to carry landing craft to an assault area, and that the Austins had not entirely met all the requirements of amphibious forces. In addition, the speed of the amphibious task forces had been set at 20 knots, a figure which the ageing Second World War vessels still in service could not meet.

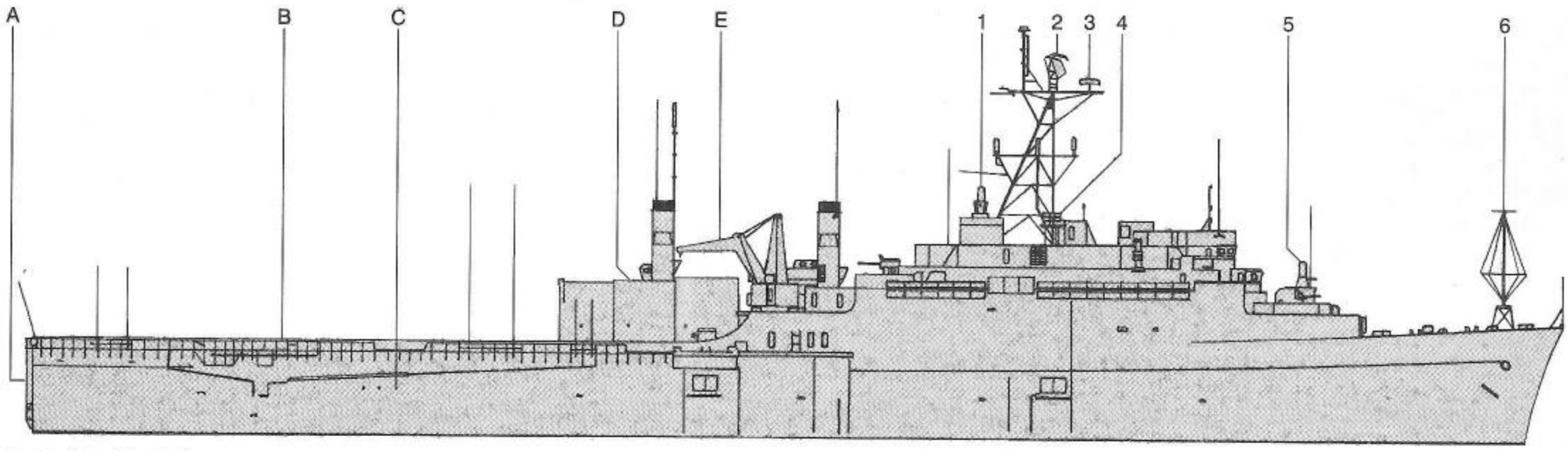
DESIGN

The Anchorage design was a development of the Thomaston (LSD 28) design, but with a longer hull, which allowed a 9 m (30 ft) increase in the length of the docking well. As a result the well can accommodate three LCUs or nine LCM 8 or, as an alternative, 50 LVTP 7s. There is a 'mezzanine deck' amidships, above the docking well, for vehicles, which are removed using the two 50 tonnes cranes.

DEPLOYMENT

Four of the class were involved in the Gulf War of 1991.

AUSTIN



Austin (Ian Sturton)
Amphibious A *Stern gate* **B** *Flight deck* **C** *Docking well* **D** *Telescopic hangar (light helicopter only)* **E** *Crane*

General 1 *Hughes Mk 15 20 mm CIWS* **2** *Lockheed AN/SPS-40B air search radar* **3** *Norden AN/SPS-67 surface search radar* **4** *AN/SLQ-32(V)1 ESM* **5** *HF discone antenna*

GENERAL SPECIFICATIONS

Operator: USA

Class: AUSTIN

Built: 12 (see 'Further Information').
Active: 11

Displacement:
standard: 9,276 t
full load: 17,520 t

Dimensions
Length: 173.8 m (570 ft)
Beam: 30.5 m (100 ft) (hull 25.6 m (84 ft))
Draught: 7 m (23 ft)

Speed: 21 kts
Range: 7,700 n miles at 20 kts

Complement: 420, including 24 officers; flag staff 90 in LPD 7-13

SHIPS

AUSTIN (LPD 4)
Builder New York Naval Shipyard, New York, USA
Laid down 4 Feb 1963
Launched 27 Jun 1964
Commissioned 6 Feb 1965

OGDEN (LPD 5)
Builder New York Naval Shipyard, New York, USA
Laid down 4 Feb 1963
Launched 27 Jun 1964
Commissioned 19 Jun 1965

DULUTH (LPD 6)
Builder New York Naval Shipyard, New York, USA
Laid down 18 Dec 1963
Launched 14 Aug 1965
Commissioned 18 Dec 1965

CLEVELAND (LPD 7)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 30 Nov 1964
Launched 7 May 1966
Commissioned 21 Apr 1967

DUBUQUE (LPD 8)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 25 Jan 1965
Launched 6 Aug 1966
Commissioned 1 Sep 1967

DENVER (LPD 9)
Builder Lockheed SB & Construction Co, Seattle, Washington, USA
Laid down 7 Feb 1964
Launched 23 Jan 1965
Commissioned 26 Oct 1968

JUNEAU (LPD 10)
Builder Lockheed SB & Construction Co, Seattle, Washington, USA
Laid down 23 Jan 1965
Launched 12 Feb 1966
Commissioned 12 Jul 1969

SHREVEPORT (LPD 12)
Builder Lockheed SB & Construction Co, Seattle, Washington, USA
Laid down 27 Dec 1965
Launched 25 Oct 1966
Commissioned 12 Dec 1970

NASHVILLE (LPD 13)
Builder Lockheed SB & Construction Co, Seattle, Washington, USA
Laid down 14 Mar 1966
Launched 7 Oct 1967
Commissioned 14 Feb 1970

TRENTON (LPD 14)
Builder Lockheed SB & Construction Co, Seattle, Washington, USA
Laid down 8 Aug 1966
Launched 3 Aug 1968
Commissioned 6 Mar 1971

PONCE (LPD 15)
Builder Lockheed SB & Construction Co, Seattle, Washington, USA
Laid down 31 Oct 1966
Launched 20 May 1970
Commissioned 10 July 1971

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 930 troops (840 in LPD 7-13)

SHIP-SHORE LIFT

- Four LCPL/LCVP plus nine LCM6s or four LCM8s, or two LCACs, or 20 LVTs plus 3,900 tonnes cargo

AVIATION FACILITIES

Specifications
Flight deck:
Hangar: 19.5 m (64 ft) long × 7.3 m (24 ft) wide. Telescopic section adds a further 4.9 m (16 ft) in length
Helicopter: Up to 6 CH-46D/E Sea Knight
Typical operational load: 1 SH-60 Seahawk; 2 CH-46 Sea Knight; 2 UH-1 Twin Huey, 4 AH-1 Sea Cobras (plus one patrol boat armed with 20 mm guns)

AMPHIBIOUS FACILITIES

- Docking well 120.1 × 15.2 m (394 × 50 ft)
- Cranes: one 30 tonne; six 4 tonne
- Elevator: 9.15 tonne
- Vehicle parking: 1,379 m² (14,844 sq ft)
- Ammunition for landing force: 1,540 m³ (54,384 cu ft)

WEAPONS SYSTEMS

GUNS

Hughes Mk 15 CIWS Phalanx

There are two Mk 15 CIWS; one is forward of the bridge, the other atop the superstructure, immediately abaft the mast.

The CIWS was developed to provide fast reaction to submarine-launched anti-ship missiles and is a 'closed loop' system, tracking both the target and the stream of rounds, and constantly seeking to reduce the difference between the two. It consists of the Mk 16 weapon group, the Mk 339 local and Mk 340 remote-control panels as well as a remote indicator panel. The weapons group is based on a barbette assembly with electronics enclosure to the rear. The gun is a six-barrelled 20 mm M61A1 Vulcan capable of extremely high firing rates. Original Block 0 systems installed in the early 1980s are gradually being uprated to Block 1.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire:
Block 0; Block 1 Baseline 0: 3,000 rds/min
Block 1 Baseline 1: 4,500 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)
Mounting:
Weight (Block 0): 5.42 t; (Block 1): 6.18 t
Traverse: 310° at 126° /s
Elevation: −25 to +85° at 92° /s

25 mm Mk 38 automatic cannon (Sea Snake)

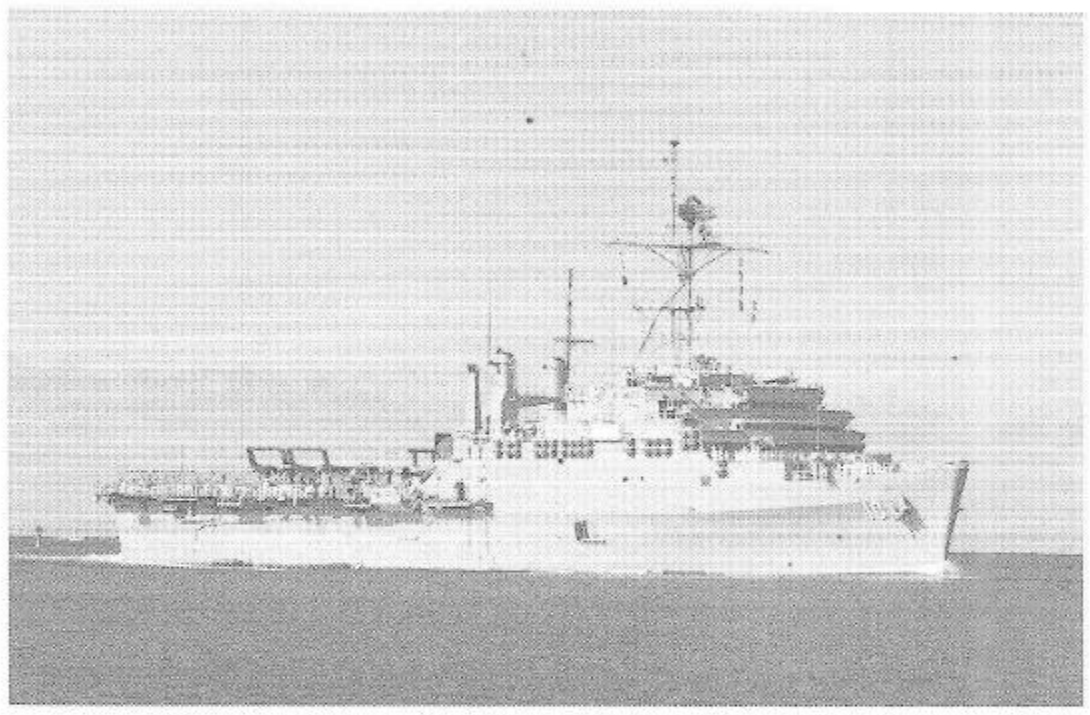
There are two single Mk 88 mountings for Mk 38 25 mm cannon (Sea Snake). The Mk 88 mounting is replacing 20 mm mountings in many US Navy warships and is designed to engage surface and shore targets in low- and mid-intensity operational environments at ranges up to 1.33 n miles (2.5 km). The M-242 is a single barrel, externally powered weapon which incorporates a rotating bolt mechanism driven by a chain drive. The weapon has been designed to allow the barrel to recoil separately from the receiver, which reduces the available travel as the bolt also has to move, the travelling distance being 12.7 mm. The Mk 38 can fire single shots or 175 rds/min and features twin shoulder braces and an optical Aimpoint sight. The weapon weighs 110.5 kg (243 lb) and is 2.74 m (9 ft) long, 0.32 m (1.0 ft) wide and 0.37 m (1.2 ft) high while the barrel is 2.30 m (7.5 ft) long. The peak recoil force is 4,536 kg (10,001 lb) in the naval version but with a McDonnell Douglas muzzle brake modification and recoil damper this can be reduced to 2,721.5 kg (6,001 lb). The barrel life is in excess of 13,000 rounds while the demonstrated reliability of the weapon is 22,000 rounds between stoppages.

Specifications
Calibre: 25 mm
Length of barrel: 81 calibres
Muzzle velocity: 1,100 m/s (3,609 ft/s)
Traverse: 300°
Elevation: −20 to +55°
Weight: 596.5 kg (1,315 lb) (loaded)
Crew: 1 (often supported by a spotter)
Range: 1.33 n miles (2.47 km)
Rate of fire: 175 rds/min (max)
Ammunition: 184 g HEI-T

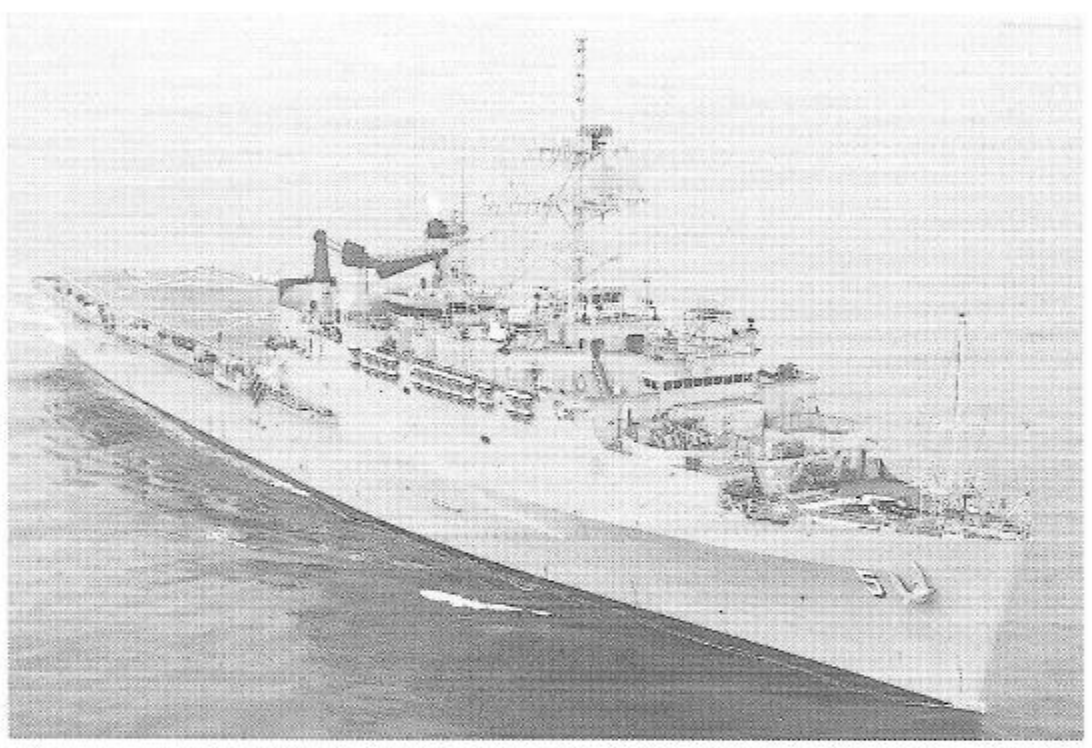
12.7 mm machine guns

Eight M2HB 12.7 mm machine guns are carried. The M2HB is a selective short recoil automatic operation weapon with a 1,143 mm (45 in) long barrel and eight right-hand grooves turning once every 381 mm.

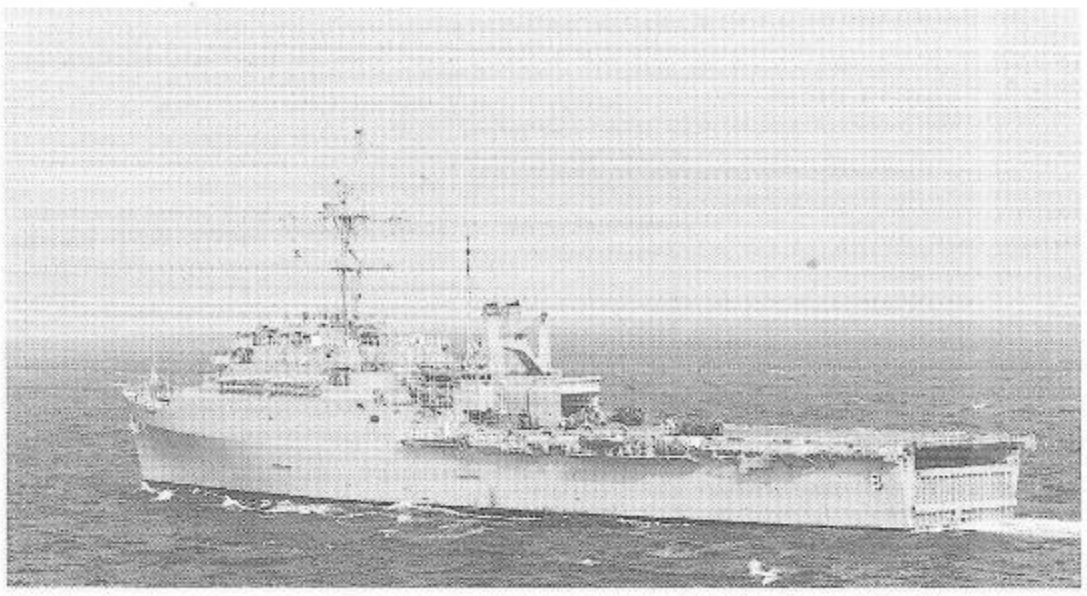
Specifications
M2HB
Calibre: 12.7 mm
Length of barrel: 190 calibres
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)



Juneau *(LPD 10). Note the second bridge level for the flag staff, a feature of LPD 7 to LPD 13 only. The ship is transporting a US Marine Corps aviation unit including a number of Rockwell OV-10 Bronco twin-engined aircraft, all of which are returning to the USA from Operation Desert Storm* (US Navy/OS2 J Bouvia)



Ogden *(LPD 5). This is one of the 'non-flag' ships and does not have a second bridge level. Note also that at the time of this picture (1987) the twin 76 mm/60 was still mounted just forward of the bridge, but the Phalanx Mk 15 CIWS had yet to be installed* (US Navy/PH2 Grzezdzinski)



Dubuque *(LPD 8) about to commence an underway replenishment. The telescopic hangar gives shelter for maintenance operations only and is not intended to accommodate helicopters* (US Navy/Cdr A J Dooley)

Nashville *(LPD 13)* (US Navy)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

AN/SLQ-32(V)1 intercept

The AN/SLQ-32(V)1 is an ESM system, giving radar warning on B to J-bands.

Manufacturer/Contractor
Raytheon, Electromagnetic System Division, Goleta, California, USA.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are four Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) systems consisting of launcher, launcher control, power supplies, ready

service lockers and munitions. The Mk 137 launcher has six 130 mm (5 in) fixed tubes arranged in parallel rows at angles of 45 and 60°. The firing circuits use electromagnetic induction to initiate the propelling charges in the cartridges. The prime cartridge is the Mk 182 Torch with chaff payload.

Specifications
Launcher dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Launcher weight: 173 kg (381 lb)
Mk 182 cartridge dimensions: 1,209 × 130 mm (47.5 × 5 in)
Cartridge weight: 22.7 kg (50 lb)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Satcom
WSC-3 (UHF)

COMMUNICATIONS AND DATALINKS

TACAN
URN-25

IFF
Mk XII
UPX-29

RADARS

	AN/SPS-40B/C	AN/SPS-67	AN/SPS-64(V)9
Manufacturer	Lockheed	Norden	Raytheon
Role	2D air search	Surface search	Navigation
Band	UHF (400-450 MHz in 10 channels)	G (5.4-5.8 GHz)	I
Beam	10 × 19°	1.5 × 31°	1.9 × 22°
Peak power	225 kW	280 kW	20 kW
Gain	21 dB		20 dB
Pulsewidth	3 µs	0.1; 0.25; 1.0 µs	0.06/0.5/1.0 µs
PRF	300 pps		3,600/1,800/900 pps
Scan rate	7.5/15 rpm		33 rpm

PROPULSION

Specifications
System: Steam
Main machinery: 2 Foster Wheeler boilers (Babcock & Wilcox in *Ogden* (LPD 5) and *Shreveport* (LPD 12)); 42.3 kg/cm² (600 psi); 467°C; 2 De Laval turbines, 18 MW (24,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The 'Austin' class was developed from the three-strong 'Raleigh' class, which was intended to follow the earlier LSDs but offer more troop and cargo carrying capacity, along with a smaller well deck. Unlike the Raleighs, the Austins had a single helicopter hangar.

Seven of the class (LPD 7 to LPD 13) were fitted for use as amphibious squadron (PhibRon) flagships. Their troop capacity is reduced from 930 to 840 troops and they have an additional bridge level.

One of these, *Coronado* (LPD 11), has spent many years as a fleet flagship and is not likely ever to use her amphibious capability. The intended 13th of the class, LPD 16, was deferred in 1966 and cancelled in 1969 in favour of the LHA programme, which explains why numbering of the new 'LPD' class, which will replace the 'Austin' class, starts with LPD 17.

The 12th member of the class, *Coronado* (LPD 11), was converted to become a fleet flagship in 1980 and has since served as locum flagship in the Middle East and the Pacific. Though *Coronado* retains amphibious capability, it is not intended that she should be used for duties other than flagship service, and her number has been changed to AGF 11. The intended 13th was never built.

DESIGN

The major change from the previous 'Raleigh' class was the insertion of a 15.2 m (50 ft) hull section at the forward end of the docking well. This additional space enabled a large telescopic hangar to be included and also increased cargo capacity from 2,000 to 3,900 tonnes. First of class, *Austin* (LPD4) does not have a hangar.

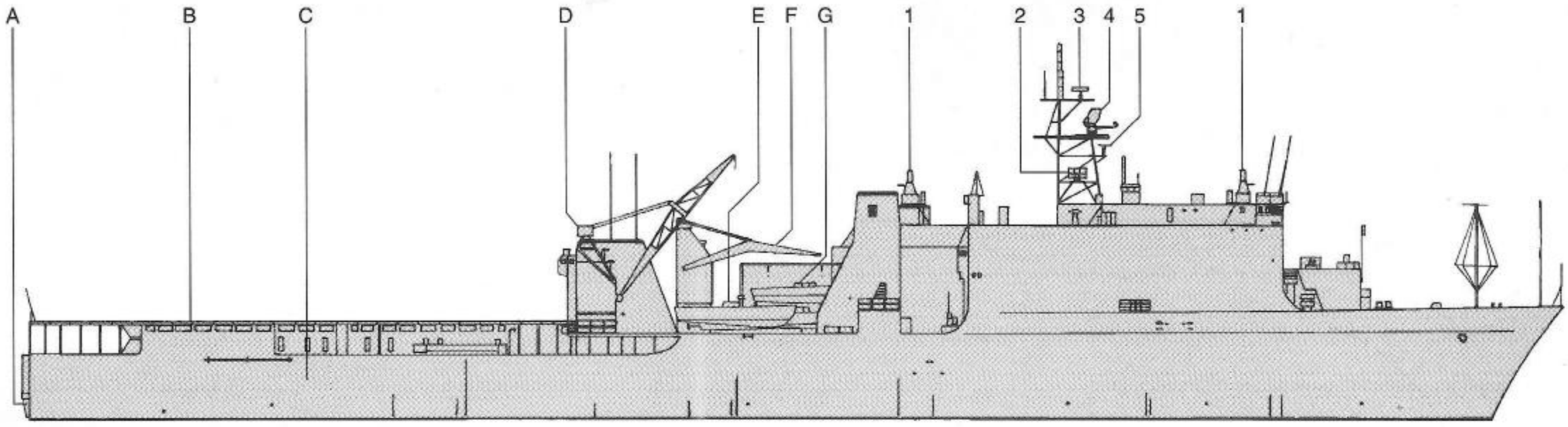
LPD 7 to LPD 13 (both inclusive) are required to serve as amphibious squadron flagships and have an additional bridge level to serve the relevant flag staff.

FUTURE

A proposed SLEP was cancelled in 1987 but all are to be kept in service beyond 2000.

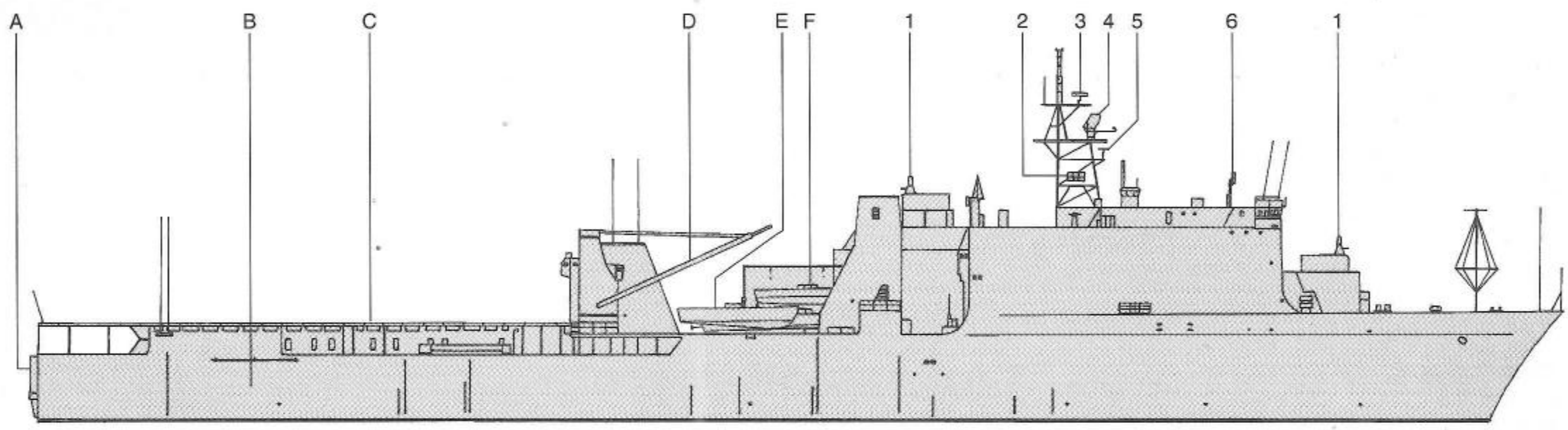
Ogden *(LPD 5)* (H & L van Ginderen Collection)

WHIDBEY ISLAND/HARPER'S FERRY



Whidbey Island (Ian Sturton)
Amphibious A *Stern gate* **B** *Flight deck* **C** *Docking well* **D** *Crane; 60 tonne capacity* **E** *LCPL* **F** *Crane; 20 tonne capacity* **G** *LCPL*

General 1 *Hughes Mk 15 20 mm CIWS* **2** *AN/SLQ-32(V)2* **3** *Norden AN/SPS-67 surface search radar* **4** *Raytheon AN/SPS-49(V)5 long-range air search radar* **5** *Raytheon AN/SPS-64(V)9 navigation radar*



Harper's Ferry (Ian Sturton)
Amphibious A *Stern gate* **B** *Docking well* **C** *Flight deck* **D** *Crane; 60 tonnes capacity* **E** *LCPL* **F** *LCVP*

General 1 *Hughes Mk 15 20 mm CIWS* **2** *AN/SLQ-32(V)2* **3** *Norden AN/SPS-67 surface search radar* **4** *Raytheon AN/SPS-49(V)5 long-range air search* **5** *Raytheon AN/SPS-64(V)9 navigation radar* **6** *AN/WSC-3 Satcom (UHF)*

GENERAL SPECIFICATIONS

Operator: USA
Type: Dock landing ships (LSD)

Class: WHIDBEY ISLAND/HARPER'S FERRY

Built: Whidbey Island — 8; Harper's Ferry — 3
Active: Whidbey Island — 8; Harper's Ferry — 3
Building: Harper's Ferry — 1

Displacement:
light: Whidbey Island — 11,125 t; Harper's Ferry — 11,303 t
full load: Whidbey Island — 15,726 t; Harper's Ferry — 16,740 t

Dimensions
Length: 185.8 m (609.5 ft)

Beam: 25.6 m (84 ft)
Draught: 6.3 m (20.5 ft)

Speed: 22 kts
Range: 8,000 n miles at 18 kts

Complement: 340, including 21 officers

SHIPS

'Whidbey Island' class

WHIDBEY ISLAND (LSD 41)
Builder Lockheed Shipbuilding, Seattle, Washington, USA
Laid down 4 Aug 1981
Launched 10 Jun 1983
Commissioned 9 Feb 1985

GERMANTOWN (LSD 42)
Builder Lockheed Shipbuilding, Seattle, Washington, USA
Laid down 5 Aug 1982
Launched 29 Jun 1984
Commissioned 8 Feb 1986

FORT McHENRY (LSD 43)
Builder Lockheed Shipbuilding, Seattle, Washington, USA
Laid down 10 Jun 1983
Launched 1 Feb 1986
Commissioned 8 Aug 1987

GUNSTON HALL (LSD 44)
Builder Avondale Industries, New Orleans, USA
Laid down 26 May 1986
Launched 27 Jun 1987
Commissioned 22 Apr 1989

COMSTOCK (LSD 45)
Builder Avondale Industries, New Orleans, USA
Laid down 27 Oct 1986
Launched 16 Jan 1988
Commissioned 3 Feb 1990

TORTUGA (LSD 46)
Builder Avondale Industries, New Orleans, USA
Laid down 23 Mar 1987
Launched 15 Sep 1988
Commissioned 17 Nov 1990

RUSHMORE (LSD 47)
Builder Avondale Industries, New Orleans, USA
Laid down 9 Nov 1987
Launched 6 May 1989
Commissioned 1 Jun 1991

ASHLAND (LSD 48)
Builder Avondale Industries, New Orleans, USA
Laid down 4 Apr 1988
Launched 11 Nov 1989
Commissioned 9 May 1992

'Harpers Ferry' class

HARPER'S FERRY (LSD 49)
Builder Avondale Industries, New Orleans, USA
Laid down 15 Apr 1991
Launched 16 Jan 1993
Commissioned 7 Jan 1995

CARTER HALL (LSD 50)
Builder Avondale Industries, New Orleans, USA
Laid down 11 Nov 1991

Launched 2 Oct 1993
Commissioned 30 Sep 1995

OAK HILL (LSD 51)
Builder Avondale Industries, New Orleans, USA
Laid down 21 Sep 1992

Launched 11 Jun 1994
Commissioned Jun 1996

PEARL HARBOR (LSD 52)
Builder Avondale Industries, New Orleans, USA
Laid down 27 Jan 1995

Launched 24 Feb 1996
Commissioned Apr 1998

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 450 troops

SHIP-SHORE LIFT

- **Whidbey Island** 4 LCAC or 21 LCM 6 or 3 LCU. 2 LCPL
- **Harpers Ferry** 2 LCAC or 9 LCM6 or 1 LCU. 2 LCPL

AVIATION FACILITIES

Whidbey Island
- 141 m³ (5,000 cu ft) marine cargo
- 1,161 m² (12,500 sq ft) for vehicles (including four preloaded LCACs in the well deck)
- Aviation fuel: 90 tonnes

Harper's Ferry
- 1,914 m³ (67,600 cu ft) marine cargo
- 1,877 m² (20,200 sq ft) for vehicles (including two or three preloaded LCACs in the well deck
- aviation fuel: 90 tonnes

AMPHIBIOUS FACILITIES

- Well deck. 134.1 × 15.2 m (440 × 50 ft) (shorter in *Harper's Ferry*)
- Cranes. 1 × 60 t; 1 × 20 t
  Whidbey Island: 1 × 60 tonnes; 1 × 20 tonnes
  Harper's Ferry: 1 × 60 tonnes.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

General Dynamics/Hughes RIM-116A RAM close in system

Whidbey Island (LSD 41), *Ashland* (LSD 48). One RAM launcher was fitted in *Whidbey Island* (LSD 41) for SSDS trials in 1993 and in *Ashland* (LSD 48) in 1996. It will be fitted in all ships of the class in due course. The Rolling-Airframe Missile (RAM) is a lightweight, close in, quick reaction, anti-missile defence system, the RIM-116 missile being based on the Sidewinder air-to-air missile, but with significant modifications, enabling it to be used as a fire-and-forget system. There is an infra-red, terminal guidance seeker in the nose (taken from the Stinger man-portable surface-to-air missile), behind which is a new dual-mode passive radio frequency seeker for mid-course guidance. Most of the rear of the missile is based upon Sidewinder components. Missiles are stored in sealed launcher-containers which are manually loaded into the 21-cell Mk 49 RAM Standard Launchers.

Radar and electro-optical sensors provide details of target location, distance and speed, while the ship's ESM system inputs data on the target's radar frequency, as well as correlating radar data on location. On launch, the missile is spun-up by a rifling band as it is driven down the launch tube and then, as it leaves the launcher, the four tail fins deploy which maintains the spin. Aerodynamic control is provided by the two canard surfaces, which also deploy after launch. The autopilot and control system maintain the initial line of sight course towards the target and then the RF seeker is activated and, once this acquires the target, it takes control of the guidance system and makes the appropriate course alterations. The IR seeker is also activated and when a sufficient signal-to-noise ratio is achieved, this takes over guidance control for the terminal phase. The missile is capable of manoeuvres up to 20 *g* in any direction. The system can only be fired automatically at the moment, but manual control will become possible with Block 2 missiles.

Harper's Ferry *(LSD 49), lead ship of four 'cargo variants' of the basic Whidbey Island design. External indications are the forward Mk 15 CIWS is on the roof of the forecastle deckhouse, the forward WSC-3 antenna is on the bridge roof, the after Mk 15 CIWS is atop a square deckhouse, and there is only one crane* (H & L van Ginderen Collection)

Comstock *(LSD 45) immediately before commissioning. Note the two Mk 15 CIWS on the top of the superstructure, and the two 'dustbin' satcom antennas, one on the roof of the forecastle deckhouse, the second at the after end of the main superstructure* (US Navy)

Specifications

Mk 49 RAM Standard launcher
Traverse: 360°
Elevation: −25 to +80°
Turning circle: 3.27 m (10.7 ft)

RIM-116 missile
Length: 2.79 m (9.1 ft)
Diameter: 12.7 cm (5 in)
Wing span: 43.4 cm (17.1 in)
Weight: 73.6 kg (162 lb)
Speed: Mach 2
Range: 5.17 n miles (9.6 km)
Warhead: 9.09 kg (20 lb) fragmentation blast WDU-17B
Motor: Hercules/Aerojet Mk 36 solid propellant rocket

Manufacturer/Contractor

General Dynamics/Hughes Missile Systems, USA.

GUNS

Hughes Mk 15 CIWS Phalanx

Two Mk 15 CIWS are installed, one on the bridge roof, the other on the hangar roof. The weapons group is based on a barbette assembly with electronics enclosure to the rear.

The gun is a six-barrelled 20 mm M61A1 Vulcan capable of very high firing rates. Original Block 0 systems installed in the early 1980s will gradually be uprated to Block 1.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire:
Block 0; Block 1 Baseline 0: 3,000 rds/min
Block 1 Baseline 1: 4,500 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)

Mounting:
Weight (Block 0): 5.42 t; (Block 1): 6.18 t
Traverse: 310° at 126° /s
Elevation: −25 to +85° at 92° /s

25 mm Mk 38 automatic cannon (Sea Snake)

There are two single Mk 88 mountings for Mk 38 25 mm cannon (Sea Snake). The Mk 88 mounting is replacing 20 mm mountings in many US Navy warships and is designed to engage surface and shore targets in low- and mid-intensity operational environments at ranges up to 1.33 n miles (2.5 km). The M-242 is a single barrel, externally powered weapon which incorporates a rotating bolt mechanism driven by a chain drive. The weapon has been designed to allow the barrel to recoil separately from the receiver, which reduces the available travel as the bolt also has to move, the travelling distance being 12.7 mm. The Mk 38 can fire single

shots or 175 rds/min and features twin shoulder braces and an optical Aimpoint sight. The weapon weighs 110.5 kg (243.6 lb) and is 2.74 m (9.0 ft) long, 0.32 m (1.0 ft) wide and 0.37 m (1.2 ft) high while the barrel is 2.30 m (7.5 ft) long. The peak recoil force is 4,536 kg (10,000 lb) in the naval version but with a McDonnell Douglas muzzle brake modification and recoil damper this can be reduced to 2721.5 kg (6,001 lb). The barrel life is in excess of 13,000 rounds while the demonstrated reliability of the weapon is 22,000 rounds between stoppages.

Specifications

Calibre: 25 mm
Length of barrel: 81 calibres
Muzzle velocity: 1,100 m/s (3,609 ft/s)
Traverse: 300°
Elevation: −20 to +55°
Weight: 596.5 kg (loaded) (1,315 lb)
Crew: 1 (often supported by a spotter)
Range: 1.33 n miles (2.47 km)
Rate of fire: 175 rds/min (max)
Ammunition: 184 g HEI-T

12.7 mm machine guns

Eight M2HB 12.7 mm machine guns are carried. The M2HB is a selective short recoil automatic operation weapon with a 1,143 mm (45 in) long barrel and eight right-hand grooves turning once every 381 mm. Muzzle energy is 1,867 mkp and the weapon uses 110-round belts.

Specifications

M2HB
Calibre: 12.7 mm
Length of barrel: 190 calibres
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

AN/SLQ-32(V)1 or (V)2

These ships are reported to carry AN/SLQ-32(V)1 or (V)2 radar intercept sets only and not the additional ECM suite to enable signals to be jammed or decoyed.

The AN/SLQ-32(V)1 version is designed to detect all radio frequency signals in Band 3 at all azimuths, covering potential enemy radar-guided anti-ship missiles and their associated supporting radars. This provides alert facilities to an attack on the ship and also allows for the control of the Mk 36 chaff rocket system carried by the ship.

AN/SLQ-32(V)2 adds two receiving subsystems. Two Band 2 direction-finding receivers and arrays and lenses each covering 90° are added to each of the port and starboard antenna assemblies, and a Band 2 semi-omni-antenna covering 180° is added to each assembly. Four small Band 1 spiral antennas are located on a yard-arm (port and starboard) to cover 360°. As well as the necessary extra electronics needed to handle the increased input data, the AN/UYK-19 computer remains the same as in the (V)1 version apart from having an additional 16 k of storage capacity.

Manufacturer/Contractor

Raytheon Company, Electromagnetic Systems Division, Goleta, California, USA

AN/SLQ-49 chaff buoys

AN/SLQ-49 is the US Navy version of the British 'Replica' system, also known as 'Rubber Duck'. This is a rapidly deployed, passive naval decoy which presents a ship-like image to the radar seeker of an incoming anti-ship missile. The equipment consists of a launcher and a pair of liferaft-type containers, each housing one octahedral-shaped radar reflector. The two reflecting bodies start to inflate as they leave the ship and once in the water they are linked to each other by a 5 m (16 ft) line with one of the container lids acting as a sea-anchor to ensure that they remain apart. The distance between the opposite tips of the decoy is approximately 2.5 m (8.2 ft) and it contains metal-coated nylon mesh curtains, which are suspended from aluminium alloy tubes.

Manufacturer/Contractor

Irvin, Letchworth, UK.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are four Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) systems consisting of launcher, launcher control, power supplies, ready service lockers and munitions. The Mk 137 launcher has six 130 mm (5 in) fixed tubes arranged in parallel rows at angles of 45 and 60°. The firing circuits use electromagnetic induction to initiate the propelling charges in the cartridges. The prime cartridge is the Mk 182 Torch with chaff payload.

Specifications

Launcher dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Launcher weight: 173 kg (381 lb)
Mk 182 cartridge dimensions: 1,209 × 130 mm (47.5 × 5 in)
Cartridge weight: 22.7 kg (50 lb)

AN/SLQ-25 Nixie torpedo decoy

AN/SLQ-25 Nixie is a solid-state, modular design, electroacoustic, countermeasures decoy system used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors (through an oscilloscope) the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming and recovering the towed bodies (which are stored on racks attached to the winch), a coaxial switching unit which selects the appropriate cable or load, and towed bodies. The towed body converts the electrical signals to acoustic signals and projects them.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Ship Self-Defense System (SSDS)

***Whidbey Island* (LSD 41) *Ashland* (LSD 48) only.** The prototype Quick Reaction Combat System/Ship Self-Defense System (QRCS/SSDS) was installed and successfully demonstrated in *Whidbey Island* (LSD 41) in 1993, using Raytheon AN/SPS-49 long-range 2D air search radar, a prototype Spar AN/SAR-8 infra-red search and track device, and AN/SLQ-32 electronic warfare system as the sensors. The SLQ-32 also controlled the SRBOC chaff/infra-red launcher as the 'soft kill' element of the system, while the 'hard kill' elements were the ship's two Mk 15 Phalanx CIWS and the Mk 116 RAM surface-to-air missile (which was also installed for the trials). All elements were linked by an FDDI/Safenet fibre optic local area network through access units and supervised by two Hughes workstations. The SPS-49 gave early warning of threats and with the SLQ-32 provided track data which was supplemented by the SAR-8 and Phalanx radars.

Following the successful trial in *Whidbey Island,* SSDS has been installed in a second ship, *Ashland* (LSD 48) and will be fitted in all other ships in due course.

COMMUNICATIONS AND DATALINKS

Satcom
SRR-1
WSC-3 (UHF)

TACAN
URN 25

RADARS

	AN/SPS-49(V)5	AN/SPS-67	AN/SPS-64(V)9
Manufacturer	Raytheon	Norden	Raytheon
Role	Long-range air search	Surface search	Navigation
Frequency	UHF (850-942 MHz)	G (5.4-5.8 GHz)	I
Beam	3.4° × cosec² to 30°	1.5 × 31°	1.9 × 22°
Peak power	360 kW	280 kW	20 kW
Gain	28.5 dB		20 dB
Pulsewidth	Long: 1.5 µs Short: 2 µs	0.1; 0.25; 1.0 µs	0.06/0.5/1.0 µs
PRF	Long: 280 pps		3600/1,800/900 pps
Scan rate	6/12 rpm		33 rpm

IFF
Mk XII UPX-29

WEAPONS CONTROL

SAR-8 IRST optronic director

***Whidbey Island* (LSD 41), *Ashland* (LSD 48) only.** SAR-8 was installed as part of the SSDS trials, and will be installed in the remainder of the class as SSDS installation progresses.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck:
Hangar: No hangar, but refuelling and rearming facilities.
Helicopters: 2 CH-53 Sea Stallion

Comstock *(LSD 45). Note the large stern gate giving access to the 134.1 × 15.2 m (440 × 50 ft) docking well and the large flight deck which, unlike previous LSDs, is fixed. There is no hangar but there are full refuelling and rearming facilities* (US Navy)

PROPULSION

Specifications
System: Diesel
Main machinery: 4 Colt SEMT-Pielstick 16 PC2.5 V 400 diesels, 27.5 MW (37,440 hp) sustained

Shafts: 2
Propellers: Controllable pitch

FURTHER INFORMATION

DESIGN

The original plan was the subject of considerable friction between the Carter Administration and Congress in the late 1970s, with the president trying to delay the project until a naval reassessment of its amphibious requirements had been completed. At one stage, the plan was for a class of six ships to replace the 'Thomaston' class LSDs, but greater clarification in the 1980s of the likely future shape of amphibious warfare eventually led to the construction of eight, with a further four 'cargo variants' (LSD-CV) being built as the 'Harper's Ferry' class.

The Whidbey Island and Harper's Ferry ships will form one third of the basic amphibious fleet envisaged for the first decade of the 21st century

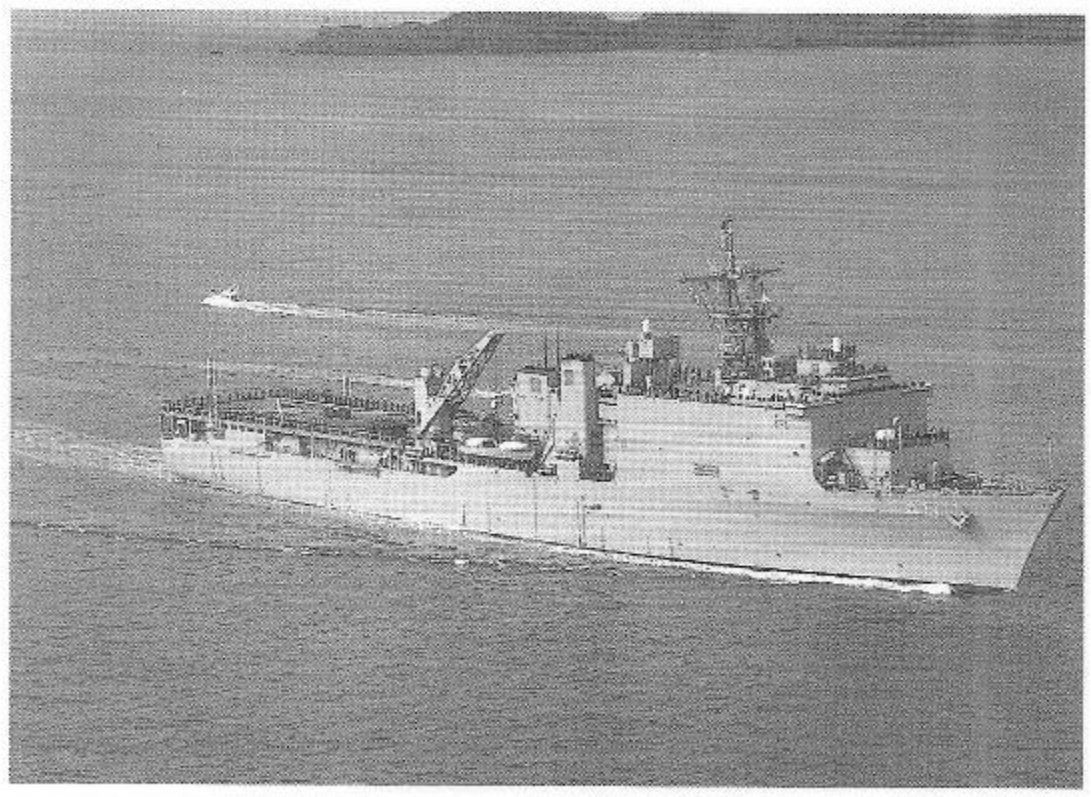
The design is based on that of the earlier 'Anchorage' class, but with a number of significant improvements. The large flight deck extends to the stern and is strong enough to handle the Marine Corps' CH-53Es. The docking well is the same width as earlier LSDs but is 3 m (9.8 ft) longer, enabling four LCACs to be accommodated.

These were the first US Navy amphibious ships to be powered by diesels rather than steam propulsion plants.

The cargo variant of the 'Whidbey Island' class has relatively minor differences in equipment and structure. The Harper's Ferry ships have additional air conditioning and pipework and a changed hull structure; the forward Phalanx is lower down and there is only one crane. The extra cargo space has been achieved at the expense of the well deck, which is shorter.

MODERNISATION

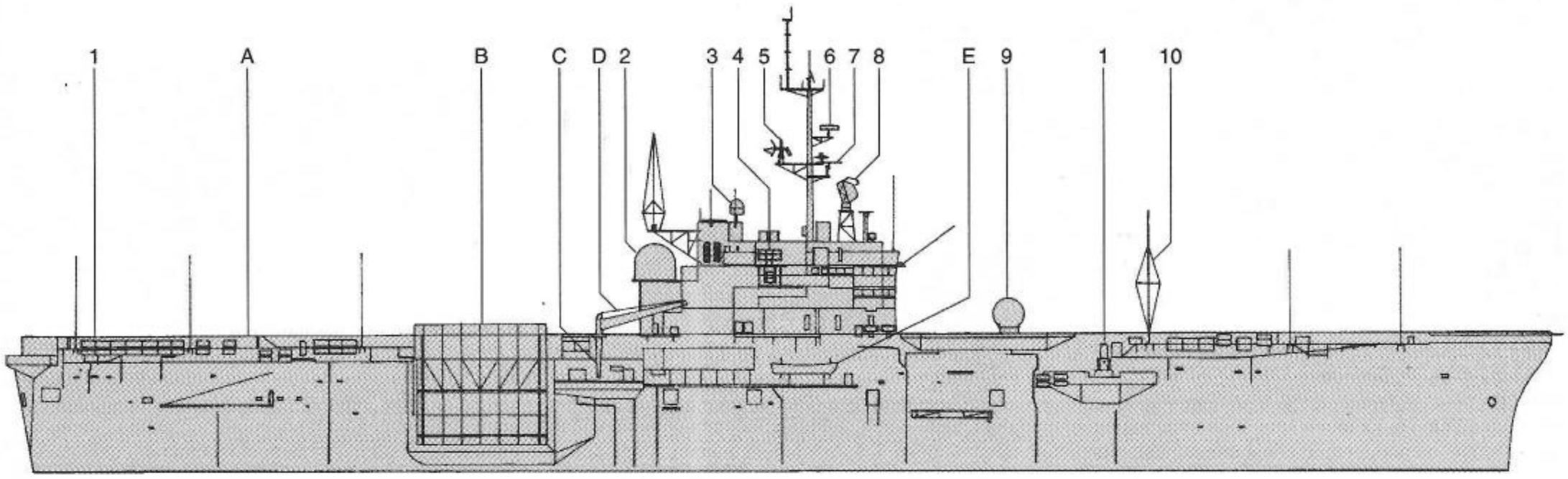
It is planned to install ACDS in due course, and all ships will receive SSDS by 2002, following the successful trials in *Whidbey Island.* One of the class is to be fitted with the new High Frequency Surface Wave radar in FY97, which is designed to give over-the-horizon detection of incoming missiles.



Comstock *(LSD 45) with 60 tonne crane ready for use* (H & L van Ginderen Collection)

Comstock *(LSD 45)* (H & L van Ginderen Collection)

IWO JIMA



Guam (Ian Sturton)
Amphibious A *Flight deck* **B** *Deck-edge elevator* **C** *LCVP* **D** *Crane* **E** *LCPL*

General 1 *Hughes Mk 15 Phalanx CIWS* **2** *AN/SPN-35A carrier control approach radar* **3** *SATCOM* **4** *AN/SLQ-32(V)3 ESM/ECM suite* **5** *AN/SPN-43B carrier control approach radar* **6** *AN/SPS-65 air search/AN/SPS-67 surface search (use same antenna)* **7** *Raytheon AN/SPS-64(V)9 navigation radar search* **8** *Lockheed AN/SPS-40E air/surface search radar* **9** *Satcom* **10** *Discone HF antenna*

GENERAL SPECIFICATIONS

Operator: USA
Type: Amphibious Assault Ships (LPH)

CLASS: IWO JIMA

Built: 7
Active: 2

Displacement:
standard: 11,250 t
full load: 18,798 t

Dimensions
Length: 183.7 m (602.3 ft)
Beam: 31.7 m (104 ft)
Draught: 9.7 m (31.7 ft)

Speed: 23 kts
Range: 10,000 n miles at 20 kts

Complement: 902, including 52 officers

SHIPS

GUAM (LPH 9)

Builder	Philadelphia Naval Shipyard, Philadelphia, USA
Laid down	15 Nov 1962
Launched	22 Aug 1964
Commissioned	16 Jan 1965

NEW ORLEANS (LPH 11)

Builder	Philadelphia Naval Shipyard, Philadelphia, USA
Laid down	1 Mar 1966
Launched	3 Feb 1968
Commissioned	16 Nov 1968

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

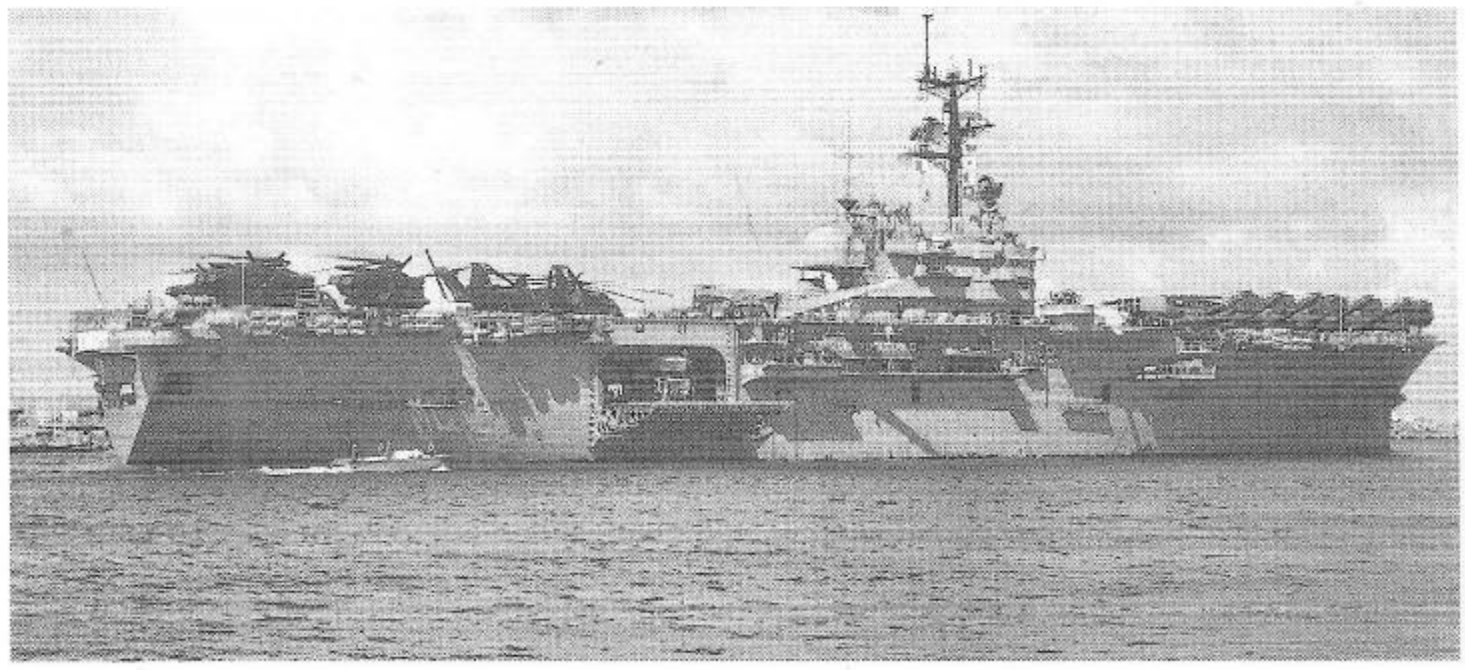
- Marine Corps battalion landing team, plus its support equipment, guns and vehicles, plus a reinforced squadron of transport helicopters and support personnel. 1,562 troops (including 158 officers); 1,500 tonnes of aviation fuel.

SHIP-SHORE LIFT

- Two LCPLs

AVIATION FACILITIES

Specifications
Flight deck: 183.7 × 31.7 m (602.3 × 104 ft)
Hangar: 70 m (230 ft) long. Accommodates 11 CH-53 or 19 CH-46
Aircraft: 20 CH-46D/E Sea Knight or 11 CH-53D/E Sea Stallions or 4 AV-8B Harriers
Max activity level: Simultaneous take-off/landing of up to 7 CH-46 Sea Knight or 4 CH-53 Sea Stallions



Tripoli *(LPH 10)* (Jane's/H M Steele)

AMPHIBIOUS FACILITIES

- Two deck-edge elevators, each 15.24 × 10.36 m (50 × 34 ft). Capacity: LPH 2-3, LPH 11-12 — 22.7 tonnes (22.32 tons); LPH 7, LPH 9-10 — 19.95 tonnes (19.6 tons)
- Hangar; 70 m (230 ft) long
- Two stores elevators
- Vehicle parking 517 m² (5,565 sq ft)
- One crane; 18.3 tonne (18 ton) capacity
- Medical facilities include two operating theatres and 155 beds

WEAPONS SYSTEMS

GUNS

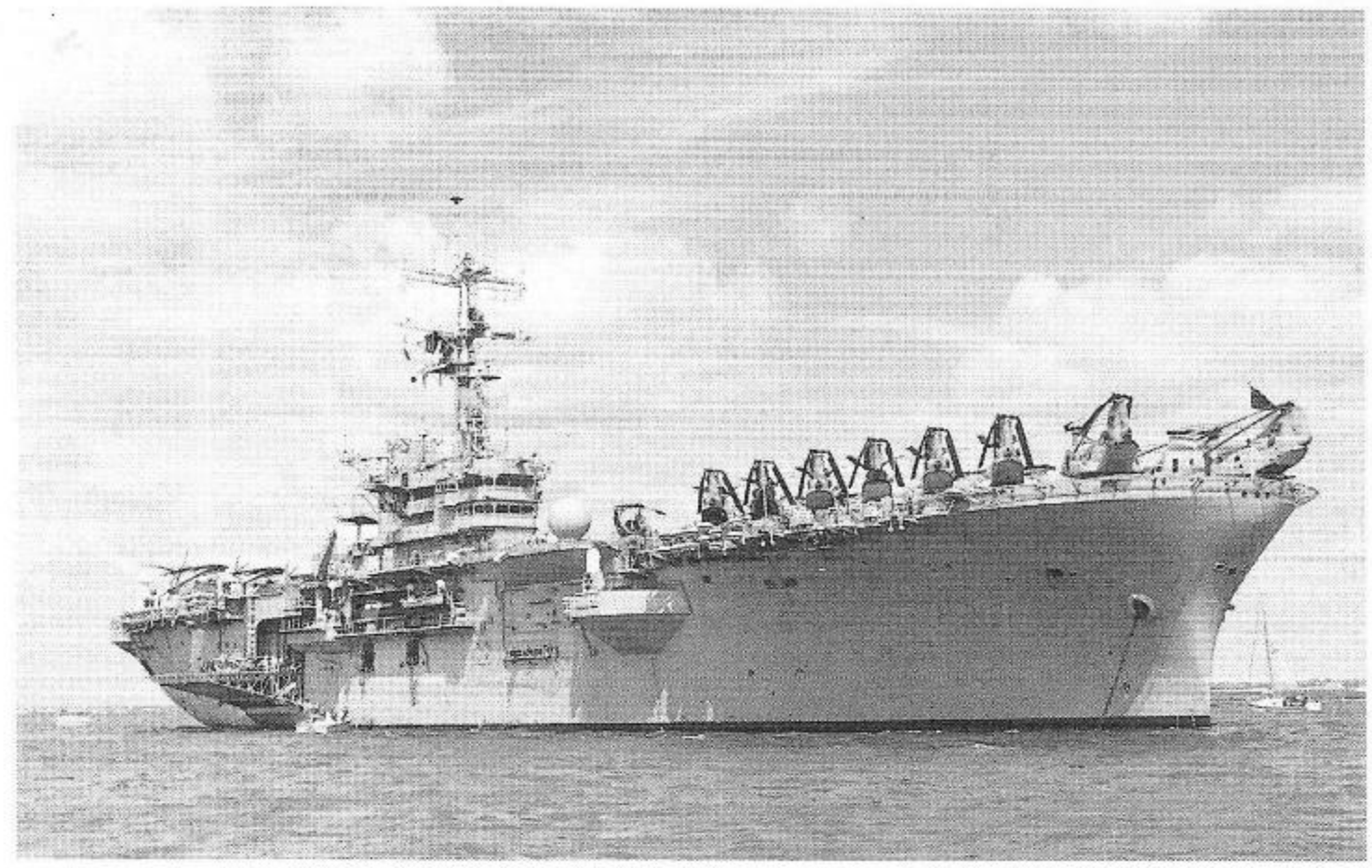
Hughes Mk 15 CIWS Phalanx

There are two Mk 15 CIWS: one is on a sponson on the starboard side forward, the other on another sponson on the port quarter. This CIWS was developed to provide fast reaction to submarine-launched anti-ship missiles and operates on a 'closed loop' system, tracking both the target and the stream of rounds, and seeking constantly to reduce the difference between the two. The gun is a six-barrelled 20 mm M61A1 Vulcan with extremely high firing rates.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire (Block 0): 3,000 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)

Mounting
Weight (Block 0): 5.42 t
Traverse: 310°
Elevation: −25 to +85°
Training speed: 126°/s
Elevation speed: 92°/s



Guam *(LPH 9) the first of the two surviving 'Iwo Jima' class ships. Note the Mk 15 Phalanx CIWS on the sponson and the large radome for a satcom antenna on the flight deck above it. Abaft the island the ship's crane is recovering an LCPL*

M2HB 12.7 mm machine guns

Up to eight M2HB are carried. This is a selective short recoil automatic operation weapon with a 1,143 mm long barrel.

Specifications
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

Tripoli *(LPH 10) showing the port-side deck-edge elevator and, at the stern, a Mk 15 Phalanx CIWS (on small sponson)* (US Navy/PH3 T Rogers)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

AN/SLQ-32(V)3 intercept and jammer

The AN/SLQ-32(V)3 is a combined ESM and ECM system, giving radar warning on B to J-bands to give jamming and deception on H to J-bands. The jammer has a maximum radiated power of 1 MW and is capable of forming 64 beams on either side of the ship, with jamming modes including range gate pull off (RGPO) and azimuth gate pull off (AGPO).

Manufacturer/Contractor
Raytheon, Electromagnetic System Division, Goleta, California, USA.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are four Mk 36 SRBOC launchers firing IR flares and chaff to 2.2 n miles (4 km). The Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) system consists of launcher, launcher control, power supplies, ready service lockers and munitions. The Mk 137 launcher has six 130 mm (5 in) fixed tubes arranged in parallel rows at angles of 45 and 60°. The firing circuits use electromagnetic induction to initiate the propelling charges in the cartridges. The prime cartridge is the Mk 182 Torch with chaff payload.

Specifications
Launcher dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Launcher weight: 173 kg (381 lb)
Mk 182 cartridge dimensions: 1,209 × 130 mm (47.6 × 5 in)
Cartridge weight: 22.7 kg (50 lb)

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

Satcom
SRR-1
WSC-3 (UHF)

Carrier Controlled Approach (CCA): SPN-35A and SPN-43B

AN/SPN-35 is a carrier approach radar set providing precise range, altitude and heading information to guide both fixed-wing aircraft and helicopters along the final approach to the carrier deck. Aircraft are accepted from the surveillance radar systems and then controlled by the SPN-35 to a final transition point from which the recovery is made. SPN-35 is mounted on a gyrostabilised platform that keeps the radar level and accurately aligned to the horizon at all times.

AN/SPN-43 is used to marshal aircraft prior to their negotiating final landings and is mounted on top of a stabilised platform that automatically compensates for the pitch and roll of the ship. SPN-43 detects aircraft at distances up to 93 km and provides tracking data allowing the radar operator to control and transition the aircraft into the final approach area for carrier recovery. Operational frequency is 3.5 to 3.7 GHz, with a peak power output of 850 kW.

Manufacturer/Contractor

ITT Gilfillan, Van Nuys, California, USA.

RADARS

	AN/SPS-65	AN/SPS-40E	AN/SPS-67(V)1	AN/SPS-64(V)9
Manufacturer	Westinghouse	Lockheed	Westinghouse Norden	Raytheon
Role	Air search	Air/surface search	Surface search	Navigation
Band	D (1,215-1,365 MHz)	UHF (400-450 MHz in 10 channels)	G (5.4-5.8 GHz)	I
Beam	6 × 16°	10 × 19°	1.5 × 31°	1.9 × 22°
Peak power	12 kW	125-225 kW	280 kW	20 kW
Gain	23 dB	21 dB		28 dB
Pulsewidth	7 µs	3 µs	0.1; 0.25; 1.0 µs	0.06/0.5/1.0 µs
PRF	3,125/3,064 pps	300 pps		3,600/1,800/900 pps
Scan rate	15 rpm	7.5/15 rpm		33 rpm
Range	—	175 n miles (320 km)		

COMMUNICATIONS AND DATALINKS

TACAN
URN 25

IFF
Mk XII AIMS
AN/UPX-29

PROPULSION

Specifications
System: Steam
Main machinery: 2 Babcock & Wilcox/Combustion Engineering boilers, 42.3 kg/cm² (600 psi); 482°C; 1 De Laval/General Electric/Westinghouse turbine; 17.2 MW (23,000 hp)
Shaft: 1

FURTHER INFORMATION

PROGRAMME

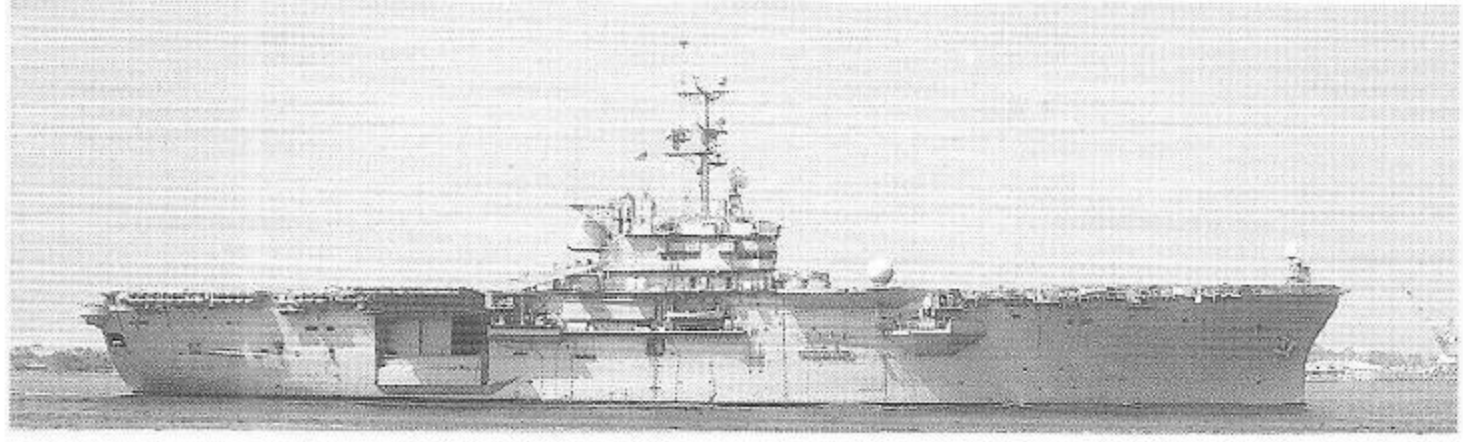
When commissioned in 1961, *Iwo Jima* was claimed to be the world's first amphibious assault ship designed to accommodate and operate helicopters. It was the ship that the Marine Corps of the 1950s had wanted to overcome the perceived threat posed by nuclear weapons to concentrations of landing ships and landing craft carrying out an opposed landing.

The 'Iwo Jima' class eventually totalled seven ships: The seven Iwo Jima ships all survived into the 1990s and several saw service in the Gulf War of 1991, where *Tripoli* (LPH 10) was badly damaged by a mine. They are now being paid off at a rate of about one a year, and only two survive in their original role, though *Inchon*, the last of the class, has recently finished an expensive conversion to a Mine Countermeasures Command Control and Support (MCS) ship role.

Name	Builder	Commissioned	Fate
Iwo Jima (LPH 2)	Puget Sound	26 Aug 1961	Decommissioned 1993
Okinawa (LPH 3)	Philadelphia	14 Apr 1962	Decommissioned 1993 following collision
Guadalcanal (LPH 7)	Philadelphia	20 Jul 1963	Decommissioned 1994
Guam (LPH 9)	Philadelphia	16 Jan 1965	Still in service 1996
Tripoli (LPH 10)	Ingalls	6 Aug 1966	Decommissioned 1995
New Orleans (LPH 11)	Philadelphia	16 Nov 1968	Still in service 1996
Inchon (LPH 12)	Ingalls	20 Jun 1970	Converted to MCS 1994-1996

DESIGN

The class served primarily as helicopter carriers, not having the facilities to handle fixed-wing aircraft until the later generations of Harriers, and also having very limited capacity for landing craft. In some quarters, these factors were deemed to make the vessels of limited usefulness; certainly, as the threat of nuclear attack on invading troops failed to materialise, US amphibious forces required other forms of support and transport alongside the helicopter carriers. The replacements for the 'Iwo Jima' class, the 'Wasp' class ships now being delivered, are noticeably more flexible in their potential roles.



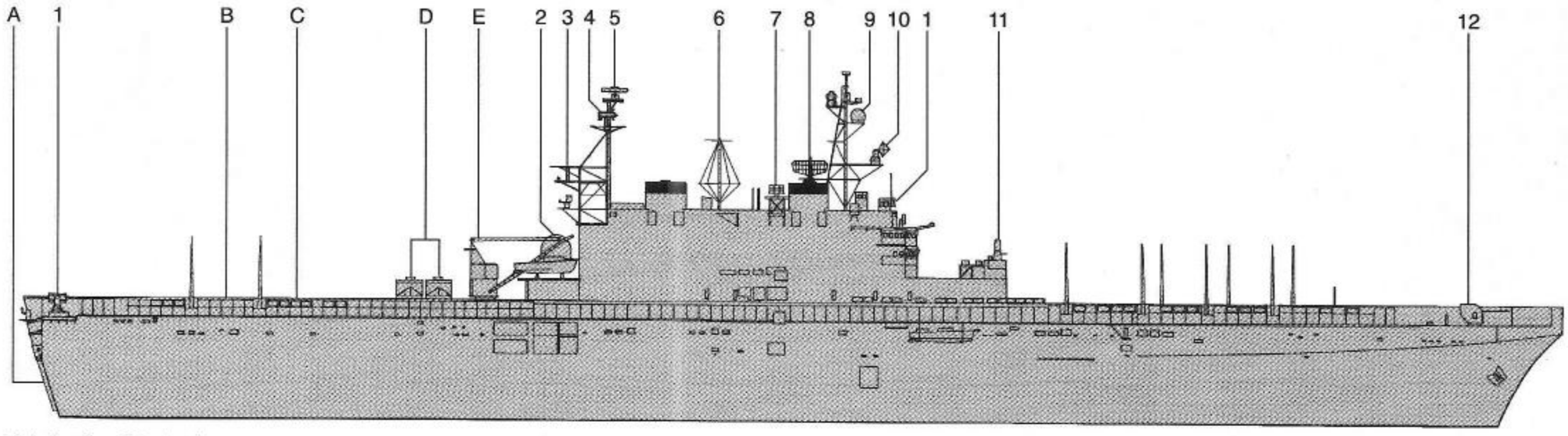
New Orleans *(LPH 77) in June 1996, one of two remaining 'Iwo Jima' class LPHs. Note the very high freeboard and the large, folding deck-edge elevator. The object in the bows is not fitted in all ships of the class* (H & L van Ginderen Collection)

MODIFICATIONS

The ships were modified to enable them to handle AV-8B Harriers as well as helicopters. The whole class has been used over many years for airborne minesweeping operations as well as more conventional amphibious roles. All of the class had extensive medical facilities: operating room, X-ray room, hospital ward, isolation ward, laboratory, pharmacy, dental operating room and medical storerooms.

These ships originally carried four twin 3 in/50 Mk 33 mountings, but they have since been removed. They were also equipped at one stage with GMLS Mk 25 Mod 1 octuple launchers carrying up to 16 Sea Sparrow surface-to-air missiles, but these, too, were removed.

TARAWA



Peleliu (Ian Sturton)
Amphibious A *Stern gate* **B** *Docking well* **C** *Flight deck* **D** *LCM 8* **E** *Crane*

General 1 *Mk 49 launcher for RAM missiles (two)* **2** *ITT AN/SPN-35 CCA radar* **3** *Hughes AN/SPS-52D air search radar* **4** *Raytheon AN/SPS-67(V)3 surface search radar* **5** *Hughes Mk 23 TAS* **6** *Discon antenna* **7** *AN/SLQ-32(V)3 radar ESM/ECM suite* **8** *Lockheed AN/SPS-40E air search radar* **9** *Lockheed AN/SPQ-9E fire-control radar* **10** *Lockheed AN/SPG-60 fire-control radar* **11** *Hughes Mk 15 20 mm Vulcan Phalanx CIWS* **12** *United Defense 127 mm (5 in)/54 Mk 45 Mod 1*

GENERAL SPECIFICATIONS

Operator: USA
Type: Amphibious Assault Ships (LHA)

Class: TARAWA

Built: 5
Active: 5

Displacement:
light: 33,536 t
full load: 39,967 t

Dimensions
Length: 254.2 m (834 ft)
Beam: 40.2 m (131.9 ft)
Draught: 7.9 m (25.9 ft)

Speed: 24 kts
Range: 10,000 n miles at 20 kts

Complement: 930 including 56 officers

SHIPS

TARAWA (LHA 1)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 15 Nov 1971
Launched 1 Dec 1973
Commissioned 29 May 1976

SAIPAN (LHA 2)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 21 Jul 1972
Launched 18 Jul 1974
Commissioned 15 Oct 1977

BELLEAU WOOD (LHA 3)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 5 Mar 1973
Launched 11 Apr 1977
Commissioned 23 Sep 1978

NASSAU (LHA 4)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 13 Aug 1973
Launched 21 Jan 1978
Commissioned 28 Jul 1979

PELELIU (ex-*Da Nang*) (LHA 5)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 12 Nov 1976 (*Da Nang* (LHA 5))
Renamed 15 Feb 1978 (*Peleliu* (LHA 5))
Launched 25 Nov 1978
Commissioned 3 May 1980

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

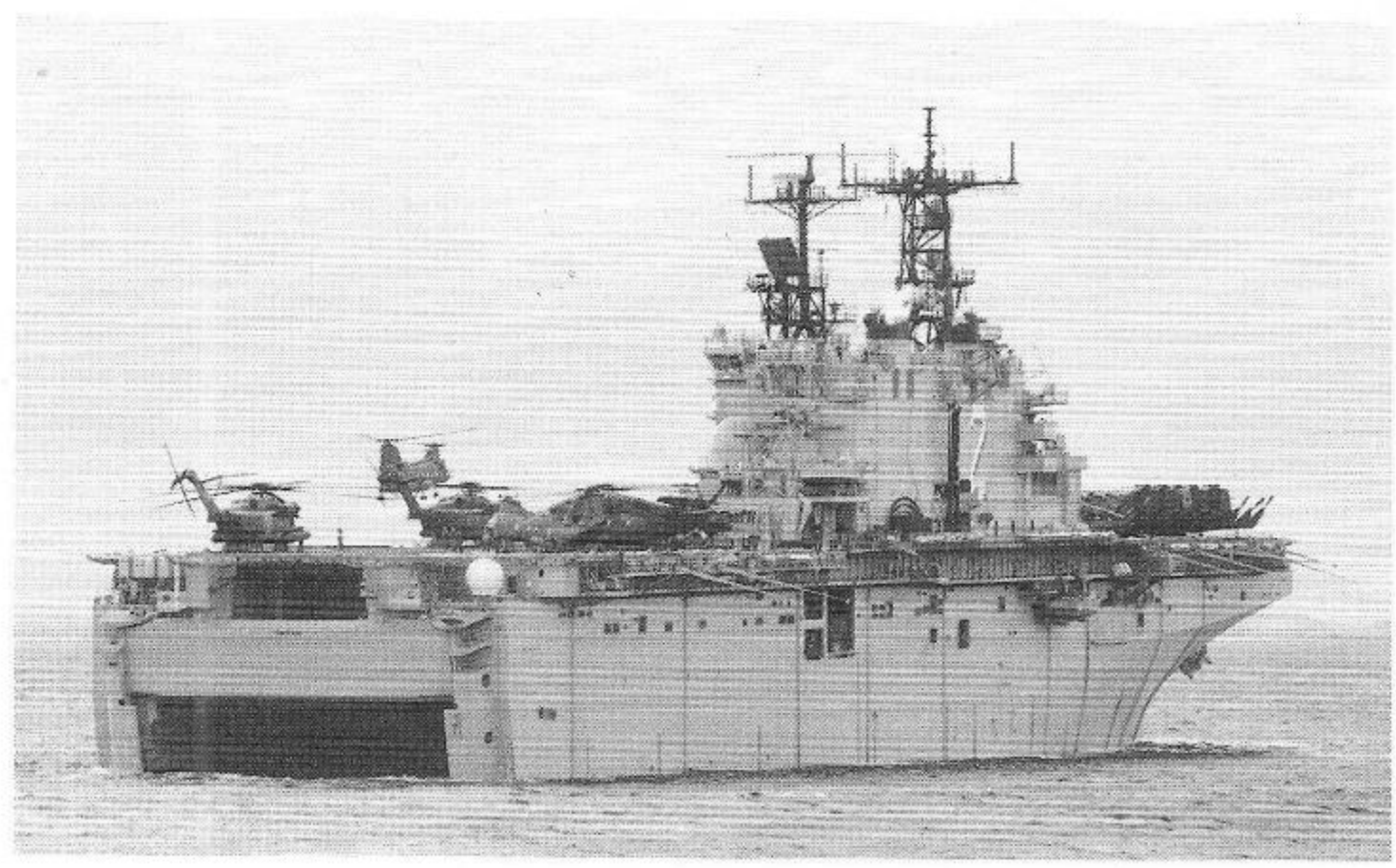
- Troops: 1,703
- Vehicle garage: 3,134 m² (33,735 sq ft)
- Military stores: 3,311 m³ (117,000 cu ft)

SHIP-SHORE LIFT

- Docking well/vehicle decks.
  4 LCU Type 1610 or
  2 LCU and two LCM 8 or
  17 LCM 6 or 45 LVT tractors or
  1 LCAC
- 4 LCPL on davits

AVIATION FACILITIES

Specifications
Flight deck: 254 × 42 m (834 × 131 ft). Areas occupied by island, centreline elevator and four weapons 'cut-outs' are not available.
Hangar: 81.6 × 23.7 × 6.5 m (268 × 78 × 20 ft)



Saipan *(LHA 2), ballasted down and with vertical-opening stern gate raised to enable landing craft to enter and leave the docking well* (US Navy)

Aircraft:
Maximum either 19 CH-53D Sea Stallion or 26 CH-46 D/E Sea Knight
Typically, nine CH-53D or 12 CH-46 plus six AV-8B Harriers

AMPHIBIOUS FACILITIES

- Docking well 81.6 × 23.7 m (268 × 78 ft).
- Lifting stern gate.
- Elevators
  - Port side; 18.14 tonnes (17.8 tons) (15.24 × 10.4 m (50 × 34 ft)
  - Stern; 36.2 tonnes (35.6 tons) (18.3 × 11.0 m (60 × 35 ft)
- Centreline elevator at after end of flight deck.
- Loading system includes elevators which bring palletised loads from cargo/equipment holds, and 11 monorail cars to distribute to individual landing craft.
- Two after elevators bring loads from holds to the hangar, where they are transferred to transporters and taken via a ramp to the flight deck for loading onto or under helicopters.
- Internal ramps connect vehicle decks to each other and to the docking well area.
- 1,200 tonnes of aviation fuel.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

In a modernisation programme completed in 1991, the two GMLS Mk 25 Sea Sparrow launchers were removed and replaced by two Vulcan Phalanx CIWSs. Subsequently, RAM launchers were fitted to all of the class between 1993 and 1995.

RIM-116A Block 1 RAM close in system with Mk 49 launchers

There are two 21-cell Mk 49 launchers for the Rolling-Airframe Missile (RAM): one is on the bridge roof offset to port, the other at the after end of the flight deck on the starboard side. RAM is a lightweight, close in, quick reaction, anti-missile defence system, the RIM-116 missile being based on the Sidewinder air-to-air missile, but with significant modifications, enabling it to be used as a fire-and-forget system. There is an infra-red, terminal guidance seeker in the nose (taken from the Stinger man-portable surface-to-air missile), behind which is a new dual-mode passive radio frequency seeker for mid-course guidance. Most of the rear of the missile is based upon Sidewinder components. Missiles are stored in sealed launcher-containers, which are manually loaded into the 21-cell Mk 49 RAM Standard Launchers.

Radar and electro-optical sensors provide details of target location, distance and speed, while the ship's ESM system inputs data on the target's radar frequency, as well as correlating radar data on location. On launch, the missile is spun-up by a rifling band as it is driven down the launch tube, and then as it leaves the launcher the four tail fins deploy which maintains the spin. Aerodynamic control is provided by the two canard surfaces, which also deploy after launch. The autopilot and control system maintain the initial line of sight course towards the target and then the RF seeker is activated and once this acquires the target it takes control of the guidance system and makes the appropriate course alterations. The IR seeker is also activated and when a sufficient signal-to-noise ratio is achieved this takes over guidance control for the terminal phase. The missile is capable of manoeuvres up to 20 *g* in any direction. The system can only be fired automatically at the moment, but manual control will become possible with Block 2 missiles.

Specifications

Mk 49 RAM Standard launcher
Traverse: 360°
Elevation: −25 to +80°
Turning circle: 3.27 m (10.73 ft)

RIM-116 Block 1 missile
Length: 2.79 m (9.15 ft)
Diameter: 12.7 cm (5 in)
Wing span: 43.4 cm (17.1 in)
Weight: 73.6 kg (162.25 lb)
Speed: Mach 2
Range: 5.17 n miles (9.6 km)
Warhead: 9.09 kg (20.0 lb) fragmentation/blast WDU-17B
Motor: Hercules/Aerojet Mk 36 solid propellant rocket

Manufacturer/Contractor

RAM Systems GmbH, D-85521 Riemerling, Germany.

GUNS

Mk 45 Mod 1 single 127 mm (5 in) L/54 gun mounting

There are two United Defense single 127 mm (5 in) Mk 45 Mod 1 mounts, mounted on small platforms cut out of the flight deck at the forward port and starboard corners of the flight deck. The gun fires semi-fixed ammunition with point detonating, proximity (variable time or infra-red), mechanical time and electronically set fuzes. The theoretical rate of fire is 20 rds/min and a gun crew of six is required, all below decks, of which four are ammunition handlers. The Mod 1 incorporates a number of improvements over the Mod 0, including the ability to change the type of ammunition under remote control and electronic fuze setting.

Specifications

Calibre: 127 mm (5 in)
Length of barrel: 54 calibres
Muzzle velocity: 807.72 m/s (2,650 ft/s) (new barrel), 762 m/s (2,500 ft/s) (mid-life)
Crew: 6 (1 mount captain, 1 panel operator, 4 ammunition handlers)
Traverse: 340° at 30°/s
Elevation: −15 to +65° at 20°/s
Range:
anti-ship: 12.39 n miles (23 km)
anti-air: 15,000 m (49,000 ft)
Rate of fire: 16-20 rds/min
Ammunition weight: 31.75 kg (70 lb) (projectile)

Manufacturer/Contractor

United Defense, Armament Systems Division, Minneapolis, Minnesota, USA.

Hughes Mk 15 CIWS Phalanx

There are two Mk 15 CIWS: one is on a platform before the bridge, the other on a small platform cut out of the after port corner of the flight deck. This CIWS was developed to provide fast reaction to submarine-launched anti-ship missiles and operates on a 'closed loop' system, tracking both the target and the stream of rounds, and seeking constantly to reduce the difference between the two. The gun is a six-barrelled 20 mm M61A1 Vulcan with extremely high firing rates.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire (Block 0): 3,000 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)

Mounting
Weight (Block 0): 5.42 t
Traverse: 310°
Elevation: −25 to +85°
Training speed: 126°/s
Elevation speed: 92°/s

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA.

25 mm Mk 38 Mod 0 automatic cannon (Sea Snake)

There are six single Mk 88 mountings for Mk 38 Mod 0 25 mm cannon (Sea Snake). The Mk 88 mounting is replacing 20 mm mountings in many US Navy warships and is designed to engage surface and shore targets in low- and mid-intensity operational environments at ranges up to 1.33 n miles (2.5 km). The M-242 is a single barrel, externally powered weapon which incorporates a rotating bolt mechanism driven by a chain drive. The weapon has been designed to allow the barrel to recoil separately from the receiver, which reduces the available travel as the bolt also has to move, the travelling distance being 12.7 mm. The Mk 38 can fire single shots or 175 rds/min and features twin shoulder braces and an optical Aimpoint sight. The barrel life is in excess of 13,000 rounds while the demonstrated reliability of the weapon is 22,000 rounds between stoppages.

Specifications

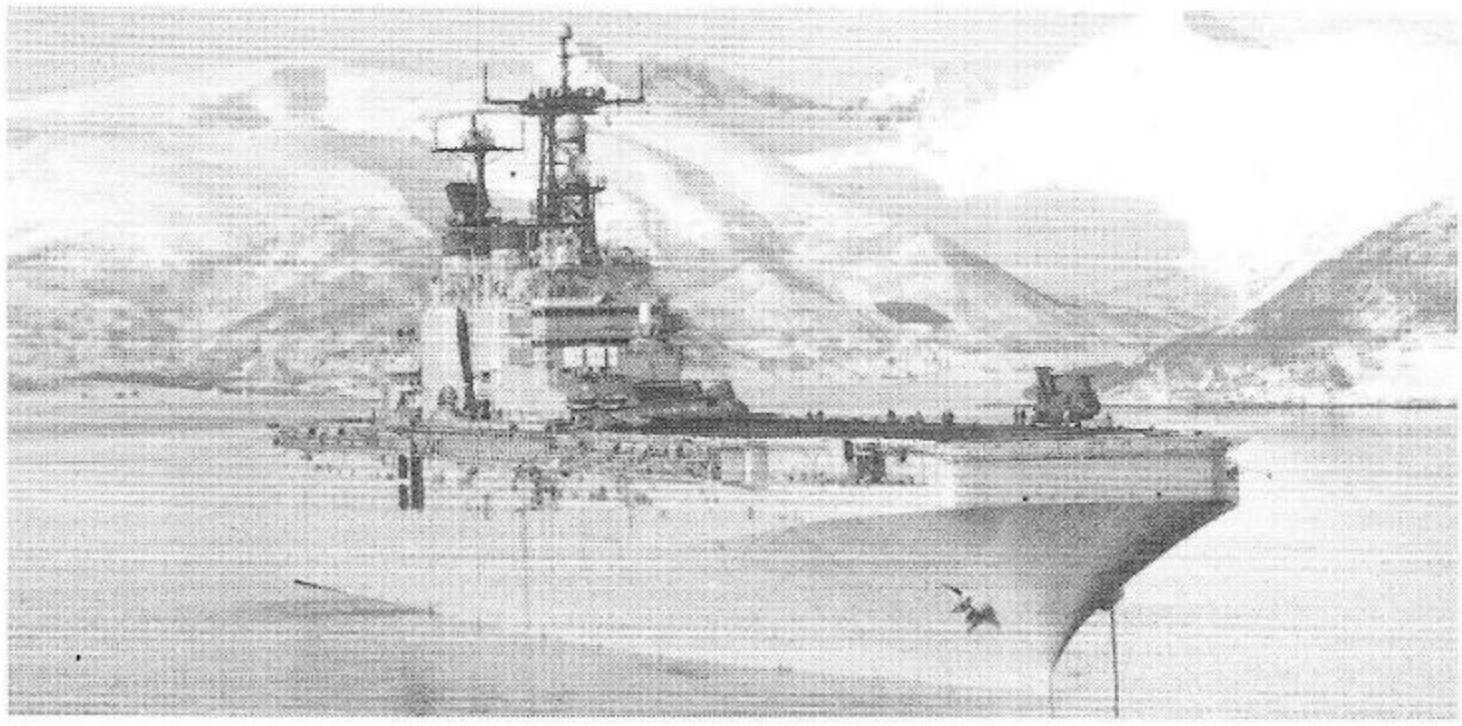
Calibre: 25 mm
Length of barrel: 81 calibres
Muzzle velocity: 1,100 m/s (3,609 ft/s)
Traverse: 300°
Elevation: −20 to +55°
Weight: 596.5 kg (1,315 lb) (loaded)
Crew: 1 (often supported by a spotter)
Range: 1.33 n miles (2.47 km)
Rate of fire: 175 rds/min (max)

Eight 12.7 mm machine guns

The M2HB is a selective short recoil automatic operation weapon using 110-round belts.

Specifications

Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)



Nassau *(LHA 4) anchored in a Norwegian fjord. During the Cold War one of the prime missions of these ships was to transport US Marine Corps units to defend NATO's northern flank from Warsaw Pact attack* (US Navy)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

AN/SLQ-32(V)3

The AN/SLQ-32(V)3 ESM system gives radar warning on B to J-bands and jamming/deception on H to J-bands. The (V)3 system covers Bands 1, 2 and 3. The jammer has a maximum radiated power of 1 MW and is capable of forming 64 beams on either side of the ship, with jamming modes including range gate pull off (RGPO) and azimuth gate pull off (AGPO).

Manufacturer/Contractor

Raytheon, Electromagnetic System Division, Goleta, California, USA.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are four Mk 36 SRBOC launchers firing IR flares and chaff to 2.2 n miles (4 km). The Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) system consists of launcher, launcher control, power supplies, ready service lockers and munitions. The Mk 137 launcher has six 130 mm fixed tubes arranged in parallel rows at angles of 45 and 60°. The firing circuits use electromagnetic induction to initiate the propelling charges in the cartridges. The prime cartridge is the Mk 182 Torch with chaff payload.

Specifications

Launcher dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Launcher weight: 173 kg (381 lb)
Mk 182 cartridge dimensions: 1,209 × 130 mm (47.6 × 5 in)
Cartridge weight: 22.7 kg (50 lb)

AN/SLQ-25 Nixie acoustic torpedo decoy system

The AN/SLQ-25 Nixie is a solid-state, modular design electroacoustic countermeasures decoy system used to protect various classes of ships from acoustic homing torpedoes. It consists of a remote-control unit which can activate, deactivate and monitor (through an oscilloscope) the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming and recovering the towed bodies (which are stored on racks attached to the winch), a coaxial switching unit which selects the appropriate cable or load, and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body and either a deck edge tow chock or two fleet angle compensators (below-deck installations only). Total weight of the system with the RL-272 winch is 2.75 tonnes.

NATO Sea Gnat

NATO Sea Gnat is a long-range chaff/infra-red (IR) decoy launching system for NATO warships and consists of a control unit, a launcher with 130 mm (5 in) tubes and munitions. The control unit provides for the launching of the most effective combination of rounds for distraction and centroid/seduction given the type, speed and direction of the threat, the ship's speed and heading as well as wind direction and speed. There are three types of round:

Mk 214 RF seduction
Mk 216 RF distraction
Mk 218 IR seduction

Manufacturers/Contractors

Thorn EMI/AB Precision Ltd, UK (control unit).
Hunting Engineering, UK (launchers).
Chemring Ltd, UK (munitions).

AN/SLQ-49 chaff buoys

AN/SLQ-49 is the US Navy version of the British 'Replica' system, also known as 'Rubber Duck.' This is a rapidly deployed, passive naval decoy which presents a ship-like image to the radar seeker of an incoming anti-ship missile. The equipment consists of a launcher and a pair of liferaft-type containers, each housing one octahedral-shaped radar reflector. The two reflecting bodies start to inflate as they leave the ship and, once in the water, they are linked to each other by a 5 m (16 ft) line with one of the container lids acting as a sea-anchor to ensure that they remain apart. The distance between the opposite tips of the decoy is approximately 2.5 m (8.2 ft) and it contains metal-coated nylon mesh curtains, which are suspended from aluminium-alloy tubes.

Manufacturer/Contractor

Irvin, Letchworth, UK.

AN/SSQ-95(V) active electronic buoy (AEB)

AN/SSQ-95(V) is a ship- or air-launched expendable buoy operating in I/J-bands (8 to 20 GHz), which is released into the ocean where it operates against hostile radar systems. The system components are a receiver, a travelling wave tube transmitter, deployable transmit/receive antenna, power supplies, a programmable digital processor, a seawater-activated battery and a built-in-test facility. The AN/SSQ-95(V) is provided in a self-contained A-size sonobuoy package with a weight of 17.3 kg (38.14 lb) and dimensions of 914 × 124 mm (36 × 4.9 in). The buoy has a high sea state survivability and is reusable.

Manufacturer/Contractor

Litton Applied Technology, San Jose, California, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Advanced Combat Direction System (ACDS) ACDS Block 0

The Advanced Combat Direction System (NTDS/ACDS) is an enhanced version of the Naval Tactical Data System (NTDS), which interfaces with the Mk 23 TAS. The Block 0 version with two AN/UYK-43B processors was installed in the 'Tarawa' class in 1996 and features software modules similar to those in the original NTDS, with a software package containing a database of approximately 1 million lines of code with an additional dedicated package specific to the host ship. The Block 0 system also features improvements in the Link 11 (TADIL A) interface, interfaces to new weapon and sensor systems as well as the replacement of the Hughes Video Signal Simulator (VSS) by the Republic Electronics AN/USQ-93 Radar Environmental Simulator System (RESS). Like NTDS, ACDS Block 0 provides Link 4A (TADIL C), Link 11 (TADIL A) and Link 14 communications.

Manufacturers/Contractors

Unisys, McLean, Virginia, USA (computers).
Hughes Aircraft Company, Los Angeles, California, USA (displays).
Rockwell International (Collins Avionics/Communications Division), Cedar Rapids, Indiana, USA (communications).

COMMUNICATIONS AND DATALINKS

Datalinks

Link 4A
Link 11
Link 14
Link 16 (in due course).

Satcom

SRR-1
WSC-3 (UHF)
USC-38 (EHF) *Saipan* (LHA 2), *Nassau* (LHA 4).
SMQ-11 Metsat.

WEAPONS CONTROL

Mk 86 Mod 4 Gun Fire Control System

The Mk 86 GFCS assists in the control of direct and indirect naval gun fire support and also assists in the engagement of both surface and air targets. It has a mainframe architecture using CMS-2 software language and consists of a computer system, a display system and up to three sensors. It also accepts data from ACDS.

Mk 86 Mod 4 uses the AN/UYK-7 32-bit computer with a memory of 256,000 words and speed of 667 Kops, and can track 120 targets. The display system consists of a Control Officer's Console (COC) and two other consoles. The COC is used to energise radars and has a PPI display, data readouts and various controls including a rollerball. With it the operator can acquire and monitor up to four surface targets and assign them to the other consoles.

The primary sensors are the AN/SPQ-9A and AN/SPG-60 fire-control radars for surface and air engagements respectively, as well as a remotely operated electro-optic tracker known as the Remote Optical Sight (ROS) of which there are usually two. Another electro-optical tracker (also designated an ROS) is attached to the AN/SPG-60 antenna mounting. Both radars are subject to improvement.

Peleliu *(LHA 5) in June 1996. This class of five ships incorporated the perceived lessons of the Korean and Vietnam Wars.* Peleliu *was originally named* Da Nang *but was renamed when the North Vietnamese conquered South Vietnam* (H & L van Ginderen Collection)

RADARS
(Note 1)

Type	AN/SPS-52C (Note 2)	AN/SPS-48E (Note 2)	AN/SPS-40E	AN/SPS-67(V)3	AN/SPS-64(V)9
Maker	Hughes	ITT-Gilfillan	Lockheed	Westinghouse-Norden	Raytheon
Role	Long-range air search	Long-range air search; 3D	Long-range air search; 2D	Surface search	Navigation
Frequency	E (2-3 GHz)	E/F	UHF (400-450 MHz in 10 channels)	G (9,375 ±25 MHz)	I (9,345-9,405 MHz)
Beam	1.1 × 2.25°	1.5 × 1.6°	10 × 19°	1.5 × 12°	1.9 × 22°
Peak power	1 kW	2,200 kW	225 kW	10, 25, 50 kW	20 kW
Gain	39.5 dB	38.5 dB	21 dB		28 dB
Pulsewidth	2.5/4.6/10 µs	3 µs	60 µs (LRM); 3 µs (SRM)	0.06, 0.5, 1 µs	0.06/0.5/1.0 µs
PRF	1,850, 925 pps	1,250-2,000 pps	300 pps	3,600, 1,800, 900 pps	3,600/1,800/900 pps
Scan rate	15/6 rpm	7.5/15 rpm	7.5/15 rpm	15 rpm	33 rpm
Typical range	240 n miles (450 km); 30,480 m (100,000 ft)	220 n miles (407 km); 30,000 m (100,000 ft)	200 n miles (370 km)	56 n miles (104 km)	

Notes:
1. TAS Mk 23 was removed when Sea Sparrow was replaced by RAM.
2. Ships have one of these two sets.

ITT Gilfillan AN/SPN-35A
AN/SPN-35A is an aircraft carrier approach radar set that provides precise range, altitude and heading information to guide fixed-wing aircraft and helicopters along the final approach to the carrier deck. Aircraft accepted from the surveillance radar systems are marshalled and controlled by the AN/SPN-35A to a final transition point from which the recovery is made. The AN/SPN-35A antenna is mounted on a gyrostabilised platform that keeps the radar level and accurately aligned to the horizon at all times.

ITT Gilfillan AN/SPN-43B
AN/SPN-43B is part of the US Navy carrier air traffic control centre, its function being to bring aircraft in to the point at which they commence landing. Mounted on top of a stabilised platform that automatically compensates for the pitch and roll of the ship, AN/SPN-43B detects aircraft at distances up to 50 n miles (93 km). It provides tracking data that allows the radar operator to control and direct the aircraft into the final approach area for carrier recovery. Operational frequency is 3.5 to 3.7 GHz, with a peak power output of 850 kW.

Manufacturer/Contractor
ITT Gilfillan, Van Nuys, California, USA.

Lockheed AN/SPG-60
AN/SPG-60 is a monopulse, I-band pulse Doppler tracking radar forming part of the Mk 86 Gun Fire Control System. It is used for acquiring and tracking air targets to ranges of about 60 n miles (111 km), tracking being either automatic or manually aided. The radar's search-to-acquire capability is computer directed, and it accepts two- or three-dimensional target designation co-ordinates in digital or synchro format from either the AN/SPQ-9 radar (also part of the Mk 86 GFCS) or other shipboard search radars and tactical data systems. The antenna is stabilised. Peak output power is given as 5.5 kW.

Acquisition is automatic with the radar performing its programmed scan search pattern about the designated point under computer control. The computer resolves the problems of blind range and range rates inherent in Doppler radars, as well as range ambiguity. The computer also automatically controls and calibrates receiver gain and monopulse channel balance.

Manufacturer/Contractor
Lockheed Martin (Sanders), Nashua, New Hampshire, USA.

Lockheed AN/SPQ-9A
AN/SPQ-9A is a high-resolution, Track-While-Scan (TWS), pulse compression, I-band naval radar. Together with the AN/SPG-60 it forms the main sensor element of the Mk 86 fire-control system and provides detection and tracking facilities within a range of 20 n miles (37 km). The radar antenna provides surface search and air cover up to 610 m (2,000 ft) against low-flying aircraft and tracking helicopters. A separate transmitter/receiver interrogates, receives, and decodes replies from transponders such as the AN/TPN-7, AN/TPN-16, or AN/UPN-32. The surface search antenna is mounted on a stabilised platform and protected by a radome.

AN/SPQ-9A has a high scanning rotation rate, giving a one second data rate. Real-time signal and data processing permit detection, acquisition, and simultaneous tracking of multiple targets. The basic capacity of the complete Mk 86 SPQ-9A system is four targets, and TWS is expandable to more than 100 targets. The radar operates in any one of five selectable frequency ranges, with pulse-to-pulse frequency agility as an additional countermeasure to jamming and natural clutter. This feature also permits a number of radars to operate without mutual interference.

Specifications
Frequency: I-band (8-10 GHz)
Power output: 1.2 kW peak
PRF: 3,000 pps
Scan rate: 60 rpm
Range: 137 m to 37 km

Manufacturer/Contractor
Lockheed Martin (Sanders), Nashua, New Hampshire, USA.

TACAN
URN 25

IFF
CIS Mk XV

PROPULSION

Specifications
System: Steam-turbine
Main machinery: 2 Combustion Engineering boilers, 42.3 kg/cm² (600 psi), 482°C; 2 Westinghouse steam-turbines, 52.2 MW (70,000 hp)
Shafts: 2
Thruster: 1 bow thruster, 670 kW (900 hp)

FURTHER INFORMATION

Ordered during the late 1960s, the 'Tarawa' class is the epitome of the change in thinking on amphibious warfare that took place as a result of the lessons of the Korean War and what appeared at the time to be the lessons of the Indochina War. In the 1950s amphibious planners were concerned with speed — setting a speed of advance of 20 knots for an amphibious task group — and arrival over the beaches of a mass of troops and equipment. The outcome was these very large ships designed very much for helicopters, but still retaining most of the more traditional amphibious ship attributes. One major exception, of course, is that the 'Tarawa' class totally lacks any ability to land troops and equipment directly onto the beach.

Thus, there is a very large flight deck, combined with a large docking well, which can handle landing craft up to LCU size, and a complex, automated cargo-handling system of conveyors and elevators. In addition, some of the available space is devoted to extensive command and control facilities. Finally, the problem of keeping the troops occupied and fit during lengthy transits or standoffs is addressed by the provision of training and acclimatisation facilities.

There were originally intended to be nine ships in this class, but only five were ever built. At one time, there were moves to convert one into a light carrier, but these came to naught. By the mid-1980s, amphibious warfare policy was becoming a little clearer, and the Tarawa programme was halted in favour of the slightly bigger, more up-to-date 'Wasp' class. These ships will remain, however, an essential part of the US Navy's amphibious fleet for the first decade of the 21st century, and if there is any slippage in the LPD 17 programme, then the oldest of the class is likely to see its 40th birthday still in service.

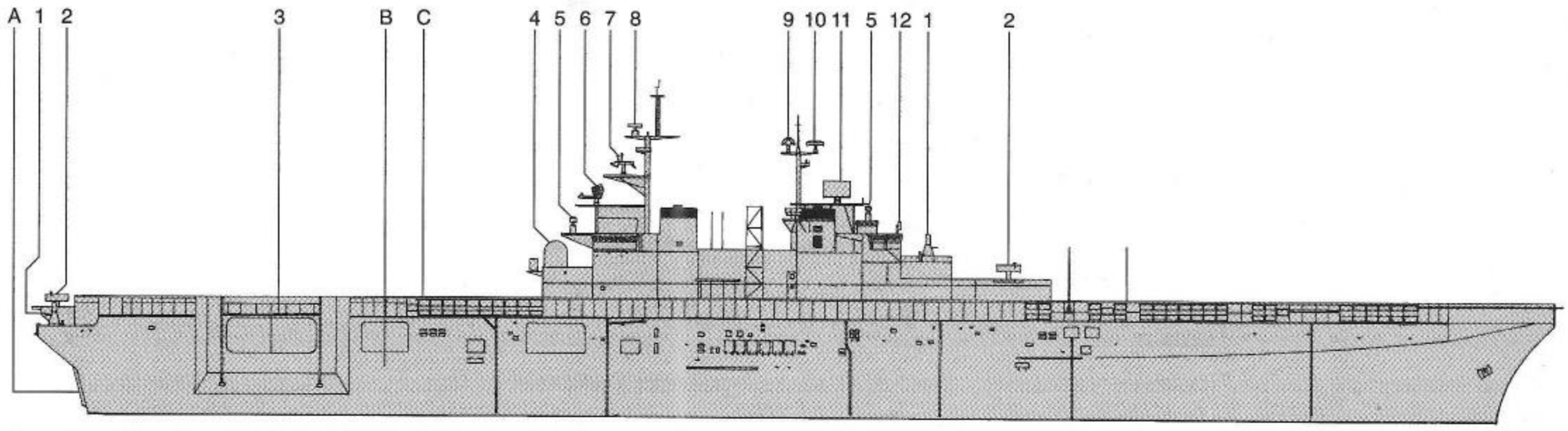
DESIGN

The large size of these ships is a result of the need to accommodate both a hangar for the helicopters and a docking well for the landing craft. Both are the same size, being 81.6 m (268 ft) long and 23.7 m (78 ft) wide, with hangar, which is directly above the docking well, having 6.5 m (20 ft) overhead clearance to enable it to accommodate the largest helicopters.

The docking well accommodates up to four LCUs, each of which can carry three main battle tanks (M60 or M1) or 150 tonnes of cargo. Two LCM 6 are stowed on the flight deck immediately aft of the island and are handled by a large crane.

Some 200 vehicles can be embarked. The large island accommodates three command organisations together with the appropriate staffs and command, control and communications (C^3) facilities. These comprise the ship's own command organisation, the Commander Amphibious Task Group and the Commander Landing Force.

WASP



Wasp (Ian Sturton)
Amphibious A *Stern gate* **B** *Docking well* **C** *Flight deck*

General 1 *Hughes Mk 15 20 mm CIWS* **2** *Mk 29 eight-cell launcher for Sea Sparrow SAM* **3** *Deck-edge elevator* **4** *AN/SPN-35A carrier-control approach radar* **5** *Mk 95 MFCS director* **6** *Raytheon AN/SPN-35A carrier-control approach radar* **7** *ITT-Gilfillan AN/SPN-43B carrier-control approach radar* **8** *Hughes Mk 23 TAS* **9** *Unidentified* **10** *Norden AN/SPS-67 surface search radar* **11** *Hughes AN/SPS-52C air search radar* **12** *AN/WSC-3 satellite antenna*

GENERAL SPECIFICATIONS

Operator: USA
Type: Amphibious Assault Ships (LHD)

Class: WASP

Built: 4
Active: 4
Building: 3

Displacement:
light: 28,233 t
full load: 40,532 t

Dimensions
Length: 257.3 m (844 ft) (oa); 240.2 m (788 ft) (wl)
Beam: 42.7 m (140.1 ft) (oa); 32.3 m (106 ft) (wl)
Draught: 8.1 m (26.6 ft)

Speed: 22 kts
Range: 9,500 n miles at 18 kts

Complement: 1,077, including 98 officers

SHIPS

WASP (LHD 1)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 30 May 1985
Launched 4 Aug 1987
Commissioned 29 Jul 1989

ESSEX (LHD 2)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 20 Mar 1989
Launched 4 Jan 1991
Commissioned 17 Oct 1992

KEARSARGE (LHD 3)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 6 Feb 1990
Launched 26 Mar 1992
Commissioned 16 Oct 1993

BOXER (LHD 4)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 8 Apr 1991
Launched 13 Aug 1993
Commissioned 11 Feb 1995

BATAAN (LHD 5)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 22 Jun 1994
Launched 15 Mar 1996
Commissioned Jul 1997

BONHOMME RICHARD (LHD 6)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down 18 Apr 1995
Launched Mar 1997
Commissioned Jul 1998

— (LHD 7)
Builder Ingalls Shipbuilding, Pascagoula, Mississippi, USA
Laid down Feb 1997
Launched Jan 1999
Commissioned May 2000

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 1,870
- Cargo capacity: 2,862 m³ (101,000 cu ft) total
- Vehicle stowage: 566 m³ (20,000 cu ft) to accommodate vehicles. Typical vehicle load:
  5 M1 tanks
  25 light armoured vehicles
  8 M198 guns
  68 trucks
  10 logistics vehicles

SHIP-SHORE LIFT

- Docking well
  12 LCM 6s or
  3 LCACs
- 4 LCPL on davits

AMPHIBIOUS FACILITIES

- Docking well 81.4 × 15.2 m (267 × 50 ft)
- Cargo handling: Six 3.66 × 7.62 m (12 × 25 ft) elevators move cargo from holds. Pallets then transferred to nine 9.75 m (32 ft) monorail trains which carry 2,721 kg (6,000 lb) each and deliver materials to the well deck at 183 m/min (6.8 mph).
- Aviation fuel: 1,232 tonnes
- Hospital facilities:
  6 fully equipped operating theatres
  4 dental surgeries
  hospital wards with 600 beds

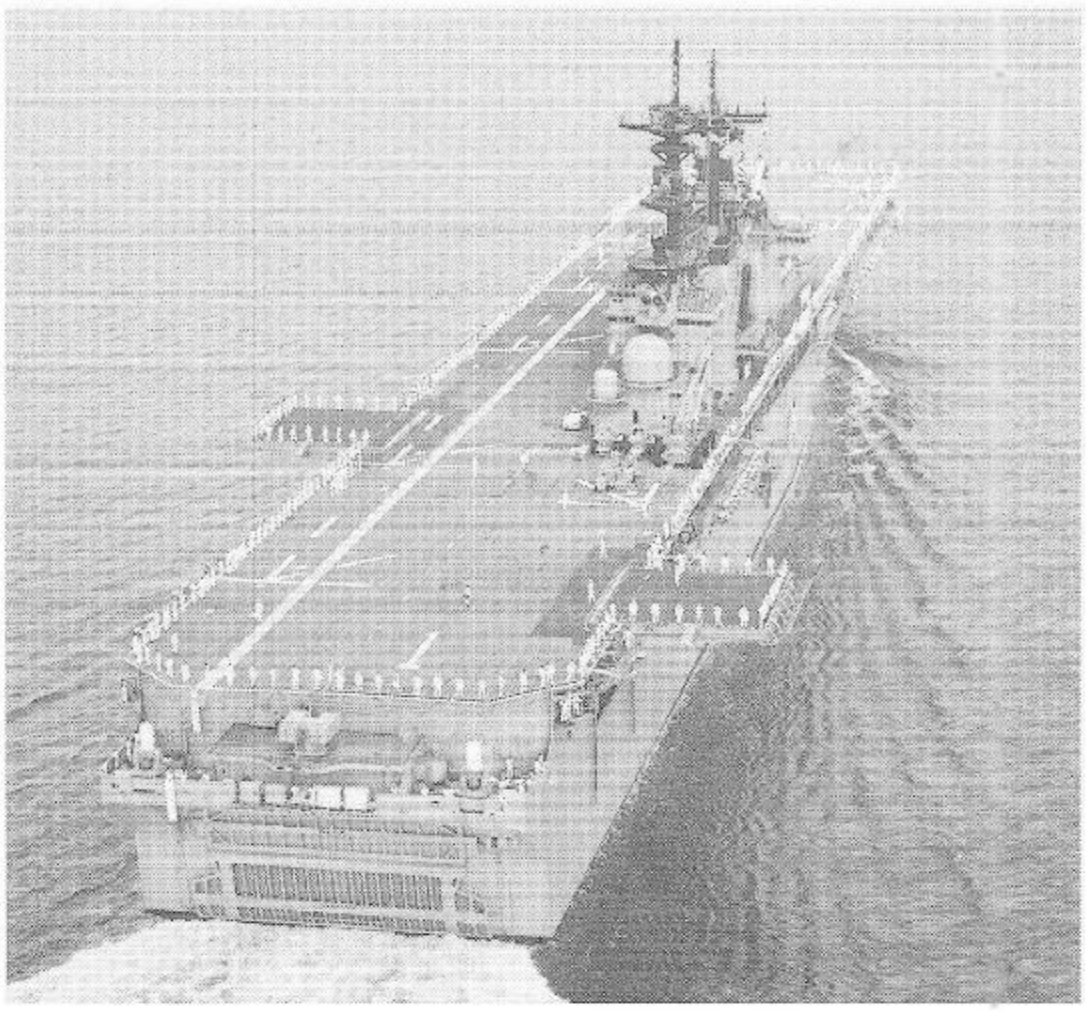
WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

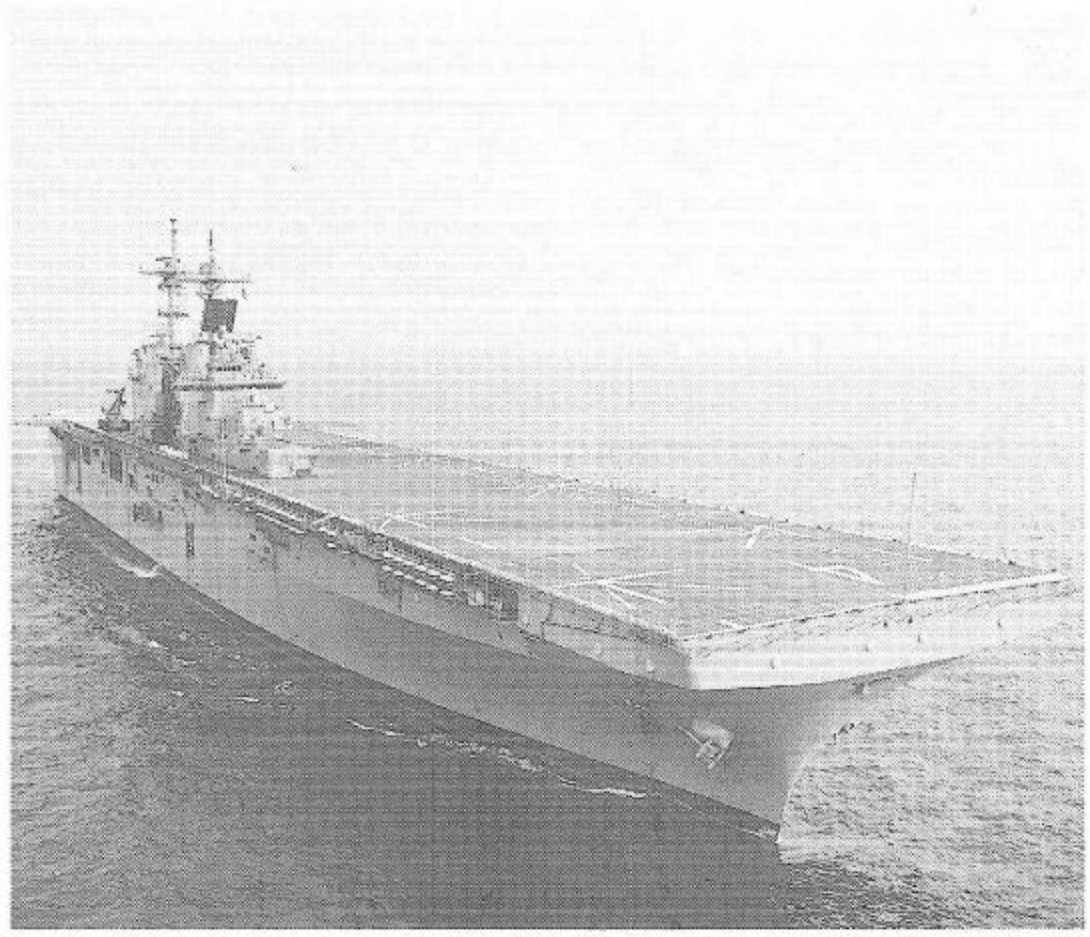
Raytheon Sea Sparrow point-defence missile system

Two GMLS Mk 29 octuple launchers are installed: one is on a small platform before the island, the other centrally on the transom, just below the edge of the flight deck. Each magazine contains 16 RIM-7 Sea Sparrow missiles. The system is fully automatic from target acquisition to interception. The Sea Sparrow missile, although based upon the air-to-air Sparrow, has been enhanced for launching from ships, and has a 38.6 kg (85 lb) blast fragmentation warhead and a dual-purpose proximity impact fuze.

Specifications
Missile (RIM-7P/R)
Length: 3.66 m (12.0 ft)
Diameter: 0.20 m (0.65 ft)
Wing span: 1.02 m (3.35 ft)
Weight: 231.5 kg (510.4 lb)
Speed: Mach 1



A stern shot of Wasp *(LHD 1) shows the after end in more detail. Note the two Mk 15 CIWS and the eight-cell launcher for Sea Sparrow SAM on the transom platform, below which is the full-width stern gate* (US Navy)



Boxer *(LHD 4), fourth in a class of seven LHDs being built for the US Navy. These are the largest amphibious warfare ships ever built and are virtually the same size as the new French nuclear carrier,* Charles de Gaulle. *Note that, in comparison with the 'Tarawa' class, there are no 'cut-outs' in the bows to accommodate weapons in order to maximise flight deck area* (Ingalls)

Range: 8 n miles (14.5 km)
Guidance: Semi-active radar

Launcher (Mk 29)
Training limits: 360°
Elevation limits: −5 to +85°
Firing rate: 3 missiles/min

Manufacturer/Contractor
Raytheon Company Equipment Division.

GUNS

Hughes Mk 15 CIWS Phalanx
There are three Mk 15 CIWS: two are on the sponson at the stern, the third immediately forward of the bridge.

This CIWS was developed to provide fast reaction to submarine-launched anti-ship missiles and operates on a 'closed loop' system, tracking both the target and the stream of rounds, and seeking constantly to reduce the difference between the two. The gun is a six-barrelled 20 mm M61A1 Vulcan with extremely high firing rates.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire (Block 0): 3,000 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)

Mounting
Weight (Block 0): 5.42 t
Traverse: 310°
Elevation: −25 to +85°
Training speed: 126°/s
Elevation speed: 92°/s

12.7 mm machine guns
Eight M2HB machine guns are carried. This is a selective short recoil automatic operation air-cooled weapon with a 1,143 mm long barrel using 110-round belts.

Specifications
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

ELECTRONIC WARFARE SYSTEMS

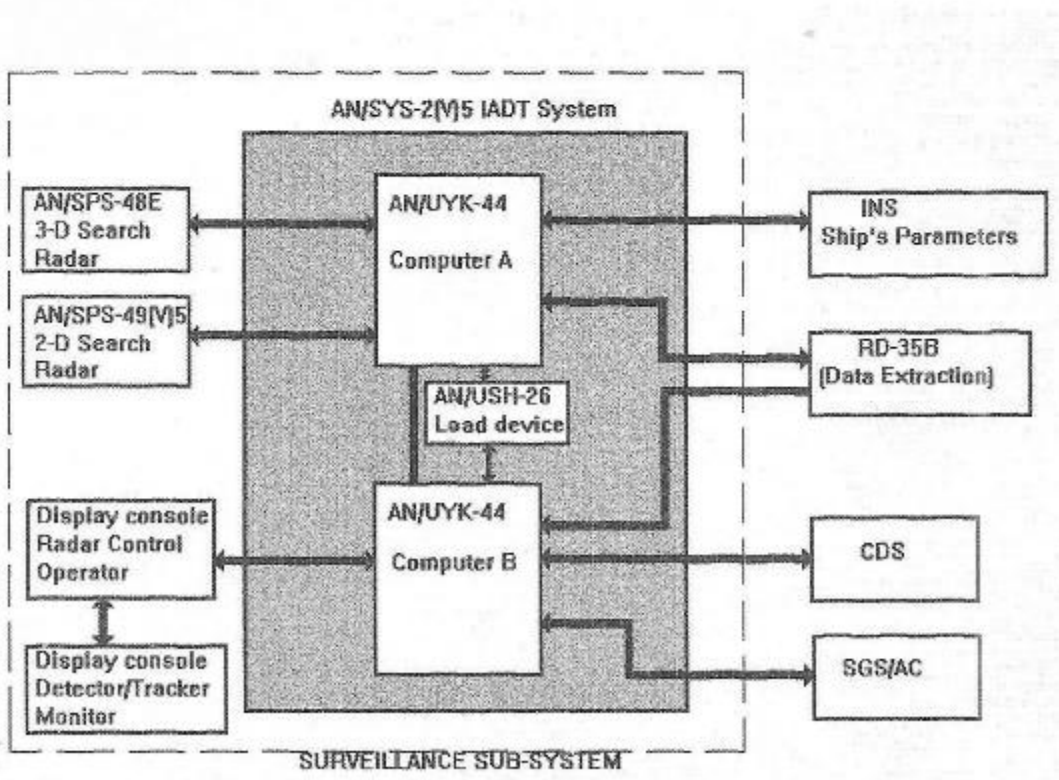
ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

Raytheon AN/SLQ-32(V)3
The AN/SLQ-32(V)3 ESM system gives radar warning on B to J-bands and jamming/deception on H to J-bands. The (V)3 system covers Bands 1, 2 and 3. The jammer has a maximum radiated power of 1 MW and is capable of forming 64 beams on either side of the ship, with jamming modes including range gate pull off (RGPO) and azimuth gate pull off (AGPO).

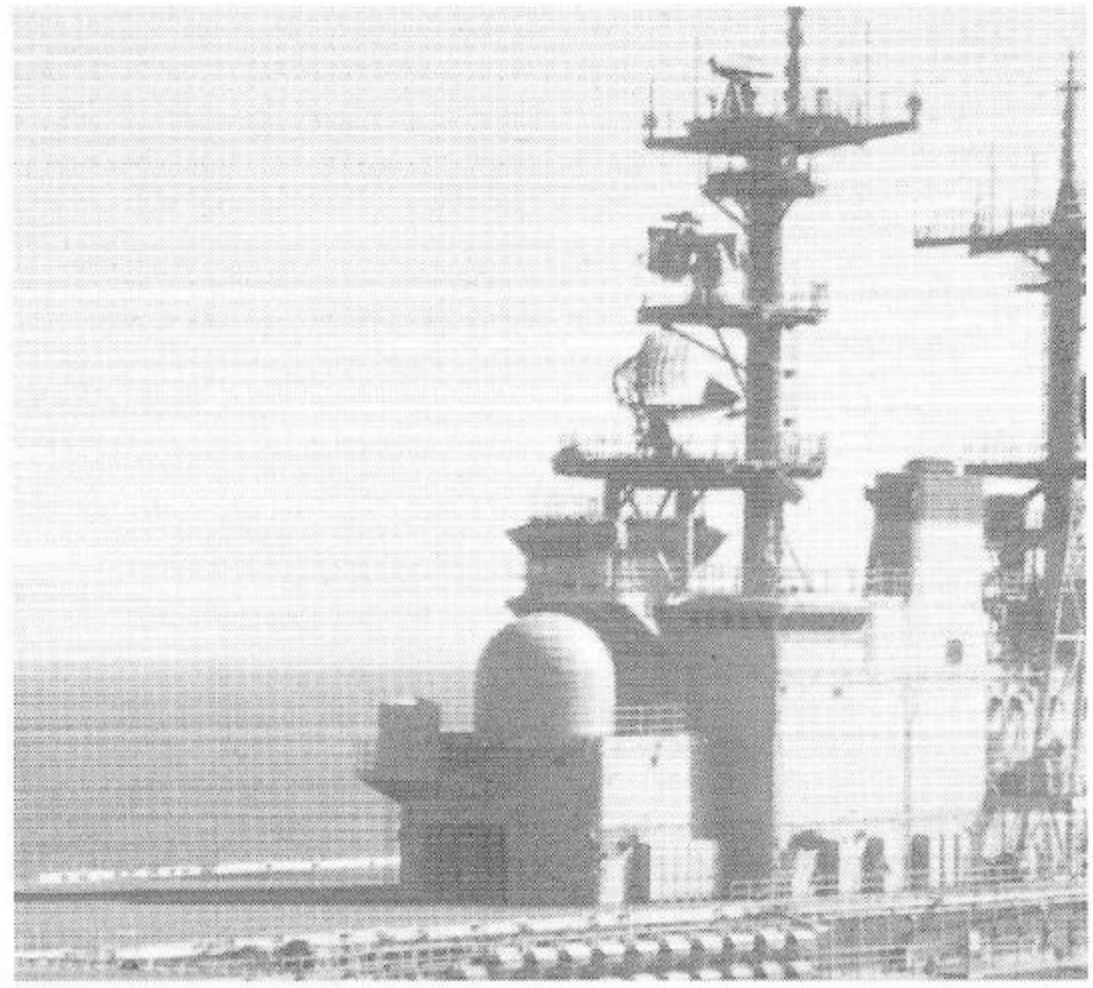
Manufacturer/Contractor
Raytheon, Electromagnetic System Division, Goleta, California, USA.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher
There are four Mk 36 SRBOC launchers firing IR flares and chaff to 2.2 n miles (4 km). The Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) system consists of launcher, launcher control, power supplies,



AN/SYS-2(V)5 IADT system



AN/SPN-35A is based in the large radome at the after end of the superstructure (Ingalls)

ready service lockers and munitions. The Mk 137 launcher has six 130 mm fixed tubes arranged in parallel rows at angles of 45 and 60°. The firing circuits use electromagnetic induction to initiate the propelling charges in the cartridges. The prime cartridge is the Mk 182 Torch with chaff payload.

Specifications
Launcher dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Launcher weight: 173 kg (381 lb)
Mk 182 cartridge dimensions: 1,209 × 130 mm (47.6 × 5 in)
Cartridge weight: 22.7 kg (50 lb)
Four Loral Hycor SRBOC six-barrelled fixed Mk 36; infra-red flares and chaff to 2.2 n miles (4 km)

Manufacturer/Contractor
Loral Hycor, USA.

AN/SLQ-25 Nixie acoustic torpedo decoy system

The AN/SLQ-25 Nixie is a solid-state, modular design electroacoustic countermeasures decoy system used to protect various classes of ships from acoustic homing torpedoes. It consists of a remote-control unit which can activate, deactivate and monitor (through an oscilloscope) the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming and recovering the towed bodies (which are stored on racks attached to the winch), a coaxial switching unit which selects the appropriate cable or load, and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body and either a deck edge tow chock or two fleet angle compensators (below-deck installations only). Total weight of the system with the RL-272 winch is 2.75 tonnes.

NATO Sea Gnat

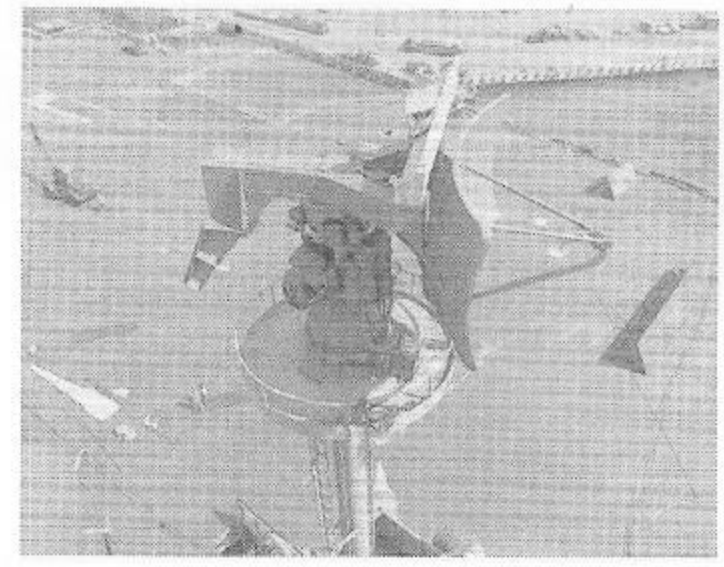
NATO Sea Gnat is a long-range chaff/infra-red (IR) decoy launching system for NATO warships and consists of a control unit, a launcher with 130 mm (5 in) tubes and munitions. The control unit provides for the launching of the most effective combination of rounds for distraction and centroid/seduction given the type, speed and direction of the threat, the ship's speed and heading as well as wind direction and speed. There are three types of round:

Mk 214 RF seduction
Mk 216 RF distraction
Mk 218 IR seduction

Manufacturers/Contractors
Thorn EMI/AB Precision Ltd, UK (control unit).
Hunting Engineering, UK (launchers).
Chemring Ltd, UK (munitions).

AN/SLQ-49 chaff buoys

AN/SLQ-49 is the US Navy version of the British 'Replica' system, also known as 'Rubber Duck.' This is a rapidly deployed, passive naval decoy which presents a ship-like image to the radar seeker of an incoming anti-ship missile. The equipment consists of a launcher and a pair of liferaft-type containers, each housing one octahedral-shaped radar reflector. The two reflecting bodies start to inflate as they leave the ship and, once in the water, they are linked to each other by a 5 m (16 ft) line with one of the container lids acting as a sea-anchor to ensure that they remain apart. The distance between the opposite tips of the decoy is approximately 2.5 m (8.2 ft) and it contains metal-coated nylon mesh curtains, which are suspended from aluminium-alloy tubes.



The antenna for AN/SPN-43 carrier control approach radar

Manufacturer/Contractor
Irvin, Letchworth, UK.

AN/SSQ-95(V) active electronic buoy (AEB)

AN/SSQ-95(V) is a ship- or air-launched expendable buoy operating in I/J-bands (8 to 20 GHz), which is released into the ocean where it operates against hostile radar systems. The system components are a receiver, a travelling wave tube transmitter, deployable transmit/receive antenna, power supplies, a programmable digital processor, a seawater-activated battery and a built-in-test facility. The AN/SSQ-95(V) is provided in a self-contained A-size sonobuoy package with a weight of 17.3 kg (38.14 lb) and dimensions of 914 × 124 mm (36 × 4.9 in). The buoy has a high sea state survivability, and is reusable.

Manufacturer/Contractor
Litton Applied Technology, San Jose, California, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Advanced Combat Direction System (ACDS) Block 0

All ships less *Wasp* (LHD 1). The Advanced Combat Direction System (ACDS), an enhanced version of the Naval Tactical Data System (NTDS) was installed in these ships in 1996/97. ACDS is a tactical data handling and target designation system which interfaces with the Mk 23 TAS. The Block 0 version with two AN/UYK-43B processors (which was also installed in the 'Tarawa' class in 1996) features software modules similar to those in the original NTDS, with a software package containing a database of approximately 1 million lines of code with an additional dedicated package specific to the host ship. The Block 0 system also features improvements in the Link 11 (TADIL A) interface, interfaces to new weapon and sensor systems as well as the replacement of the Hughes Video Signal Simulator (VSS) by the Republic Electronics AN/USQ-93 Radar Environmental Simulator System (RESS). Like NTDS, ACDS Block 0 provides Link 4A (TADIL C), Link 11 (TADIL A) and Link 14 communications.

Manufacturers/Contractors
Unisys, McLean, Virginia, USA (computers).
Hughes Aircraft Company, Los Angeles, California, USA (displays).
Rockwell International (Collins Avionics/Communications Division), Cedar Rapids, Indiana, USA (communications).

ACDS Block 1 Level 2

***Wasp* (LHD 1) only.** One ship in the class is fitted with ACDS Block 1 Level 2, having received this more advanced system as part of a demonstrator programme. ACDS Block 1, introduces Link 16, increases track capacity significantly and has automatic identification and decision aids, while featuring new command, communications, control and information interfaces. A Level 0 engineering demonstrator was installed in USS *Constellation* (CV 64) in January 1994 and completed tests in the Summer of 1994. ACDS Block 1 Level 1 software was initially tested in USS *Constellation* and by the Spring of 1995 was at an advanced stage of development. The Level 2 software was under development in 1995 and was scheduled to support Co-operative Engagement Capability (CEC) in USS *Dwight D Eisenhower* (CVN 69) and 'Wasp' (LHD 1) class amphibious assault ships from June 1996. Plans for an ACDS Block 2 have been abandoned.

In ACDS Block 1, initially designed for aircraft carriers or 'Wasp' (LHD 1) class amphibious assault ships, the system will receive sensor data from radars/IFF, the Mk 23 TAS, the AN/SLQ-32 electronic warfare suite, the navigation system and anti-submarine warfare module (in aircraft carriers). It has two UYK-43 and one TAC-3 nodes. A Link 16 interface is added to help identify not only ship classes but also individual ships and submarines by collating historical tracking data. A third UYK-43B is added as the Command and Control processor (C2P) with the USQ-69 display system. The C2P will receive data through Links 4A, 11 and 16. The ACDS will also receive external data through the Joint Maritime Command Information System (JMCIS), formerly known as the Naval Tactical Command System-Afloat (NTCS-A) using the TAC-3 workstation.

Block 1 Level 1 augments combat direction system processing. This will provide the basis of systems which *may be extended to eight tightly coupled and 248* loosely coupled computer nodes. There will be a two-way open architecture interface to JMCIS with automatic electronic warfare correlation. The Block 1 Level 2 system adds amphibious modes to the capability and will feature AN/UYQ-70 workstations and X-Windows software. The Block 1 Level 3 system will rehost processing to COTS processors and will feature improved software capabilities including enhanced X-Windows. This will be the first system capable of interacting with SSDS.

COMMUNICATIONS AND DATALINKS

Satcom
SSR-1
WSC-3 (UHF)
USC-38 (EHF)
SMQ-11 Metsat

WEAPONS CONTROL

Mk 91 Missile Fire-Control System

Two Mk 91 MFCS. The Mk 91 is a fully or semi-automatic system for the Sea Sparrow system, covering the entire engagement from target acquisition to interception, with either one (Mod 2) or two (Mod 3) fire-control radar sets (Mk 95). The Mk 91 fire-control system is a mainframe system using an NFT (Norsk Forsvarsteknologi) Mk 157 digital computer with integral system evaluation and trainer (SEAT). The computer performs all the necessary calculations, stores data and is responsible for data distribution. The tracker-illuminator consists of a Mk 78 radar director with separate transmitting and receiving antennas, a director controller (Mk 106) and a low-light TV camera (Mk 6) with 2.4 × 2.4 and 10 × 10 fields of view. The Mk 78 director weighs 1.56 tonnes while the below-decks equipment weighs 4.14 tonnes (single director system) or 7.19 tonnes (double director system). The radar is believed to operate in the I-band and directs the missile to fly a lead angle course to the intercept point which allows Sea Sparrow-equipped ships not only to protect themselves but also other vessels in the immediate *vicinity*.

The signal data converter acts as the interface between the computer and its peripheral equipment. Signals received through the tracker's receive antenna are processed by the signal data processor which provides data on the target's location and course. This data is monitored at the Mk 83 radar console while the firing officer's Mk 86 console is used to monitor and control the engagement.

Because of its I-band frequency the Mk 91 will detect sea-skimming missiles sooner than lower-frequency search radars. Thus the system can be fully autonomous conducting search, detection and engagement automatically. It can also accept outside designations from radar, EW or optic sources. Radar data from the director is then processed in the signal data processor to provide range and angle tracking data.

This data is passed to the firing officer's console from where prelaunch data and firing commands are relayed to the Mk 29 trainable launcher and missile. The launcher then trains in azimuth to the intercept point

and in superelevation to optimum angle to maximise missile kinetic energy. If the correct azimuth is blocked by the ship's superstructure, the launcher trains to the nearest clear azimuth and the missile is commanded to 'fly around the corner' to the direct path to the intercept. The missile upon launch flies a proportional navigation path (lead angle intercept) directly to intercept point in a lofted trajectory to maximise energy and minimise image effects.

Manufacturer/Contractor
Raytheon Company Equipment Division, USA.

SYS-2(V)3 IADT
SYS-2 increases the number of air and surface targets which may be detected and tracked by radar in all types of electronic environments. The system accepts contacts from each radar, seeks potential targets, correlates the data by comparing all the sensors' returns and then produces a single file of valid tracks while avoiding duplication. The data are then fed to the ship's command and weapon control systems.

Each system consists of two 16-bit Paramax computers (AN/UYK-20 or AN/UYK-44) and two display consoles. In later systems 32-bit digital microprocessors are added to improve sensor data fusion. The SYS-1 system uses either the AN/UYK-20 or AN/UYK-20A while SYS-2 uses the AN/UYK-44 which is capable of 900 Kops. Supplementary processors are the Motorola 68020, the INMOS Transputer (801/5) and the Intel i860 RISC. The UYK-20 and UYK-44 use Ultra-16 Assembly language and Ada is planned for SYS-2. The transputer uses OCCAM software language.

In most systems one computer is used to interface with the sensors and the inertial navigation system while the other supports the display consoles and interfaces with the combat direction system, and fire/weapon control systems. In SYS-2 the two computers are linked by an AN/USH-26 signal data recorder/reproducer.

Wasp (LHD-1) has the (V)3 system with SPS-49/52 air search radars while the remainder of class has the (V)5 system and SPS-48/49 air search radars.

RADARS

Type	AN/SPS-52C	AN/SPS-48E	AN/SPS-49 (V)9	TAS Mk 23	AN/SPS-67(V)3	AN/SPS-64(V)9
Ships	*Wasp* (LHD 1) only	Not *Wasp* (LHD 1)	All	All	All	All
Maker	Hughes	ITT-Gilfillan	Raytheon	Hughes	Westinghouse-Norden	Raytheon
Role	Long-range air search	Long-range air search; 3D	Very long-range air search	Target acquisition for Sea Sparrow	Surface search	Navigation
Band	E (2-3 GHz)	E/F	UHF band (850-942 MHz)	D	G (9,375 ±25 MHz	I (9,345-9,405 MHz)
Beam	1.1 × 2.25°	1.5 × 1.6°	3.4 × cosec² to 30°	3.3 × 75°	1.5 × 12°	1.9 × 22°
Peak power	1 kW	2,200 kW	360 kW	200 kW	10, 25, 50 kW	20 kW
Gain	39.5 dB	38.5 dB	28.5 dB	21 dB		28 dB
Pulsewidth	2.5/4.6/10 µs	3 µs	1.5 µs	—	-0.06, 0.5, 1 µs	0.06/0.5/1.0 µs
PRF	1,850, 925 pps	1,250-2,000 pps	LR: 280 pps SR:800/1,000 pps	4,000/900 pps	3,600, 1,800, 900 pps	3,600/1,800/900 pps
Scan rate	15/6 rpm	7.5/15 rpm	6/12 rpm	15/30 rpm	15 rpm	33 rpm
Typical range	240 n miles (450 km); 30,480 m (100,000 ft)	220 n miles (407 km); 30,000 m (100,000 ft)	<250 n miles (463 km)	Surveillance: 90 n miles (167 km) Engagement: 20 n miles (37 km)	56 n miles (104 km)	

ITT Gilfillan AN/SPN-35A
AN/SPN-35A is an aircraft carrier approach radar set that provides precise range, altitude and heading information to guide fixed-wing aircraft and helicopters along the final approach to the carrier deck. Aircraft accepted from the surveillance radar systems are marshalled and controlled by the AN/SPN-35A to a final transition point from which the recovery is made. The AN/SPN-35A antenna is mounted on a gyrostabilised platform that keeps the radar level and accurately aligned to the horizon at all times.

ITT Gilfillan AN/SPN-43B
AN/SPN-43B is part of the US Navy carrier air traffic control centre, its function being to bring aircraft in to the point at which they commence landing. Mounted on top of a stabilised platform that automatically compensates for the pitch and roll of the ship, AN/SPN-43B detects aircraft at distances up to 50 n miles (93 km). It provides tracking data that allows the radar operator to control and transition the aircraft into the final approach area for carrier recovery. Operational frequency is 3.5 to 3.7 GHz, with a peak power output of 850 kW.

Manufacturer/Contractor
ITT Gilfillan, Van Nuys, California, USA.

Textron AN/SPN-46(V)
AN/SPN-46(V) will be installed soon in all these ships. AN/SPN-46(V) was developed in the early 1980s for simultaneous and automatic control of two aircraft during final approach and landing. The system is a precision dual-band automatic acquisition/tracking radar and aircraft skin tracking with Mode I, II and III operational capabilities. There are four groups of equipment: the radar/ship motion sensor subsystem, the central computer, the display, and ancillary equipment. Designed primarily as a navigation aid for use during CASE III recovery periods, the system offers three modes of operation. Mode I is a closed-loop hands-off automatic landing mode, Mode II is an instrument landing system approach where position data is presented on the aircraft display, and Mode III which is a carrier-controlled talk-down approach.

Specifications
Frequencies: K-band (33.2 ±0.2 GHz); I-band (9,310 ±35 MHz)
Peak power: 50 kW
Pulsewidth: 0.2 µs
PRF: 2,000 pps
Automatic search: 1° elevation; 25° azimuth; 366 m (12,001 ft) range
Scan rate: 12 scans/min
Radar coverage: ±150° azimuth; +30 to −15° elevation

Manufacturer/Contractor
Textron Defense Systems, Wilmington, Massachusetts, USA.

Mk 95
There are two Mk 95 tracker-illuminators, which are part of the Mk 91 MFCS. The Mk 95 tracker-illuminator consists of a Mk 78 radar director with separate transmitting and receiving antennas, a director controller (Mk 106) and a low-light TV camera (Mk 6) with 2.4 × 2.4° and 10 × 10° fields of view. The I-band radar directs the missile to fly a lead angle course to the intercept point allowing Sea Sparrow-equipped ships to protect both themselves and other ships in company.

Manufacturer/Contractor
Raytheon Company, Equipment Division, USA (prime).

Tacan
URN 25

IFF
CIS Mk XV
UPX-29

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: 249.6 × 32.3 m (819 × 106 ft). Nine helicopter landing spots. Flight deck is covered with HY100 steel.
Hangar: 98 × 26 × 6.4 m (322 × 85 × 21 ft)
Elevators: 2—15.24 × 13.7 m (50 × 45 ft) deck-edge aircraft elevators, one to starboard and aft of the island superstructure, and one to port amidships. Both fold for Panama Canal transits. Weight limit 34,020 kg (75,000 lb).
Aircraft:
30 CH-46E Sea Knight helicopters, plus 6-8 AV-8B Harrier II

20 AV-8B Harrier II plus 4-6 SH-60B Seahawk in secondary role.

Can also support AH-1W SuperCobra, CH-53E Super Stallion, CH-53D Sea Stallion, UH-1N Twin Huey, AH-1T Sea Cobra and SH-60B Seahawk helicopters.

PROPULSION

Specifications
System: Steam-turbines
Main machinery: 2 Combustion Engineering boilers, 42.3 kg/cm² (600 psi), 482°C; 2 Westinghouse turbines, 52.2 MW (70,000 hp)

Shafts: 2
Auxiliary power: 16,500 kW

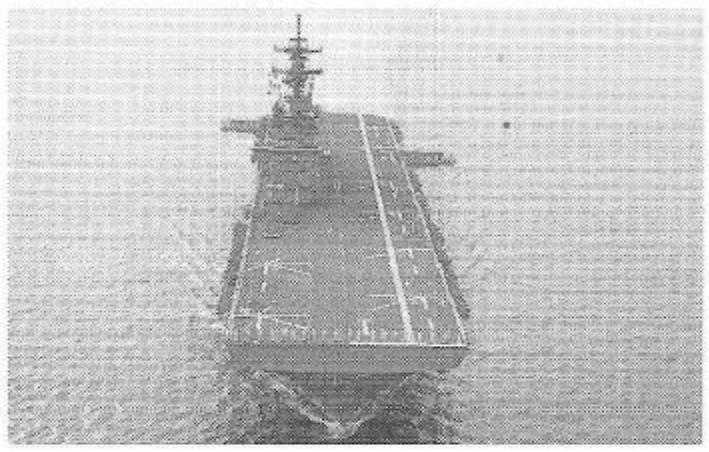
FURTHER INFORMATION

PROGRAMME

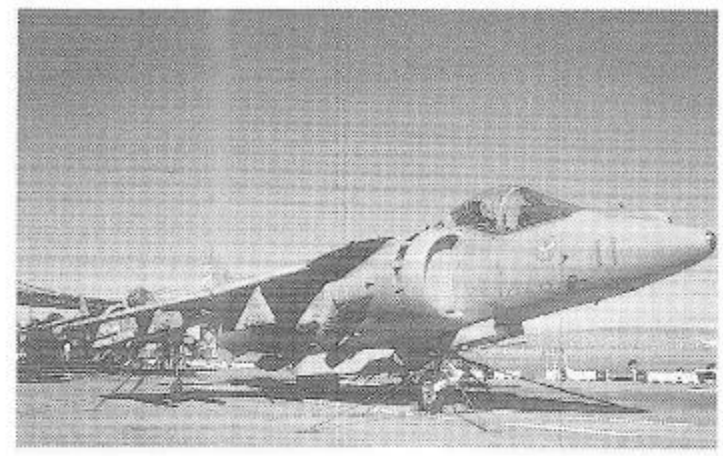
The 'Wasp' class has suffered from the vacillations which seem to have become an inseparable part of US defence planning, with the result that 15 years after the development contract, there are still only four ships in service, with a further three in varying stages of construction. The currently planned total of seven ships is, however, larger than seemed likely at some stages in the past.

DESIGN

A basic factor in the design is that the ship has two roles. The first is to serve as an amphibious landing ship, but the second is to serve as a Sea Control Ship, with an air wing consisting of 20 AV-8B Harrier II and six SH-60B Seahawk ASW helicopters.



An aerial picture of Wasp *(LHD 1) shows that the flight deck is rectangular in shape, with the two deck-edge elevators well clear and only the 'island' taking up space which would otherwise be allocated to flying operations* (US Navy)



AV-8B Harrier aboard Boxer *(LHD 4)*

The design is a slightly larger version of the 'Tarawa' class LHA, retaining the advantages of the earlier design but with a number of new ideas, including enhanced survivability.

Thus, most of the command and communications facilities have been moved from the island down into the hull in order to enhance their survivability, while also enabling the superstructure to be lowered by two deck levels and reducing the area it occupies on the flight deck. In addition, the flight deck surface is constructed from HY100 steel, the same as that used for the pressure hulls of nuclear submarines.

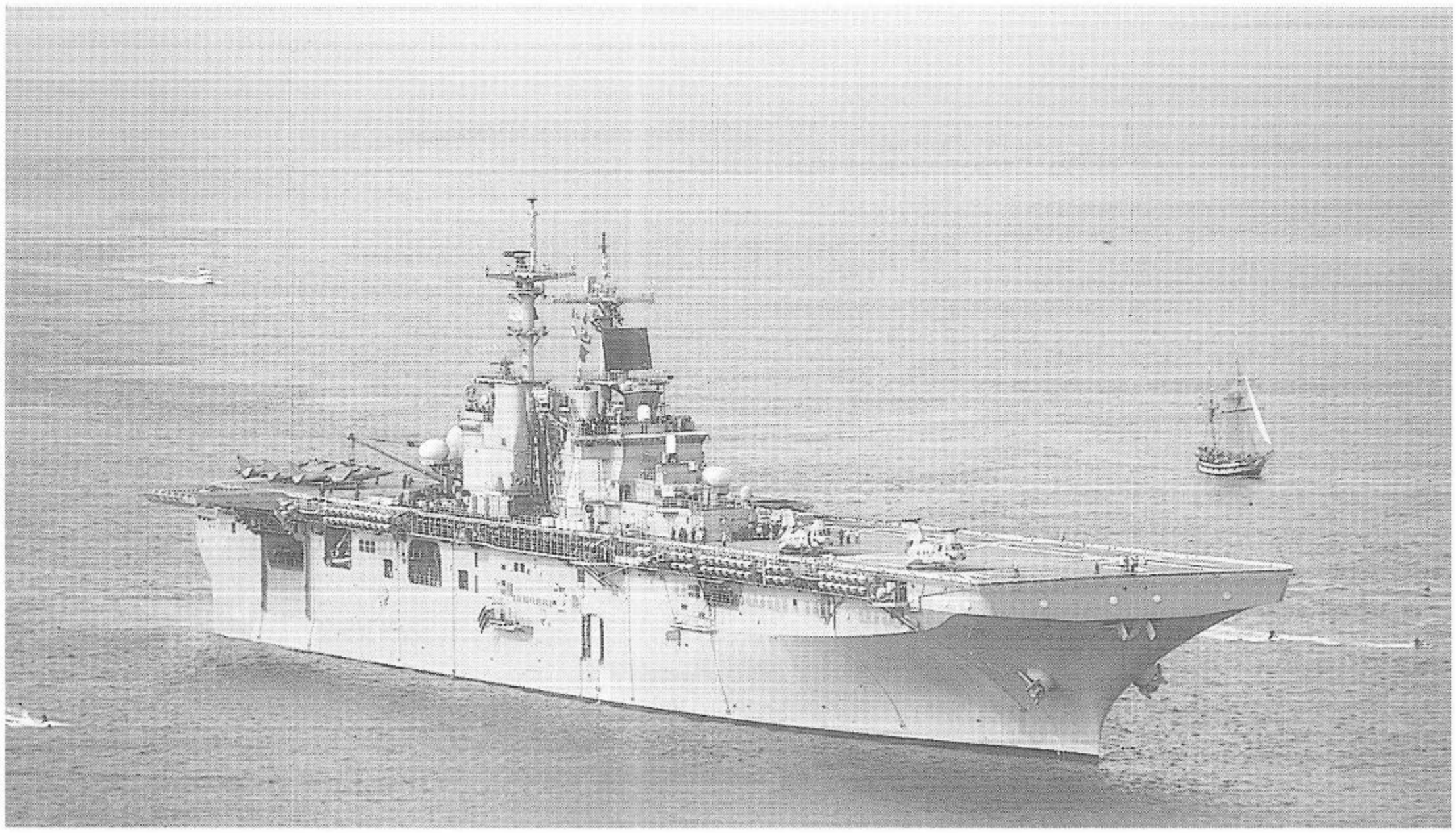
There is a large bulb at the foot of the stem to enhance sea-keeping, which was planned at one point to be installed in the 'Tarawa' class, but was cancelled due to lack of funding. The stern gate design has also been changed from the rising type in the Tarawa to a more conventional lower hinged type as in the LPDs.

Major efforts have been made to maximise the area of flight deck available for aircraft use. Thus, the footprint of the island has been reduced and both deck-edge elevators are completely clear of the flight deck. In the 'Tarawa' class the stern elevator, which is inset into the after end of the flight deck has an effect on

Boxer *(LHD 4) showing the flight deck, deck-edge lifts and five AV-8B Harriers*

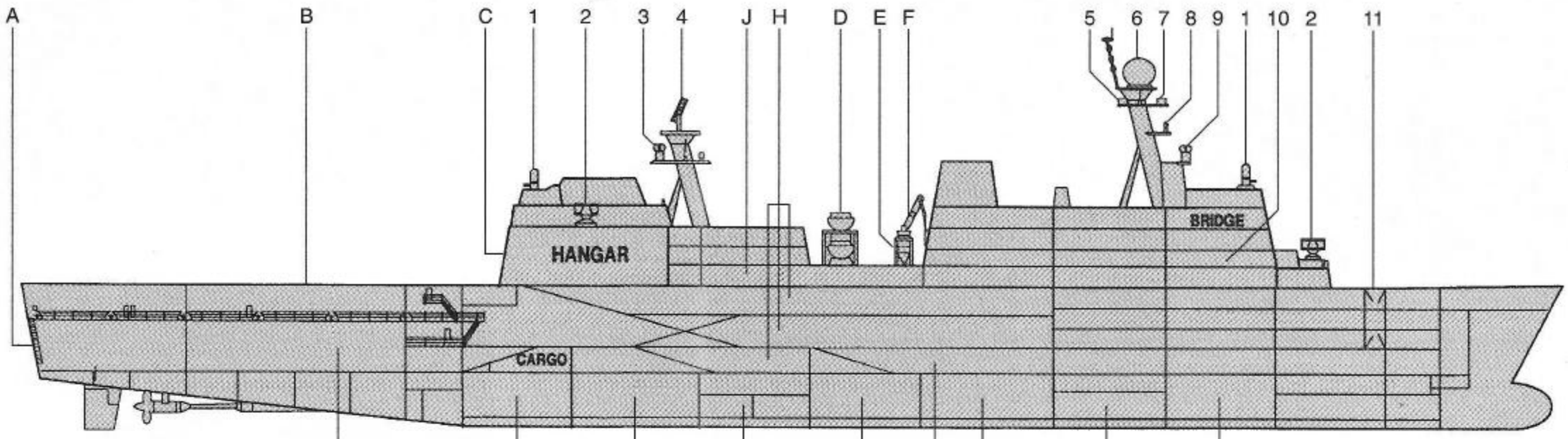
operations out of proportion to its actual size. In addition, the weapons which occupied 'cut-outs' in the four corners of the Tarawa flight deck have been moved (and the 127 mm guns deleted), enabling the areas to be restored to flying operations. Consideration was given to installing a ski jump to enhance the payload capability of the AV-8B Harrier II, but this was rejected as it would have reduced the number of helicopter 'spots.'

Somewhat surprisingly, these ships are powered by steam turbines. Consideration was given to powering at least the later units by gas-turbines, but this has been rejected, again on cost grounds.



Boxer *(LHD 4) in October 1996. Aft are three AV-8B Harrier IIs which is one of the types the 'Wasp' class was designed to operate. Consideration was given to installing a ski jump, but it was rejected on the grounds it would reduce the number of helicopter landing spots* (H & L van Ginderen Collection)

SAN ANTONIO (LPD 17)



LPD 17
Amphibious A *Stern gate* **B** *Flight deck* **C** *Hangar* **D** *LCVP* **E** *RHIB* **F** *Crane* **G** *Ammunition* **H** *Vehicle storage* **J** *Medical facilities* **K** *Docking well*

General 1 *Hughes Mk 15 20 mm CIWs* **2** *Mk 49 launcher for RAM* **3** *NSSMS director* **4** *Raytheon AN/SPS-48E air search radar* **5** *CEC No 2* **6** *Lockheed AN/SPQ-91 missile control radar* **7** *CEC No 1* **8** *Norden AN/SPS-67(V)3 surface search radar* **9** *NSSMS director* **10** *AN/SLQ-32 (Y) 3 ESM/ECM suite (in bridge wing)* **11** *Mk 41 VLS for Evolved Sea Sparrow SAM* **12** *Auxiliary machinery room (Ship's Services)* **13** *Main machinery room*

GENERAL SPECIFICATIONS

Operator: USA
Type: LPD 17 Amphibious Transport Docks (LPD)

Class: SAN ANTONIO

Active: 0
Proposed: 12

Displacement:
full load: 25,300 tonnes

Dimensions
Length: 208.4 m (683.7 ft) (oa); 200 m (656 ft) (pp)
Beam: 31.9 m (104.7 ft)
Draught: 7 m (23 ft)

Speed: 22 kts (sustained)

Complement: 493, including 34 officers

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops
- 2,323 m² (25,000 sq ft) of deck space for vehicles
- 708 m³ (25,000 cu ft) of cargo space below decks

SHIP-SHORE LIFT

- Two LCACs

AVIATION FACILITIES

Specifications
Flight deck: Landing for 2 CH-53E or 4 AH/UH-1s or 4 CH-46, or 2 MV-22.
Hangar: Full facilities for 1 CH-53E Sea Stallion, or 2 CH-46 Sea Knight, or 1 V-22 Osprey, or 3 UH/AH-1s

	Ship's crew	Marines (normal)	Totals (normal)	Surge	Maximum
Officers	34	66	100	10	110
CPO/SNCO	30	41	71	6	77
Enlisted/ Troops	429	597	1,026	75	1,101
TOTALS	**493**	**704**	**1,197**	**91**	**1,288**

AMPHIBIOUS FACILITIES

- Three vehicle decks, 2,323 m² (25,000 sq ft)
- Two cargo/ammunition magazines, 708 m³ (25,000 cu ft)
- Cargo fuel, JP-5, 1,190 m³ (42,000 cu ft)
- Cargo fuel, MOGAS, 38 m³ (1,342 cu ft)
- No beaching capability
- No heavy over-the-side lift capability
- Well deck and stern gate arrangements similar to 'Wasp' class
- Crane for support of boat operations
- Hospital facilities
  Four operating theatres (two medical, two dental)
  24 bed ward
  100 casualty overflow beds

WEAPONS SYSTEMS

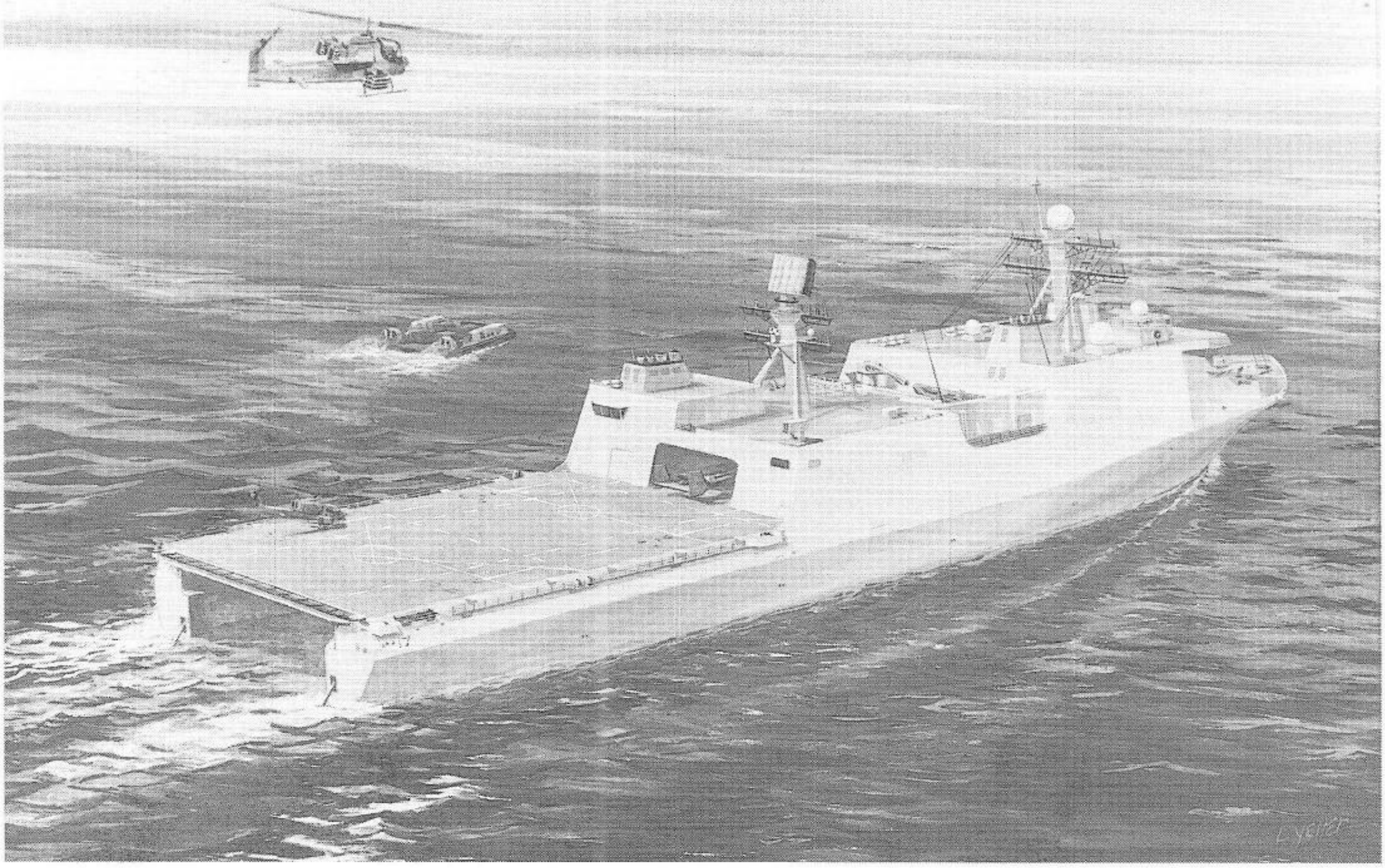
SURFACE-TO-AIR MISSILES (SAM)

Evolved Sea Sparrow Missile System (ESSMS)/RIM-7RTC point defence system

LPD 17 will be armed with the Evolved Sea Sparrow Missile System (ESSMS), a developed version of the Mk 57 NATO Sea Sparrow Missile System (NSSMS), with the RIM-7RTC missile. RIM-7P, which succeeded the RIM-7M missile on the production lines in 1991, has a Missile-Borne Computer (MBC), which controls overall missile performance and links the major missile subsystems. The missile also has an improved low-altitude guidance mode and enhanced subclutter performance against very low-altitude targets. Other features include a 38.6 kg (85.1 lb) warhead with new fuze for low-altitude use, a command uplink, sample data homing and multiple target designation. The RIM-7R is similar, but in addition has a dual-mode semi-active radar and infra-red seeker.

ESSM (RIM-7RTC) will have many of the features of RIM-7P and RIM-7R, including the same guidance system, but with a new autopilot and a larger rocket motor. It will be wingless and with tail control as well as integral thrust vector control both for vertical launch and to double the manoeuvrability. The system is fully compatible with the GMVLS Mk 41, but since each cell was dimensioned to house a Tomahawk missile a special module has been developed which accommodates four Sea Sparrows in a single vertical launch cell. These are known as 'quad packs'.

Targets are detected by the ship's radar and designated through the combat information centre and the tracker system then traverses onto the relevant bearing and elevation, while radar data from the director is processed in the signal data processor to provide range and angle tracking data. The data is then passed to the firing officer's console which passes prelaunch data and the firing command to the missile which is then launched. The missile lifts to a height of approximately 4 m (13 ft) and then begins to pitch over in the correct



Artist's impression of San Antonio *(LPD 17). Note the large flight deck, hangar and stern well* (Ingalls)

azimuth to the intercept point, controlled by the jet Vector Control, which is then jettisoned (approximately 2 seconds after lift-off). The missile follows a proportional guidance path directly to the intercept point.

Specifications

RIM-7P/R
Length: 3.66 m (12.0 ft)
Diameter: 20.3 cm (8 in)
Wing span: 1.02 m (3.3 ft)
Weight: 231.5 kg (510 lb)
Speed: Mach 1
Range: 8 n miles (14.5 km)
Guidance: Semi-active radar

Manufacturers/Contractors

Raytheon Company, Equipment Division (prime system).
Raytheon Company, Missile Systems Division (prime missile).
Hughes Missile Systems (second missile source).

RIM-116A RAM close in system

Two Mk 31 Mod 0 launchers for the Rolling-Airframe Missile (RAM) system are being installed: one will be immediately forward of the bridge, the other at the after, starboard corner of the hangar. The RIM-116 missile is based on the Sidewinder air-to-air missile, but with significant modifications, enabling it to be used as a fire-and-forget system. There is an infra-red, terminal guidance seeker in the nose (taken from the Stinger man-portable surface-to-air missile), behind which is a new dual-mode passive radio frequency seeker for mid-course guidance. Most of the rear of the missile is based upon Sidewinder components. Missiles are stored in sealed launcher-containers and are manually loaded into the 21-cell Mk 49 RAM Standard Launcher, which is mounted on the same base as that used by the Phalanx and retains that system's elevation and train drive assemblies.

Radar and electro-optical sensors provide details of target location, distance and speed, while the ship's ESM system inputs data on the target's radar frequency, as well as correlating radar data on location. On launch, the missile is spun-up by a rifling band as it is driven down the launch tube, and then as it leaves the launcher the four tail fins deploy which maintain the spin. Aerodynamic control is provided by the two canard surfaces, which also deploy after launch. The autopilot and control system maintain the initial line of sight course towards the target and then the RF seeker is activated and, once this acquires the target, it takes control of the guidance system and makes the appropriate course alterations. The IR seeker is also activated and when a sufficient signal-to-noise ratio is achieved this takes over guidance control for the terminal phase. The missile is capable of manoeuvres up to 20 *g* in any direction.

Specifications

Mk 49 RAM Standard launcher
Traverse: 360°
Elevation: −25 to +80°
Turning circle: 3.27 m (10.73 ft)

RIM-116 missile
Length: 2.79 m (9.15 ft)
Diameter: 12.7 cm (5 in)
Wing span: 43.4 cm (17.1 in)
Weight: 73.6 kg (162.25 lb)
Speed: Mach 2
Range: 5.17 n miles (9.6 km)
Warhead: 9.09 kg (20 lb) fragmentation blast (WDU-17B)
Motor: Hercules/Aerojet Mk 36 solid propellant rocket

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA.

MISSILE LAUNCHER

GMVLS Mk 41 Mod 0

The LPD 17 will be fitted with two eight-cell Mk 41 Mod 0 Guided Missile Vertical Launch Systems (GMVLS) inset in the foredeck, which will be used for Evolved Sea Sparrow Missile (ESSM) which will also be deployed, with each GMVLS tube accommodating four of the new missiles. Total of 64 missiles.

GUNS

Hughes Mk 15 CIWS Phalanx

Two Mk 15 CIWS will be mounted, one on the bridge roof, the other aft on the hangar roof. The weapons group is based on a barbette assembly with electronics enclosure to the rear. The group takes up 5.5 m² space on deck and is on a 150 mm (5 in) thick platform. The gun is a six-barrelled 20 mm M61A1 Vulcan capable of extremely high firing rates. Original Block 0 systems installed in the early 1980s are gradually to be uprated to Block 1.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire:
Block 0; Block 1 Baseline 0: 3,000 rds/min
Block 1 Baseline 1: 4,500 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)

Mounting:
Weight:
(Block 0): 5.42 t
(Block 1): 6.18 t
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

Manufacturer/Contractor

Hughes Missile Systems, Tucson, Arizona, USA.

25 mm Mk 38 Mod 0 automatic cannon (Sea Snake)

There will also be three single Mk 88 mountings for Mk 38 Mod 0 25 mm cannon (Sea Snake). The Mk 88 mounting is replacing 20 mm mountings in many US Navy warships and is designed to engage surface and shore targets in low- and mid-intensity operational environments at ranges up to 1.33 n miles (2.5 km). The M-242 is a single barrel, externally powered weapon which incorporates a rotating bolt mechanism driven by a chain drive. The weapon has been designed to allow the barrel to recoil separately from the receiver, which reduces the available travel as the bolt also has to move, the travelling distance being 12.7 mm. The Mk 38 can fire single shots or 175 rds/min and features twin shoulder braces and an optical Aimpoint sight. The weapon weighs 110.5 kg (243.6 lb) and is 2.74 m (9.0 ft) long, 0.32 m (1.05 ft) wide and 0.37 m (1.2 ft) high while the barrel is 2.30 m (7.5 ft) long. The peak recoil force is 4,536 kg (10,0001 lb) in the naval version but with a McDonnell Douglas muzzle brake modification and recoil damper this can be reduced to 2721.5 kg (6,000 lb). The barrel life is in excess of

13,000 rounds while the demonstrated reliability of the weapon is 22,000 rounds between stoppages.

Specifications
Calibre: 25 mm
Length of barrel: 81 calibres
Muzzle velocity: 1,100 m/s (3,609 ft/s)
Traverse: 300°
Elevation: −20 to +55°
Weight: 596.5 kg (1,315 lb) (loaded)
Crew: 1 (often supported by a spotter)
Range: 1.33 n miles (2.47 km)
Rate of fire: 175 rds/min (max)
Ammunition: 184 g HEI-T

Mk 26 Mod 17 12.7 mm machine guns
Four Mk 26 Mod 17 machine guns will be carried. This is a selective-fire, short-recoil, automatic weapon with a 1,143 mm long barrel.

Specifications
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

AN/SLQ-32A(V)3 intercept and jammer
The AN/SLQ-32A(V)3 is a combined ESM and ECM system, giving radar warning on B to J-bands to give jamming and deception on H to J-bands. The jammer has a maximum radiated power of 1 MW and is capable of forming 64 beams on either side of the ship, with jamming modes including range gate pull off (RGPO) and azimuth gate pull off (AGPO).

Manufacturer/Contractor
Raytheon, Electromagnetic System Division, Goleta, California, USA.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher
Four Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) systems are mounted, consisting of launcher, launcher control, power supplies, ready service lockers and munitions. The Mk 137 launcher has six 130 mm fixed tubes arranged in parallel rows at angles of 45 and 60°. The firing circuits use electromagnetic induction to initiate the propelling charges in the cartridges. The prime cartridge is the Mk 182 Torch with chaff payload.

Specifications
Launcher dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Launcher weight: 173 kg (381 lb)
Mk 182 cartridge dimensions: 1,209 × 130 mm (47.6 × 5 in)
Cartridge weight: 22.7 kg (50 lb)

AN/SLQ-25A Nixie
AN/SLQ-25A Nixie is a solid-state, modular design electroacoustic countermeasures decoy system used to protect various classes of ships from acoustic homing torpedoes. It consists of a remote-control unit which can activate, deactivate and monitor (through an oscilloscope) the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming and recovering the towed bodies (which are stored on racks attached to the winch), a coaxial switching unit which selects the appropriate cable or load, and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummy loads for testing the amplifier without streaming a towed body and either a deck edge tow chock or two CSL27 fleet angle compensators. Total weight of the system with the RL-272 winch is 2.75 tonnes.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

AN/SYQ-20 Advanced Combat Direction System Block 1 Level 3 (ACDS)
AN/SYQ-20 ACDS is an enhanced version of the widely used Naval Tactical Data System (NTDS) tactical data handling and target designation system, which interfaces with the Mk 23 TAS. The LPD-17 will have ACDS Block 1 with three AN/UYK-43B processors, featuring software modules similar to those in the original NTDS, with a software package containing a database of approximately 1 million lines of code with an additional dedicated package specific to the host ship. The Block 1 system also features a Link 11 (TADIL A) interface, as well as interfaces to Link 16 and Naval Tactical Command System-Afloat (NTCS-A). There are also interfaces to new weapon and sensor systems. As with NTDS, ACDS Block 1 provides Link 4A (TADIL C), Link 11 (TADIL A) and Link 14 communications. The Link 16 facility will use the Unisys AN/USQ-69 data terminal.

ACDS Block 1 Level 1 system will augment combat direction system processing, providing the basis of systems which may be extended to eight tightly coupled and 248 loosely coupled computer nodes. There will be a two-way open architecture interface to JMCIS with automatic electronic warfare correlation. The Block 1 Level 2 system adds amphibious modes to the capability and will feature AN/UYQ-70 workstations and X-Windows software. The Block 1 Level 3 system will rehost processing to COTS processors and will feature improved software capabilities including enhanced X-Windows. This will be the first system capable of interacting with SSDS.

Manufacturer/Contractor
Unisys, McLean, Virginia, USA (computers).
Hughes Aircraft Company, Los Angeles, California, USA (displays).
Rockwell International (Collins Avionics/Communications Division), Cedar Rapids, Indiana, USA (computers).

Ship Self-Defense System (SSDS) Mk 1
LPD-17 will be the first class to have SSDS Mk 1 installed during build. A prototype Quick Reaction Combat System/Ship Self-Defense System (SSDS) was installed and successfully demonstrated in *Whidbey Island* (LSD 41) in 1993, using Raytheon AN/SPS-49 long-range 2D air search radar, a prototype Spar AN/SAR-8 infra-red search and track device, and AN/SLQ-32 electronic warfare system as the sensors. The SLQ-32 also controlled the SRBOC chaff/infra-red launcher as the 'soft kill' element of the system, while the 'hard kill' elements were the ship's two Mk 15 Phalanx CIWS and the Mk 116 RAM surface-to-air missile. All elements were linked by an FDDI/Safenet fibre optic local area network through access units and supervised by two Hughes workstations. The SPS-49 gave early warning of threats and with the SLQ-32 provided track data which was supplemented by the SAR-8 and Phalanx radars. The operational system in LPD 17 will continue to use the FDDI-Safenet LAN and the advanced display, and will retain the SLQ-32 and Mk 36 SRBOC, the Phalanx and the RAM.

RADARS

	AN/SPS-48E	AN/SPS-67(V)3	AN/SPS-64(V)9	AN/SPQ-91
Manufacturer	ITT	Westinghouse Norden	Raytheon	Lockheed
Role	3D air search	Surface search	Navigation	Mk 86 FCS
Band	E/F	G (5.4-5.8 GHz)	I	I/J
Beam	1.5 × 1.6°	1.5 × 31°	1.9 × 22°	1.35 × 3°
Peak power	2,200 kW	280 kW	20 kW	1.2 kW
Gain	38.5 dB		28 dB	37 dB
Pulsewidth	3 µs	0.1; 0.25; 1.0 µs	0.06/0.5/1.0 µs	0.3-16 µs
PRF	1,250-2,000 pps		3,600/1,800/900 pps	3,000 pps
Scan rate	7.5/15 rpm		33 rpm	60 rpm

WEAPONS CONTROL

Mk 91 Mod 3 Fire-Control System (FCS)
The Mk 91 Mod 3 is a two-channel FCS for the NATO Sea Sparrow Missile System (NSSMS). Mk 91 is fully automatic from target acquisition to interception and in the Mod 3 version has two Mk 95 fire-control radar sets. Mk 91 FCS is a mainframe system using an NFT Mk 157 digital computer which performs all necessary calculations, stores data and is responsible for data distribution. The tracker-illuminator consists of a Mk 78 radar director with separate transmitting and receiving antennas, a director controller (Mk 106) and a low-light TV camera (Mk 6) with 2.4 × 2.4° and 10 × 10° fields of view. The radar is believed to operate in the I-band and directs the missile to fly a lead angle course to the intercept point, allowing Sea Sparrow-equipped ships to protect both themselves and other vessels in the immediate vicinity. Inboard equipment includes a Mk 73 continuous wave illuminator transmitter, a signal data processor (Mk 17), a signal data converter (Mk 80) and a director controller (Mk 106). There is a radar set console (Mk 83), with Bell Aerospace low-light television monitor and a firing officer's console (Mk 86). The Mod 3 system has two radar directors, two transmitter-receivers, two signal data processors and two radar consoles.

Using I-band frequencies enables the Mk 91 to detect sea-skimming missiles sooner than lower-frequency search radars and it can thus be fully autonomous, conducting search, detection and engagement automatically. It can also accept outside designations

from radar, EW or optic sources. Radar data from the director is then processed in the signal data processor to provide range and angle tracking data. This data is passed to the firing officer's console from where pre-launch data and firing commands are relayed to the Mk 29 trainable launcher and missile, which trains in azimuth to the intercept point and in superelevation to optimum angle to maximise missile kinetic energy. If the correct azimuth is blocked by the ship's superstructure, the launcher trains to the nearest clear azimuth and the missile is commanded to 'fly around the corner' to the direct path to the intercept. On launch, the missile flies a proportional navigation path (lead angle intercept) directly to intercept point in a lofted trajectory to maximise energy and minimise image effects.

Manufacturer/Contractor

Raytheon Company Equipment Division.

PROPULSION

Specifications

System: Diesel

Main machinery: 4 medium-speed, turbocharged marine diesels, 29.84 MW (40,000 hp)

Shafts: 2

Propellers: 2, fixed pitch

Ship's services: Five — 2,500 kW, marine diesel generator sets

FURTHER INFORMATION

PROGRAMME

The LPD 17 programme is very ambitious, intending to replace no fewer than four classes of amphibious vessel: the 'Austin' class LPD 4s; the 'Newport' class LST tank landing ships; the 'Anchorage' LSD 36s; and the 'Charleston' amphibious cargo ship LKAs. In practice, of course, it is not that clear cut. The Charlestons have already gone into reserve or 'reduced operational status'; while the 'Newport' class has been reduced to two full-time in-service ships, with a few more in semi-retirement and the majority already sold or leased to foreign navies. The cargo-carrying duties of the LKAs, plus some of the troop- and equipment-carrying duties of the 'Anchorage' class LSDs, will naturally fall to the 'Whidbey Island' LSDs and their cargo-carrying version, the 'Harpers Ferry' class (LSD-CV).

The LPD-17 class, which is planned to number 12 ships by 2008, is an important class of ship for the US Navy. Its arrival will complete the process begun many years ago, and pursued with haphazard decisiveness, of reducing to about a third the original number of amphibious ships, standardising the ship types, and restoring the amphibious capability of moving troops and equipment into hostile territory.

The programme passed Milestone 0 at the start of FY91 and the preliminary design work was completed in FY94. Award of the contract for the lead ship was issued in December 1996 and the ship, to be named *San Antonio*, is expected to enter service in 2004. Current estimates of costs are approximately US$640 billion for the lead ship, with the remaining eleven making up a programme worth many billions of dollars. Two groups of shipbuilders lined up to bid for the entire class but the winner was Avondale Industries of New Orleans, with team members General Dynamics/Bath Iron Works; General Motors/Hughes Aircraft; and Intergraph.

DESIGN

A significant feature of the LPD-17 is that it will carry a much heavier armament than has been customary in past amphibious warfare vessels. This is because it is expected to operate in an increasingly hostile littoral environment where it will need its own defences against air attack — and particularly from cruise missiles. Thus, it will have a substantial sensor suite, including AN/SPS-48E 3D air search radar, AN/SPQ-9B horizon search radar, and the AN/SPS-67(V)3, whose performance will be enhanced by the Ship Self-Defense System (SSDS) and the Co-operative Engagement Capability. Defensive weapons will include Evolved Sea Sparrow launched from a Mk 41 Vertical Launch System (VLS), two RAM launchers and three Mk 15 Vulcan Phalanx CIWS.

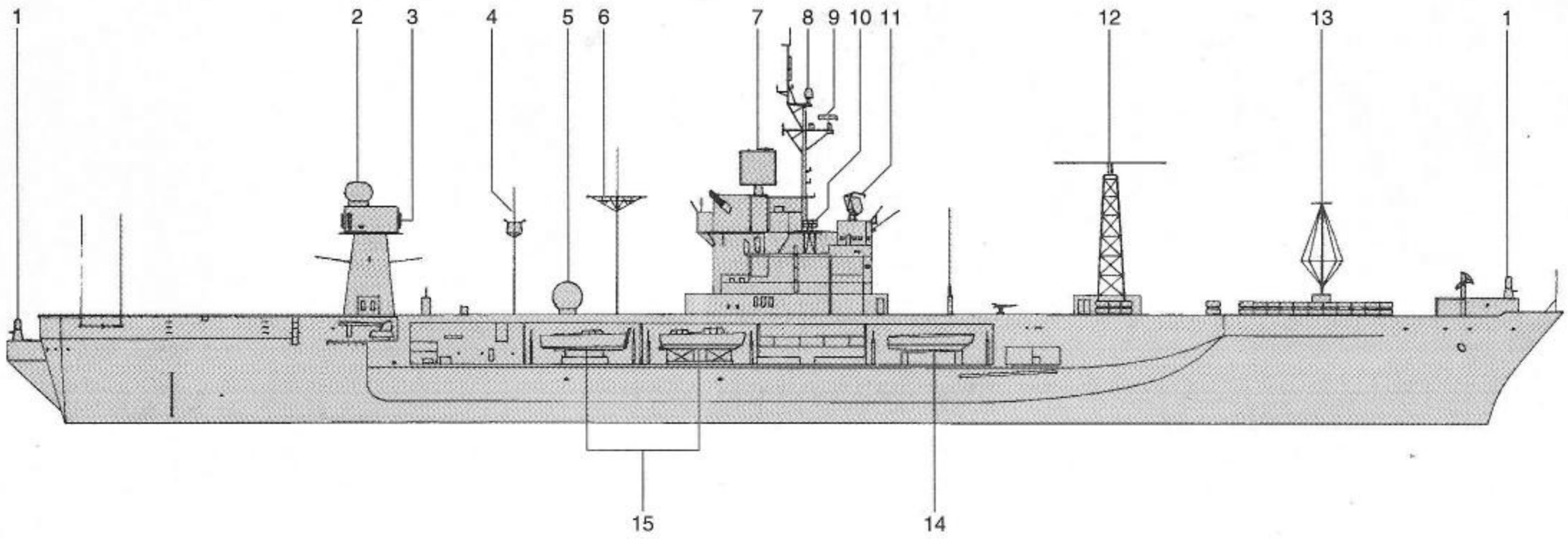
The hull and superstructure are made of steel, and all exposed surfaces are sloped and shaped to reduce the radar cross-section (RCS), while as many items as possible have been moved inside the superstructure or concealed, as far as is possible. Sharp corners have been smoothed, radar 'pockets' eliminated, masts raked, and infra-red hot spots cooled. The ship has also been designed with 'producibility' in mind, in order to simplify construction and reduce costs.

LPD-17 will not have all the attributes of the classes it is replacing. There is, for instance, no over-the-side lift capability, nor can the ship offload over a beach.

One of the features of the requirement is that it must be capable of passing through the Panama Canal.

A 'rough study sketch' of LPD 17 by Bath Iron Works (Bath Iron Works)

BLUE RIDGE



Blue Ridge (Ian Sturton)
1 *Hughes Mk 15 20 mm CIWS* **2** *Satellite antenna* **3** *Unidentified antenna array* **4** *Unidentified antenna arrays* **5** *Satellite antenna* **6** *Unidentified antenna array* **7** *ITT AN/SPS-48C air search radar* **8** *Satellite antenna* **9** *Hughes Mk 23 TAS radar* **10** *AN/SLQ-32(V)3 ESM/ECM antenna array* **11** *Lockheed AN/SPS-40C radar* **12** *Log periodic HF antenna* **13** *Discone antenna for NTDS* **14** *LCVP* **15** *LCPL*

GENERAL SPECIFICATIONS

Operator: USA
Type: Amphibious Command Ships (LCC)

Class: BLUE RIDGE

Built: 2
Active: 2

Displacement:
standard: *Blue Ridge* 17,059 t; *Mount Whitney* 16,357 t
full load: *Blue Ridge* 18,666 t; *Mount Whitney* 18,944 t

Dimensions
Length: 194 m (636.5 ft)
Beam: 32.9 m (107.9 ft)
Draught: 8.8 m (28.9 ft)

Speed: 23 kts
Range: 13,000 n miles at 16 kts

Complement: 821, including 43 officers, plus 170-190 flag staff

SHIPS

BLUE RIDGE (LCC 19)
Builder Philadelphia Naval Shipyard, Philadelphia, USA
Laid down 27 Feb 1967
Launched 4 Jan 1969
Commissioned 14 Nov 1970

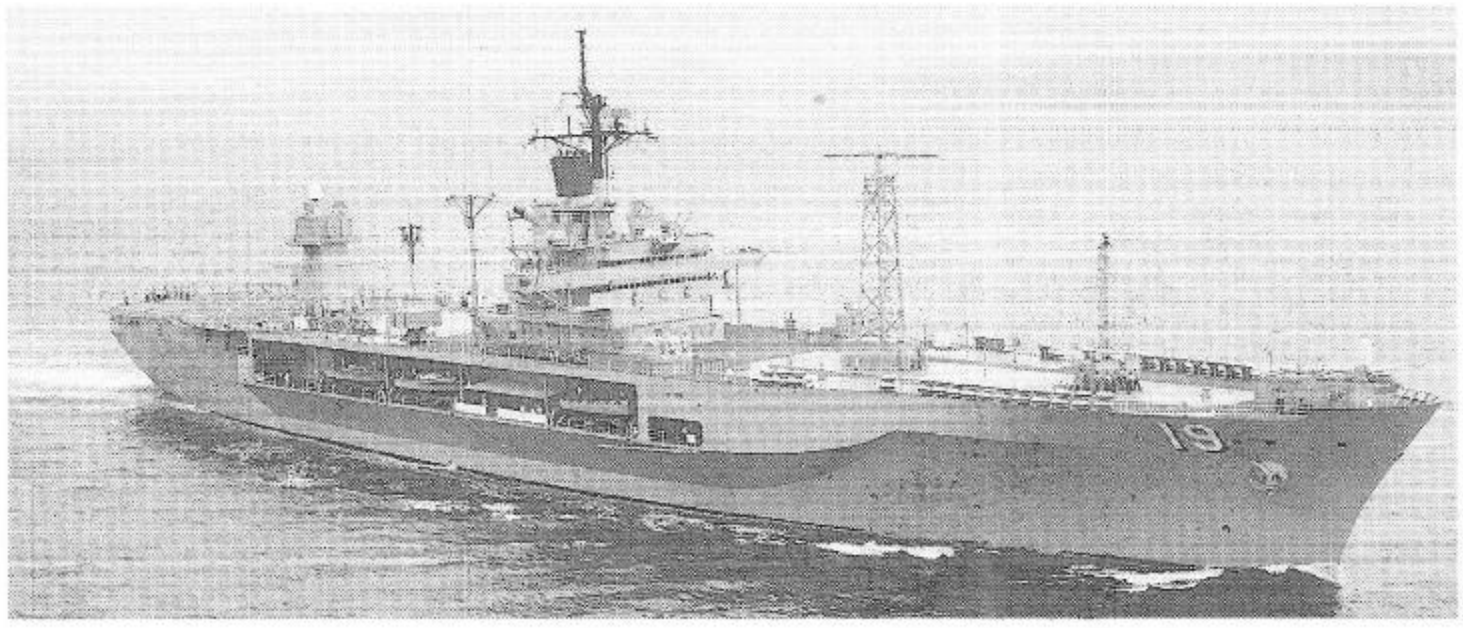
MOUNT WHITNEY (LCC 20)
Builder Newport News Shipbuilding, Newport News, USA
Laid down 8 Jan 1969
Launched 8 Jan 1970
Commissioned 16 Jan 1971

WEAPONS SYSTEMS

GUNS

Hughes Mk 15 CIWS Phalanx

Sole armament are two Mk 15 CIWS. This CIWS was developed to provide fast reaction to submarine-launched anti-ship missiles and operates on a 'closed loop' system, tracking both the target and the stream of rounds, and seeking constantly to reduce the difference between the two. The gun is a six-barrelled 20 mm M61A1 Vulcan with extremely high firing rates.



Specifications
Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire (Block 0): 3,000 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)

Mounting
Weight (Block 0): 5.42 t
Traverse: 310°
Elevation: −25 to +85°
Training speed: 126°/s
Elevation speed: 92°/s

Blue Ridge *(LCC19), flagship of Commander Seventh Fleet in 1992. Note that at this stage the armament included two Mk 15 CIWS (one is out of sight on the stern sponson), two twin 76 mm (3 in) forward of the bridge and two BPDMS launchers. The 76 mm guns and missile launcher have since been removed* (US Navy/Ensign J Hilton)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES/ ELECTRONIC COUNTERMEASURES (ESM/ECM)

AN/SLQ-32(V)3 intercept and jammer

The AN/SLQ-32(V)3 is a combined ESM and ECM system, the receive element giving radar warning on B to J-bands, while the countermeasures element gives jamming and deception on H to J-bands. The jammer has a maximum radiated power of 1 MW and is capable of forming 64 beams on either side of the ship, with jamming modes including range gate pull off (RGPO) and azimuth gate pull off (AGPO).

Manufacturer/Contractor
Raytheon, Electromagnetic System Division, Goleta, California, USA.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher

There are four Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) system consists of launcher, launcher control, power supplies, ready service lockers and munitions. The Mk 137 launcher has six 130 mm fixed tubes arranged in parallel rows at angles of 45 and 60° . The firing circuits use electromagnetic induction to initiate the propelling charges in the cartridges. The prime cartridge is the Mk 182 Torch with chaff payload.

Specifications

Launcher dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Launcher weight: 173 kg (381 lb)
Mk 182 cartridge dimensions: 1,209 × 130 mm (47.6 × 5 in)
Cartridge weight: 22.7 kg (50 lb)

Blue Ridge *(LCC19) in 1993, with both 76 mm (3 in) guns and BPDMS launchers removed*

AN/SLQ-25 Nixie torpedo decoy

AN/SLQ-25 Nixie is a solid-state, modular design, electroacoustic, countermeasures decoy system used to protect the ship from acoustic homing torpedoes. It consists of a remote-control unit which activates, deactivates and monitors (through an oscilloscope) the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming and recovering the towed bodies (which are stored on racks attached to the winch), a coaxial switching unit which selects the appropriate cable or load, and towed bodies. The towed body converts the electrical signals to acoustic signals and projects them.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Navy Tactical Data System (NTDS)
Amphibious Command Information System (ACIS)
Naval Intelligence Processing System (NIPS)

COMMUNICATIONS AND DATALINKS

Datalinks:
Link 4A, Link 11, Link 14, Link 16
JMCIS
Satcom:
SSR-1, WSC-3, WSC-6, USC-38, SMQ-6 receiver

TACAN
URN 25

IFF
Mk XII AIMS
AN/UPX-29

RADARS (Note 1)

	AN/SPS-48C	AN-SPS-40E	Mk 23 TAS (Note 3)	AN/SPS-65(V)1	LN-66	AN/SPS-64(V)9
Manufacturer	ITT	Lockheed	Hughes	Raytheon	Canadian-Marconi	Raytheon
Role	3D air search	2D air search	Target acquisition	Surface search	Navigation	Navigation
Band	E/F	UHF (400-450 MHz in 10 channels)	D (1-2 GHz)	G (1,215-1,365 MHz)	I-band (9,375 MHz ±30 MHz)	I (9,375 MHz ±25 MHz)
Beam	1.5 × 1.6°	10 × 19°		6 × 16°		1.9 × 22° (Note 2)
Peak power	2,200 kW	225 kW	200 kW	12 kW	12 kW	50 kW
Gain	38.5 dB	21 dB		23 dB		28 dB
Pulsewidth	3 µs	3 µs		7 µs	0.5/0.9 µs	0.06, 0.5, 1 µs
PRF	1,250-2,000 pps	300 pps		2,315/3,064 pps	800/1,250/2,500 pps	3,600, 1,800, 900 pps
Scan rate	7.5/15 rpm	7.5/15 rpm		20 rpm	22 rpm ±10%	33 rpm

Notes
1. There are also two Mk 51 radars for the Sea Sparrow fire-control system. These remain installed even though the missile launchers have been disembarked.
2. Depends on antenna
3. TAS = Target Acquisition System

AVIATION

Specifications

Flight deck: There is a large flight deck at the stern
Hangar: There is no hangar (and thus no maintenance capability), but there are refuelling facilities

Helicopters: 2 light /utility liaison/transport helicopters can be embarked, but normally there is only 1

PROPULSION

Specifications

System: Steam
Main machinery: 2 Foster Wheeler boilers, 42.3 kg/cm² (600 psi); 467°C; 1 General Electric steam-turbine; 16.4 MW (22,000 hp)
Shaft: 1

FURTHER INFORMATION

PROGRAMME

These two ships were designed to provide command facilities for the amphibious elements of the Atlantic and Pacific Fleets, with the space, communications and facilities required for the naval, marine and air commanders and their staffs, a total of 200 officers and 500 enlisted men in addition to the ship's crew.

It was originally intended that there would be six of these ships, and there was another plan to build a third as a combined fleet and amphibious command ship. In the event, only two were built, and the extra command facilities offered by other ships, such as the 'Tarawa' class LHAs has proved an adequate substitute.

DESIGN

The start point for the design was the 'Iwo Jima' class LPH, but this was very considerably modified to meet the new role. The hull is 8.5 m (27.9 ft) longer than the 'Iwo Jima' class and the space previously occupied by the hangar was converted to house command centres, offices and extra accommodation, as well as the considerable extra communications and electronic facilities. Two large sponsons were added on either side of the ship to house the ship's boats and two LCPLs. The upper deck is given over almost entirely to communications arrays of various types, a wide, but somewhat short superstructure, and a helicopter flight deck aft.

The ships' role is dependent almost completely on good communications and the upper deck is largely devoted to an 'antenna farm', with a host of different arrays. The communications arrays are changed frequently, reflecting new requirements or replacement systems coming into service.

DESIGNATION

These ships were originally designated Amphibious Force Flagships (AGC), but were redesignated Amphibious Command Ships (LCC) on 1 Jan 1969.

MODERNISATION

Both ships were modernised in 1987. The work included removing the two twin 76 mm (3 in) gun mountings (there was no associated gun fire-control system to be removed). The launchers for the Sea Sparrow missile system (which had been added in 1974) were disembarked, although the onboard mountings have been retained and the launchers could be refitted, if required; the associated Mk 115 MFCS remains installed, although unused. The Mk 23 TAS radar was fitted after the modernisation.

DEPLOYMENT

Blue Ridge (LCC 19) is the Seventh Fleet flagship based at Yokosuka, Japan. *Mount Whitney* (LCC 20) is the flagship of the Second Fleet, based at Norfolk, Virginia. *Blue Ridge* is one of only two amphibious ships in the US Navy, the other is the 'Tarawa' class ship *Saipan*, to have its own Internet site.

Mount Whitney *(LCC20) in October 1996. The log periodic antenna has been removed from the lattice tower on the foredeck, there are some unusual twin domes on the bridge roof, there is a new 'light bulb shaped' radome atop the after tower. The latter appears very similar to the Signaal satellite radomes now found on many Dutch frigates* (H & L van Ginderen Collection)

Mount Whitney *(LCC20) in July 1994. There is an SH-3 Sea King on the flight deck; the ship offers landing and refuelling facility but has no hangar* (US Navy/PH2 J Sokolowski)

MINOR US LANDING CRAFT

LCU 2000

(LCU = Landing Craft, Utility)

GENERAL SPECIFICATIONS

Built: 35
Active: 14
Reserve: 12
Prepositioned: 8
Training: 1

Displacement:
full load: 1,102 t

Dimensions
Length: 53 m (173.8 ft)
Beam: 12.8 m (42 ft)
Draught: 2.6 m (8.5 ft)

Speed: 11.5 kts
Range: 4,500 n miles at 11.5 kts

Complement: 13 including two officers

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 350 tonnes

COMMAND AND CONTROL SYSTEMS

RADARS

2 Raytheon SPS-64; I-Band

PROPULSION

Specifications
2 Cummins KTA50-M diesels, 1.87 MW sustained, 2 shafts; bow thruster

FURTHER INFORMATION

These US Army large landing craft were the first to be built to an army specification. Lockheed won the order for 25, with an option on a further 15, on 11 June 1986; in the event only 35 were built, with the first completed by Moss Point Marine in February 1990. Of the 35 built, 14 are active, 12 are in reserve, eight are prepositioned and one is used for training.

LCV 2006 of the US Army (Giorgio Arra)

LCU 1600

(LCU = Landing Craft, Utility)

GENERAL SPECIFICATIONS

Built: 67
Active: 51 (US Navy — 38; US Army — 13)

Displacement:
full load: 375 (437 t LCU 1680, 1681)

Dimensions
Length: 41.1 m (134.9 ft)
Beam: 8.8 m (29 ft)
Draught: 1.9 m (6.1 ft)

Speed: 11 kts

Range: 1,200 n miles at 8 kts

Complement: 14 including two officers

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 170 tonnes, three M48 tanks (each 48 t) or 350 troops

WEAPONS SYSTEMS

2 20 mm Oerlikon or two 12.7 mm MG (not normally embarked)

COMMAND AND CONTROL SYSTEMS

RADARS

LN-66 or AN/SPS-53; I-Band

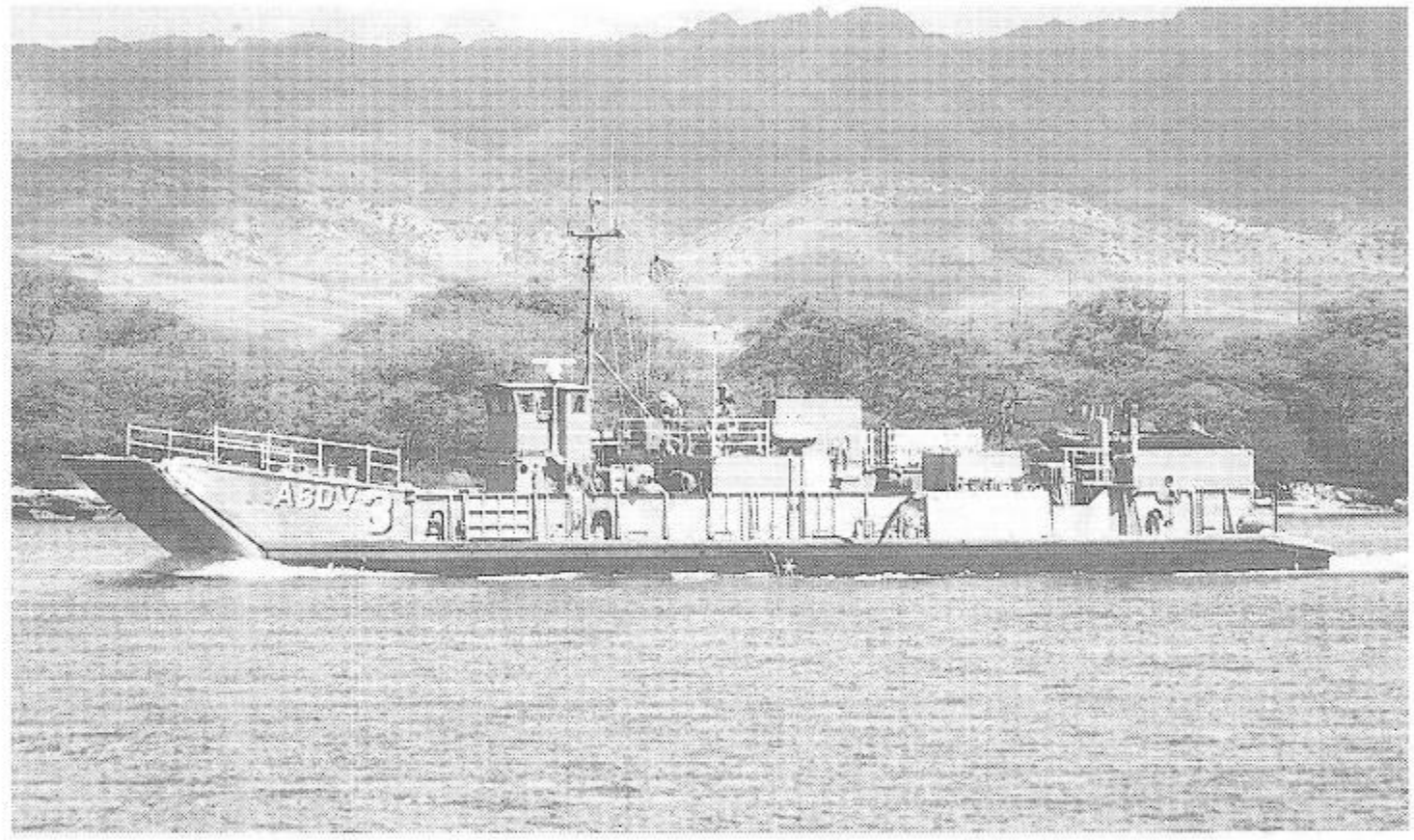
PROPULSION

Specifications
4 detroit 6-71 diesels, 519 kW sustained
Shafts: 2
Nozzles: 2 Kort

FURTHER INFORMATION

These LCUs have a small superstructure on the starboard side, enabling the tank deck to have a drive-through capability over the bow and stern ramps. Two of these LCUs may be embarked aboard 'Tarawa' class LHAs.

67 were built between the mid-1960s and the mid-1980s, and production is complete. Some have been converted for other uses by the US Navy, and a small number has been supplied to foreign navies, including two to Bangladesh. Very similar designs have been built in Germany as the Type 520, of which a number have recently been sold to Greece. Another similar craft has been built in South Korea as the 'Furseal' class.



ASDV-3, a version of the LCU 1600 used by the US Navy and US Army (H & L van Ginderen Collection)

LCM 8

(LCM = Landing Craft, Medium)

GENERAL SPECIFICATIONS

Built: 216
Active: 216 (US Navy — 91; US Army — 125)

Displacement:
full load: 105 t (aluminium version); 60 t (steel version)

Dimensions
Length: 22.5 m (73.7 ft)
Beam: 6.4 m (21 ft)
Draught: 1.6 m (5.2 ft)

Speed: 12 kts
Range: 190 n miles at 9 kts (full load)

Complement: 5

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 180 tonnes, 1 M48 tank (48 t) or **1** M 60 tank (60 t) or 200 troops

PROPULSION

Specifications
2 Detroit 6-71 diesels, 260 kW sustained
Shafts: 2

FURTHER INFORMATION

LCMs are normally embarked aboard LHDs, LHAs, LPDs. LCM 8 Mod 1 is the steel version; LCM 8 Mod 2 is the aluminium version.

LCM 6

(LCM = Landing Craft, Medium)

GENERAL SPECIFICATIONS

Built:
Active: 55

Displacement:
full load: 64 t

Dimensions
Length: 17.1 m (56.2 ft)
Beam: 4.3 m (14 ft)
Draught: 1.2 m (3.9 ft)

Speed: 9 kts
Range: 130 n miles at 9 kts (full load)

Complement: 5

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 34 tonnes, 80 troops

PROPULSION

Specifications
2 Detroit 6-71 diesels, 260 kW (348 hp) or 2 Detroit 8V-71 diesels, 344 kW (460 hp)
Shafts: 2

FURTHER INFORMATION

LCMs are normally embarked aboard LHDs, LHAs, LPDs. Numbers reducing as the type is superceded by LCM 8.

LVT 7

(LVT = Landing Vehicle, Tracked)

GENERAL SPECIFICATIONS

Built:
Active: 55

Displacement:
full load: 64 t

Dimensions
Length: 7.5 m (24.6 ft)
Beam: 3.27 m (10.73 ft)
Draught: 1.72 m (5.66 ft)

Speed in water:
waterjets: 13.5 km/h
tracks: 7.2 km/h
Endurance in water: 7 hours at 2,600 rpm
Crew: 3

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 25 troops or 4,500 kg (10,000 lb) cargo

WEAPONS SYSTEMS

1 12.7 mm M85 machinegun

PROPULSION

Specifications
2 Detroit 8V53T diesels, 400 hp at 2,800 rpm or 2 Cummins VT 400 8-cylinder, water-cooled, supercharged diesel, 400 hp at 2,800 rpm
Drive: 2 waterjets or 2 tracks

LVTP-7 (USMC)

FURTHER INFORMATION

The LVT-7 is a tracked landing vehicle, operated by the US Marine Corps. The vehicle is fully amphibious without any preparation and can operate in rough seas and land through surf up to 3 m (10 ft) high. It is loaded and unloaded through the large stern door, which has a bottom hinge and incorporates a ramp. Various versions are in service including: LVTP-7 — troop carrier; LVTC-7 — command post; LVTR-7 — recovery. It should be noted that while these vehicles resemble army armoured personnel carriers (APC) in appearance, they are unarmoured; thus, while their tracks enable them to be used on land, they are landing craft which can climb onto the beach, as opposed to APCs than can swim.

These highly effective vehicles are carried by various types of amphibious warfare ships, including: 'Tarawa' class — 45; 'Austin' class — 20; 'Whidbey island' — 60; 'Anchorage' — 50.

LCAC/MCAC

(LCAC = Landing Craft Air Cushion/MCAC = Minesweeping Craft Air Cushion)

GENERAL SPECIFICATIONS

Built: 91
Active: 91

Displacement:
light: 88.5 t
full load: 184.0 t

Dimensions
Length:
on cushion: 26.8 m (87.93 ft) oa
between hard structures: 24.7 m (81.0 ft)
Beam:
on cushion: 14.3 m (46.91 ft)
hard structure: 13.1 m (42.98 ft)
draft off cushion: 0.9 m (2.95)

Speed: 40 kts
Range: 300 n miles at 35 kts; 200 n miles at 40 kts

Complement: 5

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 1 main battle tank plus 24 troops
- or, in transport version — 180 troops
- cargo capacity 60-75 tonnes; 168.1 sq m (1,809 sq ft)

RAMPS, DECKS

- Bow ramp 8.74 m (28.7 ft)
- Stern ramp 4.57 m (15ft)

PROPULSION

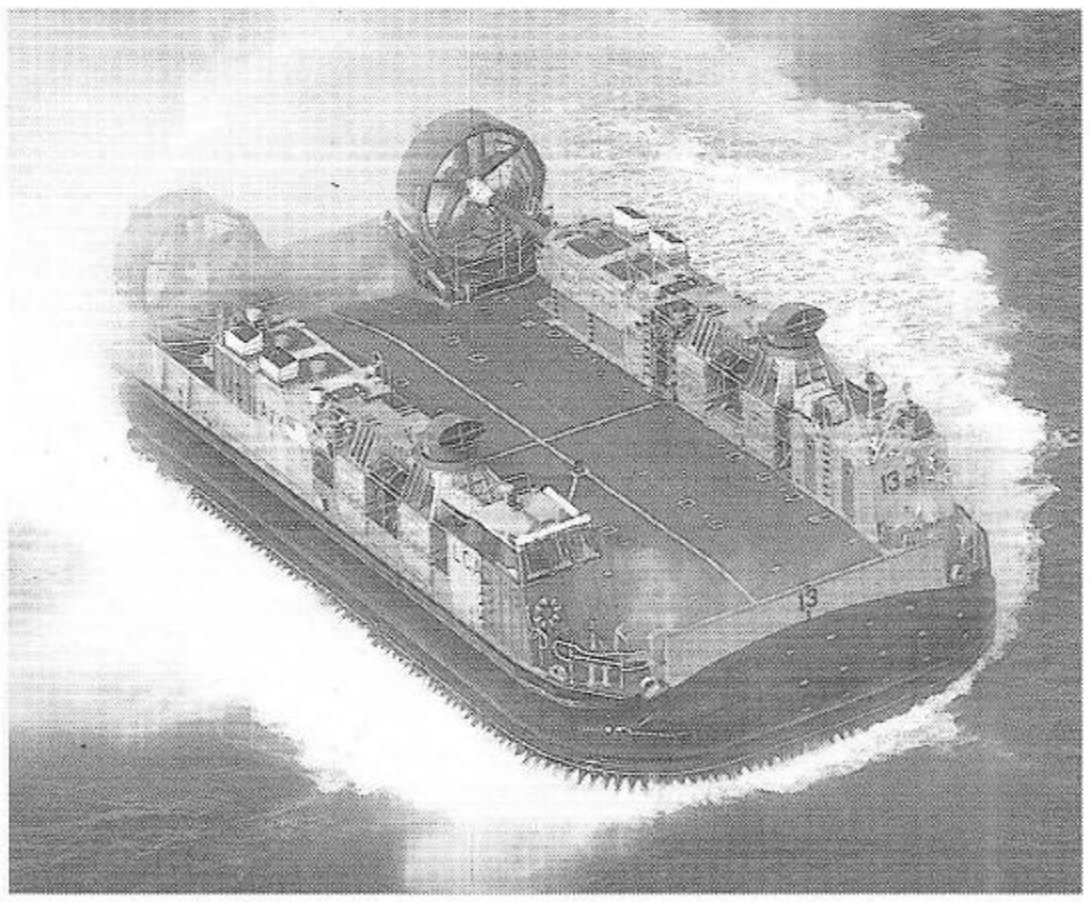
4 Avco-Lycoming TF-40B gas turbines, 2 for propulsion and 2 for lift, 12 MW (16,000 hp) sustained; 2 shrouded reversible pitch airscrews; 4 double entry fans, centrifugal or mixed flow (lift)

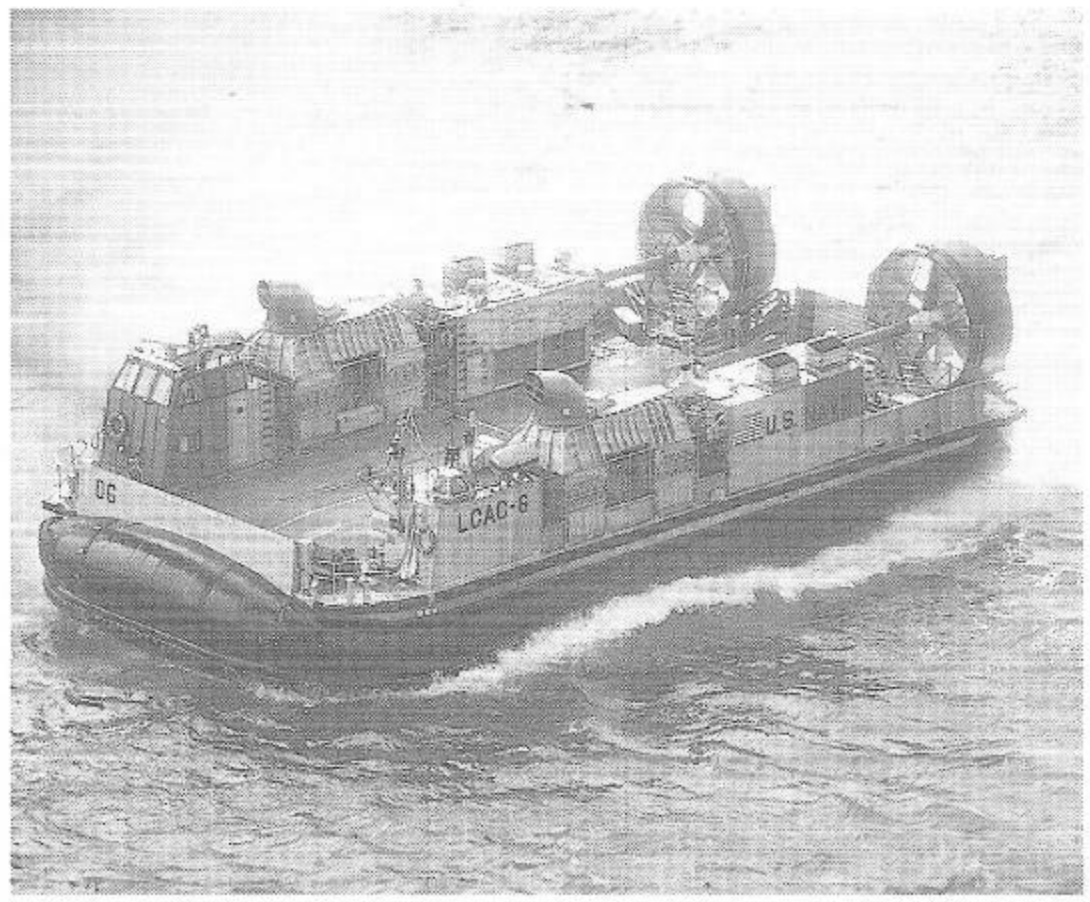
FURTHER INFORMATION

91 LCACs were built by Textron Marine Systems and Avonvale Gulfport between 1983 and 1993. They can be carried on Tarawa (one), Wasp (three), Anchorage (four), Austin (two), Whidbey Island (four) and Harpers Ferry (two) ships. Eight minesweeping kits were acquired in 1994/95 with the intention of converting some to MCAC. US Marine Corps says the craft can cross 70 per cent of the world's coastlines, compared to 15 per cent for conventional landing craft.

Their performance and reliability have exceeded expectations. The craft have been used in the Gulf War and in numerous relief/rescue operations.

Two have been sold to Japan.





LCAC (H & L van Ginderen Collection)

FRANK S BESSON

OVERVIEW

The US Army obtained approval for the first of these ro-ro logistic support vessels in FY85 budget, and the second in FY87, while the other four have been paid for from Army reserve funds. They are of traditional LST size and design, except that they have a flat bow ramp rather than clamshell doors. They are built to commercial standards and use reconditioned General Motors diesel engines.

They have 975 m² (10,500 sq ft) of deck space and can beach with 1.2 m (4 ft) of water over the ramp on a 1:30 gradient with a payload of 900 tonnes of cargo.

The US Army ships have a stern ramp, but the two ships built later for the Philippines do not, the after end of the ship being used to accommodate 150 troops and to support a raised platform for light helicopters.

BACOLOD CITY (FRANK S BESSON)

GENERAL SPECIFICATIONS

Operator: USA

Class: BACOLOD CITY
Type: Frank S Besson (LSV-Army)

Displacement:
light: 1,700 t
full load: 4,333 t

Dimensions
Length: 83.1 m (272.8 ft)
Beam: 18.3 m (60 ft)

Draught: 3.7 m (12 ft)
Endurance: 38 days

Speed: 11.6 kts
Range: 6,000 n miles at 11 kts

Complement: 30, including six officers

SHIPS

Frank S Besson (USA)
GENERAL FRANK S BESSON JR (LSV 1)
Builder Moss Point Marine, Escatawpa, Mississippi, USA
Launched 30 Jun 1987
Completed 18 Dec 1987

CW 3 HAROLD C CLINGER (LSV 2)
Builder Moss Point Marine, Escatawpa, Mississippi, USA
Launched 18 Sep 1987
Completed 20 Feb 1988

GENERAL BREHON B SOMERVELL (LSV 3)
Builder Moss Point Marine, Escatawpa, Mississippi, USA
Launched 18 Nov 1987
Completed 2 Apr 1988

LIEUTENANT GENERAL WILLIAM B BUNKER (LSV 4)
Builder Moss Point Marine, Escatawpa, Mississippi, USA
Launched 11 Jan 1988
Completed 18 May 1988

MAJOR GENERAL CHARLES P GROSS (LSV 5)
Builder Moss Point Marine, Escatawpa, Mississippi, USA
Launched 11 Jul 1990
Completed 30 Apr 1991

SPECIALIST 4 JAMES A LOUX (LSV 6)
Builder Moss Point Marine, Escatawpa, Mississippi, USA
Launched 7 Apr 1994
Completed 16 Dec 1994

Bacolod City (Philippines)
BACOLOD CITY (LC 550)
Builder Trinity Marine – Moss Point Marine, Escatawpa, Mississippi, USA
Commissioned 1 Dec 1993

DAGUPAN CITY (LC 551)
Builder Trinity Marine – Moss Point Marine, Escatawpa, Mississippi, USA
Commissioned 5 Apr 1994 as Cagayan De Oro City

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- 2,280 tonnes of vehicles, including 26 M1 Abrams tanks, containers or general cargo

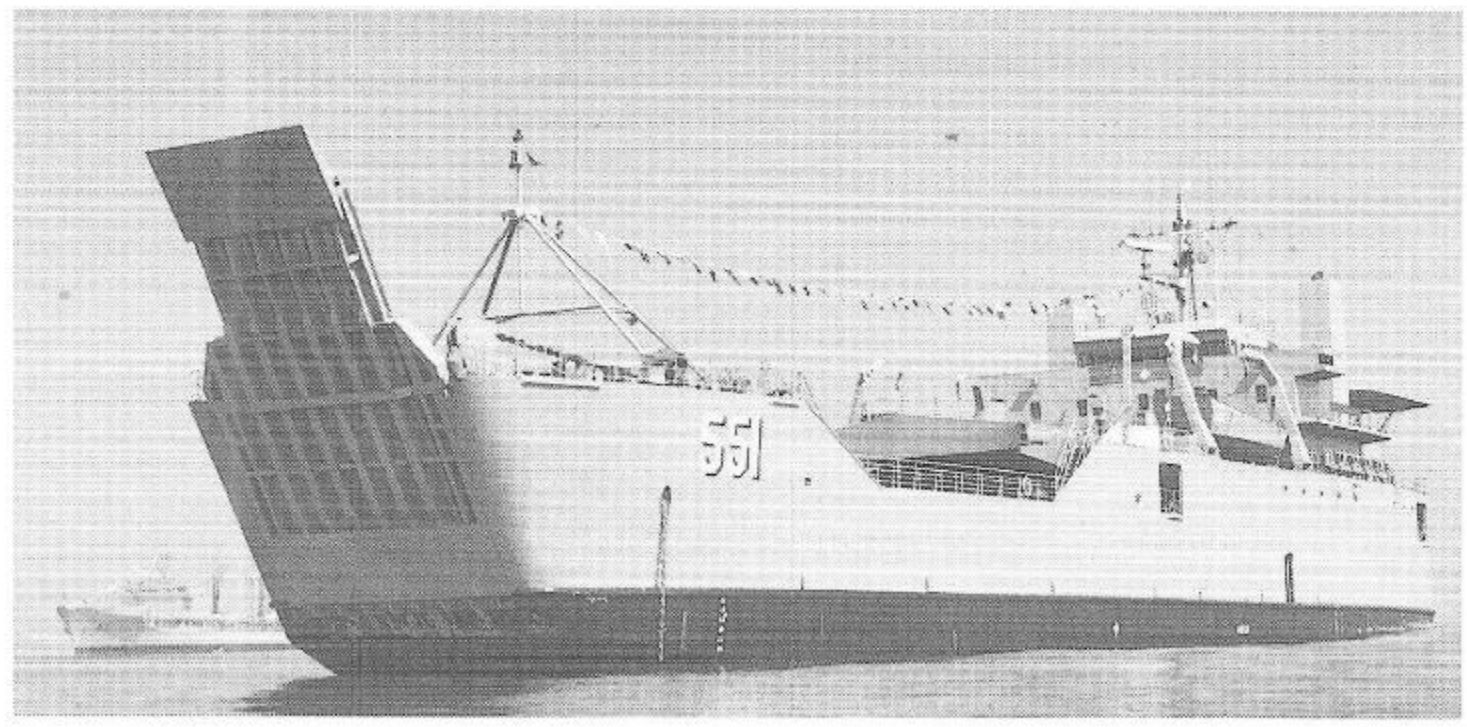
AVIATION FACILITIES

Bacolod City (Philippines) only

Specifications
Flight deck: There is a raised platform on the stern
Hangar: None
Helicopter: 1 light helicopter

AMPHIBIOUS FACILITIES

- Bow ramp, 8.23 m (27.0 ft) wide
- **Frank S Besson (USA) only.** Stern ramp, 8.23 m (27.0 ft) wide
- 975 m² (10,500 sq ft) deck space



Philippine Navy landing ship Dagupan City *(LC 551). The Philippines purchased two of these ships (which are both the largest and newest in the Navy). Note the flight deck aft*

COMMAND AND CONTROL SYSTEMS

RADARS

AN/SPS-64(V)2
There are two AN/SPS-64(V)2 radars, used for navigation and surface surveillance.

Specifications
Frequency: I-band (9,375 ±25 MHz)
Peak power: 10, 25 and 50 kW
Wavelength: 3 cm
Range: 18.3 m-118.5 km
Pulsewidth: 0.06, 0.5, 1 µs
PRF: 3,600, 1,800, 900 pps
Receiver bandwidth: 24, 4, 4 MHz
Receiver IF: 45 MHz
Video Amp bandwidth: 20 MHz
Receiver noise: 10 dB max

Manufacturer/Contractor
Raytheon Marine Company, Hudson, New Hampshire.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors EMD 16-645E2 diesels, 2.9 MW (3,900 hp)

Shafts: 2
Bow thruster: 1 Schottel 250 hp unit.

FURTHER INFORMATION

Frank S Besson (USA) only
Three are based at Fort Eustis in Virginia, two in Hawaii, and *General Brehon B Somervell* (LSV 3) is with the National Guard at Tacoma, Washington.

These ships are unarmed.

Bacolod City (Philippines) only
The contract for these vessels was announced by Trinity Marine on 3 April 1992, with an option on a third vessel.

It should be noted that these ships have several differences compared to the US Army ships, principally in the replacement of the stern exit and ramp by additional accommodation for 150 troops, and a helicopter platform. As with the US Army ships, they are unarmed.

Major General Charles P Gross *(LSV 5) one of six 'Besson' class landing ships operated by the US Army. These ro-ro vessels can carry 26 M1 Abrams main battle tanks and can beach with a payload of 900 tonnes* (H & L van Ginderen Collection)

Major General Charles P Gross *(LSV 5). Note the large stern ramp and kedge anchor*

SILBA

OVERVIEW

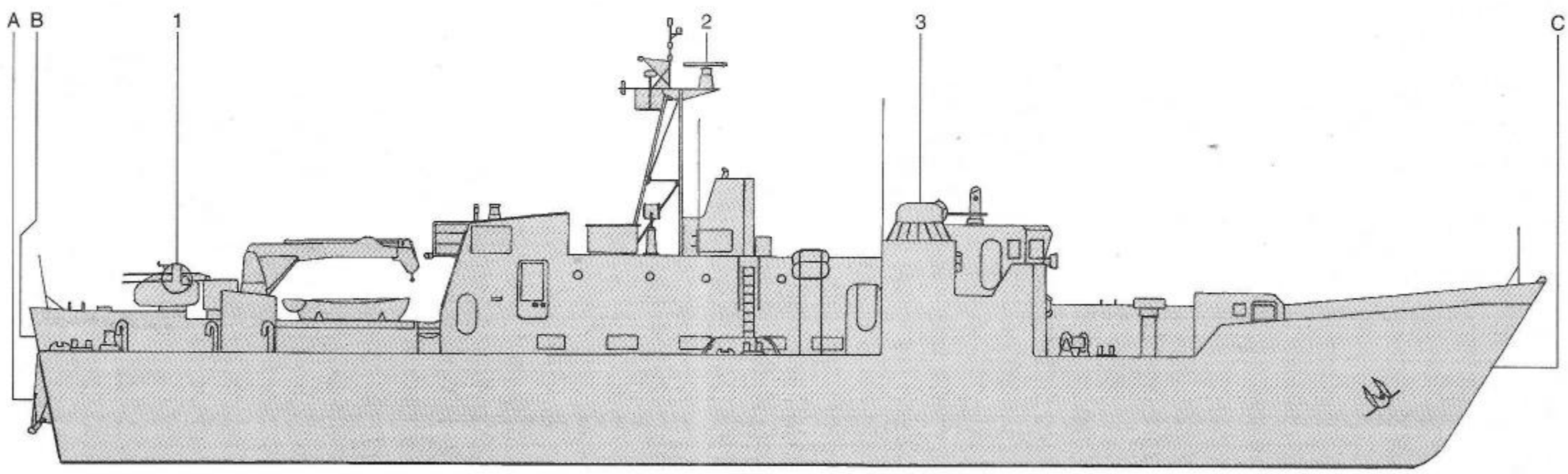
Three 'Silba' class landing craft were produced for the navy of the Yugoslavian Republic, but with the break-up of that state one is now operated by the present Yugoslav Navy of Serbia and Montenegro, while the other two are operated by the Croatian Navy, in whose country the shipyard now is. The Silba is a roll-on roll-off design with ramps at both bow and stern, and is used as both a landing craft and a minelayer. As far as can be ascertained, this is an original Yugoslav design and was not, as was the case in a number of other ships, a modification of a Russian design. As the three ships are identical, they are covered in one entry below.

Cetina *(81), one of the two 'Silba' class landing craft/minelayers now operated by the Croatian Navy* (Tim Ripley)

Cetina *(81)*

Silba *(DBM 241), the only one of three ships to be operated by the new Yugoslav Navy. Note the long stern ramp and kedge anchor* (Yugoslav Navy)

SILBA



'Silba' class (Croatia/Yugoslavia) (Ian Sturton)
Amphibious A *Kedge anchor* **B** *Stern ramp* **C** *Bow ramp*

General 1 *M75 quad 20 mm mount* **2** *Racal-Decca navigation radar* **3** *AK-230 twin 30 mm cannon (two)*

GENERAL SPECIFICATIONS

Country of Origin: Yugoslavia
Operators: Yugoslavia (Serbia and Montenegro)
Croatia

Class: Silba (LCT/ML)

Built: 3

Active:
Croatia: 2
Yugoslavia: 1
Displacement:
full load: 880 t

Dimensions
Length: 49.7 m (163.1 ft) (oa); 43.9 m (144 ft) (wl)
Beam: 10.2 m (33.5 ft)
Draught: 2.6 m (8.5 ft)

Speed: 12 kts
Range: 1,200 n miles at 12 kts

Complement: 33, including three officers

SHIPS

Croatia

CETINA (81)
Builder Brodosplit, Split, Yugoslavia (now in Croatia)
Launched 18 Jul 1992
Commissioned 19 Feb 1993

KRKA (82)
Builder Brodosplit, Split, Yugoslavia (now in Croatia)
Launched 17 Sep 1994
Commissioned 1996

Yugoslavia

SILBA (DBM 241)
Builder Brodosplit, Split, Yugoslavia (now in Croatia)
Commissioned 1990

AMPHIBIOUS CAPABILITIES

MILITARY LIFT

- Troops: 300 with equipment
- Medium tanks: 6
- Armoured personnel carriers: 7
- 130 mm guns plus towing vehicles: 4
- Cargo: 460 tonnes

AMPHIBIOUS FACILITIES

- Bow and stern ramps

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 'Grail' (Strela-2M)

There is one, four-missile launcher for the SA-N-5 short-range SAM system. SA-N-5 is the NATO designation for the Russian Strela-2M (Strela = arrow), which is the naval version of the very widely used Strela-2 (NATO = SA-7 Grail) land-based, shoulder-launched short-range missile system. In the naval version, four missiles are mounted on a metal framework, with the operator standing inside the framework, leaning back into a lumbar pad, with the missiles at shoulder level, as in the land-based system.

When the target is acquired the operator selects a missile and then activates the thermal battery. When the seeker acquires the target the operator receives an audio signal and he partially pulls the trigger to activate the missile gyros, which are tame some four to six seconds to warm up. The operator uses stadia reference marks in his optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile. The booster burns for 0.05 seconds, ejecting the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spinning it up. Then, at a distance of 6 m (20 ft), the sustainer ignites and the trailing fins pop out.

The missile has four small fins of cruciform configuration and two pop-out trailing fins behind the exhaust. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M (SA-7B 'Grail' Mod 1) the seeker has a filter for improved performance and the warhead has better fragmentation uniformity.

Specifications

Strela 2
Length: 1.45 m (4.76 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (21.98 lb)
Speed: Mach 1.7
Range: 5.5 km (2.6 n miles)
Altitude: 18-4,500 m (60-15,000 ft)
Guidance: IR homing

Manufacturer/Contractor

Fakel.

GUNS

30 mm/65 AK-230

Four 30 mm/65 AK 230 in two twin mounting. AK-230 is a twin barrelled, fully automatic, water-cooled weapon, with a 2,000 round magazine beneath the pedestal. The AK-230 is designed to engage air targets at heights of up to 4,000 m, and is is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km).

Specifications

Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s
Traverse: 360 at 70/s
Elevation: −12 to +87 at 50/s
Crew: 2 (off mount)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (AA)
Rate of fire: 1,000 rds/min (per gun)
Ammunition: 0.54 kg (HE)

20 mm M75

Four 20 mm M75 guns in one quad mounting. After the Second World War Yugoslavia developed its own version of the Hispano-Suiza HS 804 20 mm cannon as the M55 at Crvena Vastava, Kragujevac. In addition to adapting the weapon to Yugoslav industrial capabilities the M55 featured a new muzzle brake and in addition to land-based towed weapons, three naval versions were also produced. The single-barrel mounting is the M71, the quad version is M75 and there is also a triple-barrel version whose designation is unknown.

Specifications

M55 Gun
Calibre: 20 mm
Length of barrel: 80 calibres
Muzzle velocity: 840-850 m/s
Range:
anti-surface: 1.5 km
anti-air: 1,500 m
Rate of fire: 700 rds/m
Round weight: 241 g
Projectile: 122 g

M75 mounting
Elevation: −10 to +85
Weight: 1,900 kg (loaded)

128 mm illuminant launchers

There are two 128 mm illuminant launchers. The model cannot be identified, although the Croatian Navy has certainly operated Bofors 57 mm rocket system on other ships, where it is used primarily as an illuminant and chaff launcher.

MINES

Type SAG-1

94 are carried and are laid over the stern.

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca

There is one Racal-Decca, I-band navigation radar; model unknown.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Burmeister & Wain Alpha 10V23L-VO diesels, 2.28 MW (3,100 hp) sustained
Shafts: 2
Propellers: Controllable pitch

FURTHER INFORMATION

The Croatian vessesl are based at Split and the Yugoslav vessel at Tivat.

MINELAYERS

MINELAYERS

INTRODUCTION

The sea-mine is a very potent weapon; it is easy to manufacture, the technology is widely available; and it can be laid in a wide variety of ways: by submarines and aircraft, by surface warships, by converted merchant ships and by specialist minelayers. Mines have both strategic and tactical roles, and can be used to deny waters to hostile naval forces, such as through 'choke points' as well as to defend important targets such as harbours, anchorages and offshore facilities. Finally, the sea-mine can have an effect out of all proportion to its cost and complexity.

Many modern warships, especially those designed and built in Russia and China have a limited minelaying capability built in. The 'Udaloy' class, for example, has two rails with a capacity of 30 mines, while Chinese 'Jianghu' class frigates can carry up to 60. Merchant ships can also be given simple conversions to enable them to serve as minelayers, modern Ro-Ro ferries, with their cavernous holds and stern ramps being particularly suitable for such a role. The UK, for example, has paid for a number of British-owned and -registered civilian Ro-Ro ferries to have the necessary fittings installed during construction.

A few nations, however, have developed specialist minelayers, although, since in modern conditions minelaying could probably only take place at the very start of a conflict, most have a secondary role to perform once they have completed their primary missions.

As the majority of minelayers are dual-purpose ships, the problem of where to place them in this book arises. It has, therefore, been decided to place allpurpose-built minelayers in this section, with the exception of five Turkish ships, which are predominantly LSTs with a subsidiary role of minelaying *(Cakabey, Sarucabey, Karamürselbey, Bayraktar* and *Sancaktar)*, and the minelayer version of the Danish 'Flyvefisken' class.

TABLE 1: MINELAYERS IN SERVICE - 1997

Country	Class Name	Number in service	Displacement	Entered service	Mines (see Note)	Secondary Role
China	Beleijan	1	3,100 t	1988	300	—
Denmark	Falster	4	1,910 t	1963-64	400	Training
Finland	Pohjanmaa	1	1,100 t	1979	120	Training
	Häneenmaa	2	1,300 t	1992	150	Transport, support
	Pansio	3	450 t	1991-92	50	Transport, support
Greece	Aktion	2	1,100 t	1953	130	—
Iran	Iran Ajr	2	2,310 t	1980	50	Transport
Japan	Hayase	1	2,000 t	1971	116	—
	Souya	1	3,300 t	1971	460	—
Korea South	?	1	3,300 t	1998	400	—
Norway	Vidar	2	1,673 t	1977-78	400	Transport, ASW escort, offshore patrol, torpedo recovery
Romania	Cosar	2	1,450 t	1980-81	200	MCMV command and support
Russia	Alesha	2	3,860 t	1967-76	400	Command, netlayer, MCM support
Sweden	Älvsborg	1	2,650 t	1976	300	Command ship
	Carlskrona	1	3,550 t	1982	105	Training, torpedo target
Turkey	Mersin	1	1,100 t	1952	400	—
	Bayraktar	2	4,080 t	1945		Primary LST
	Sarucabey	2	2,600 t	1984-1987	150	Primary LST
	Cakabey	1	1,600 t	1983	150	Primary LST

Note: This is the estimated maximum figure and would vary markedly with the type and size of mines carried.

BELEIJAN

GENERAL SPECIFICATIONS

Operator: China, People's Republic
Type: Minelayer

Class: BELEIJAN

Built: 1
Active: 1

Displacement:
full load: 3,100 t

Dimensions
Length: 93.8 m (307.7 ft)
Beam: 14.4 m (47.2 ft)
Draught: 4.0 m (13.1 ft)

Speed: 18 kts
Range: 7,000 n miles at 14 kts

Complement: 180

SHIPS

WOLEI (814)

MINELAYING

SYSTEM

No details are known

MINES

300 mines

WEAPONS SYSTEMS

GUNS

Chinese 37 mm/63 cannon
There are eight Chinese 37 mm/63 guns in four twin mountings. A Russian-derived weapon manufactured in China, the 37 mm/63 has become a standard light air defence gun in a variety of ships. In the twin mounting, the barrels are enclosed in separate water jackets with exposed spring recuperators.

Specifications
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 886 m/s (2,906 ft/s)
Rate of fire: 180 rds/min
Traverse: 360° at 17°/s (25°/s in Type 76)
Elevation: −10 to 85° at 13°/s
Crew: 3

Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,840 ft)
Ammunition: 0.732 kg

COMMAND AND CONTROL SYSTEMS

RADARS

Radars are fitted for surface search, fire control, and navigation; types unknown.

PROPULSION

Specifications
System: Diesel
Main machinery: 4 diesels; 6,400 hp(m) (4.7 MW)
Shafts: 2

FURTHER INFORMATION

Following the example of the Russian Navy, the PLA-N fits minerails into virtually all its surface combatants, and this is its first purpose-built minelayer. *Beleijan* was built at Dalian Shipyard and completed successful sea trials in 1988. In appearance it resembles the Japanese 'Souya' class and may have a secondary role as an MCMV support ship.

FALSTER

GENERAL SPECIFICATIONS

Operator: Denmark
Type: Minelayer

Class: FALSTER

Built: 4
Active: 4

Displacement:
full load: 1,910 t

Dimensions
Length: 77 m (252.6 ft)
Beam: 12.8 m (42 ft)
Draught: 3.6 m (11.8 ft)

Speed: 17 kts

Complement: 74 (10 officers) plus cadets

SHIPS

FALSTER (N 80)
Builder Nakskov Skibsvaerft, Denmark
Launched 19 Sep 1962
Commissioned 7 Nov 1963

FYEN (N 81)
Builder Frederikshavn Vaerft, Frederikshavn, Denmark
Launched 3 Oct 1962
Commissioned 18 Sep 1963

MØEN (N 82)
Builder Frederikshavn Vaerft, Frederikshavn, Denmark
Launched 6 Jun 1963
Commissioned 29 Apr 1964

SJAELLAND (N 83)
Builder Nakskov Skibsvaerft, Denmark
Launched 14 Jun 1963
Commissioned 7 Jul 1964

MINELAYING

SYSTEM

The minelaying system is fully automated, hydraulically operated, and — since a recent refit — computer controlled.

These ships normally lay defensive minefields composed of both bottom and anchored mines, each preferably of two or more different types.

Bottom mines are laid at 17 knots (also the maximum speed of the 'Falster' class) or less in shallow waters. Anchored mines are launched at a speed of 10 to 12 knots. The time to lay a complete load of mines depends on the configuration of the minefield, navigational and weather conditions and type of mine, but would certainly be 'some hours'.

MINES

Average load is 400 mines, the actual number depending on the type of mine to be laid.

Falster *(N 80) showing the minelaying doors open* (Royal Danish Navy)

WEAPONS SYSTEMS

GUNS

US 76 mm (3 in)/50 Mk 33

Two twin 76 mm (3 in) 50: one on the foredeck in 'A' position, the second aft in 'Y' position. The Mk 33 is a twin-gun, power-driven, base-ring mount with local or remote control. All Mk 33 mounts use amplidyne elevation and training power drives. The guns used are the Mk 22 Mods 4 to 9 and each has an automatic loader Mk 2, capable of handling up to 50 rds/min. Four drum ammunition magazines are available.

Specifications
Traverse: 360° at 30°/s (manual)
Elevation: −14/15° to +85° at 24°/s (manual)
Rate of fire: 100 rds/min

Oerlikon 20 mm

Four mounts per ship (due to be replaced by two twin Stinger SAM mountings).

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km (1,640 yd)
anti-air: 1,150 m (3,773 ft)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal Cutlass B1 ESM system

Cutlass B1 is designed for operation in very dense signal environments, receiving signals in the 1 to 18 GHz frequency range, measuring their parameters, comparing these with those in the radar library which contains the parameters of 2,000 radars, and displaying the information — all within 1 second. The EW operator is presented with a tabular display for threat identity and threat evaluation, and a tactical display giving a pictorial representation of the RF environment. Selected digital outputs can be sent to other local systems, a hard copy printout of the intercepted radar is also available. The tabular display can indicate 150 intercepts, in the order of priority. Cutlass is wide open in both bearing and frequency: that is, it does not employ sweep techniques, giving a very high intercept probability (nearly 100 per cent). Cutlass B1 uses the Cutlass processor and an Instantaneous Frequency Measurement (IFM) receiver. It has a 32-element array antenna to provide bearing measurement by phase analysis techniques. This antenna also provides RF for the IFM. In both systems the processor is provided with fast and accurate information on incoming pulses.

Specifications
Frequency coverage: 1-18 GHz
Accuracy: 2° RMS in bearing
Coverage: 360° azimuth; +40 to −10° elevation
Pulse density capability: 500,000/s
Radar store capability: 2,000 modes

Manufacturer/Contractor
Racal Radar Defence Systems Ltd, Chessington, Surrey, UK.

DECOYS

57 mm launchers

Two 57 mm multiple chaff and IR flare launchers in each ship.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Terma TDS

TDS is a distributed processor system based upon the Motorola 68000 series and designed to acquire data from various sensors, then to process and display it to assist in decision making and weapon selection. The system uses Pascal and C language software. The system interfaces with three radars (search, navigation and fire control) as well as the gun fire-control, missile, ESM, ECM and radio systems. The functions of TDS are to compile a picture of the tactical situation using automatic tracking from onboard and offboard radars (the latter through a datalink). It can allocate targets for gun and surface-to-surface missiles as well as conducting

surface-to-surface missile planning engagements and carrying out chaff and torpedo fire control. Recording, playback and hard-copy facilities are available and the system can be used for exercise simulation.

WEAPONS CONTROL

Contraves CGS-1 fire-control system

CGS-1 is the Danish designation for the Contraves Denezy fire-control system for the two twin 76 mm guns. It is a 1960s vintage analogue system, with an I-band tracking radar.

RADARS

Racal-Decca CWS-2

CWS-2 is the Danish designation for the Racal-Decca AWS-1 air search radar.

Specifications
CWS-2
Role: Air search
Frequency: D/E-band
Beam: 1.5 × 40°
Peak power: 750 kW
Gain: 32 dB
Pulsewidth: 0.35/1.5 µs
PRF: 1,000/400 pps
Scan rate: 10/20 rpm
Range: 60 n miles (110 km)
Company: Racal-Decca

Contraves CGS-1

An I-band fire-control radar, part of the 76 mm gun fire-control system.

CelsiusTech NWS-2

The I-band NWS-2 is normally used as part of the 9LV200 fire-control system, but appears to be used in these ships as a surface search radar.

Terma Pilot

The Pilot is an E/I-band navigation radar from the Danish company Terma.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM/EMD 16-567D3 diesels; 3.58 MW (4,800 hp) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

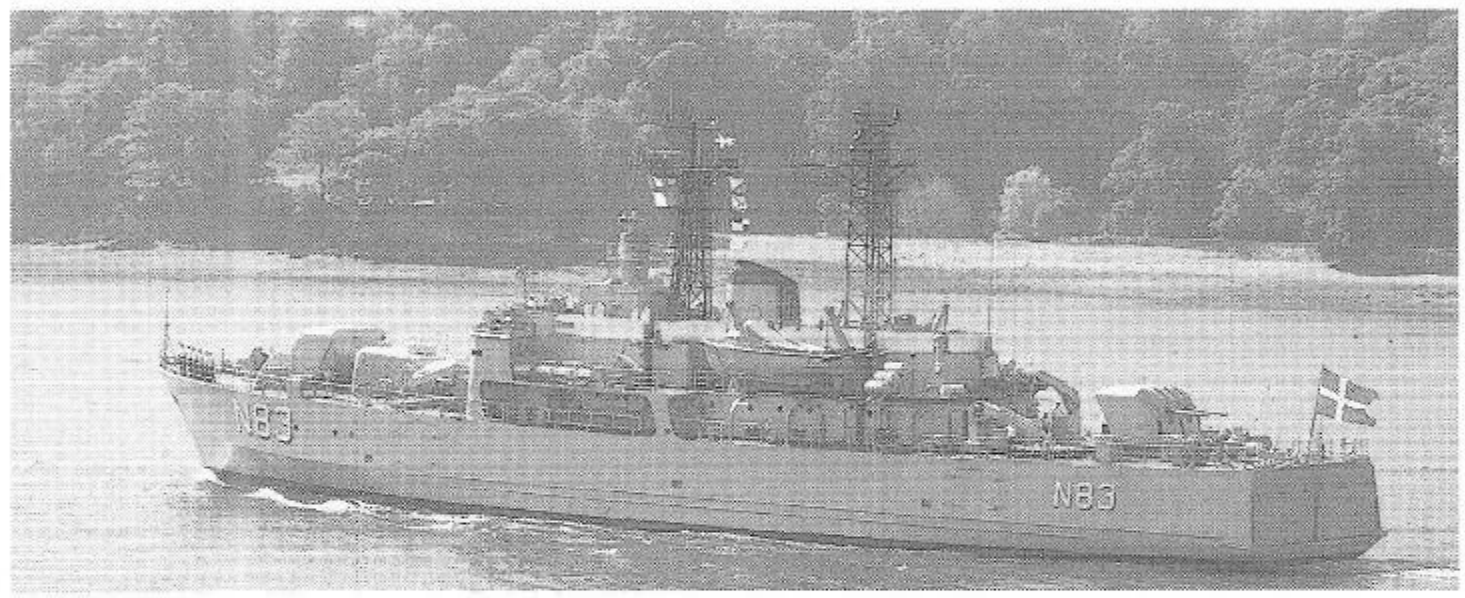
This is a Danish design for a large fast minelayer to lay mines in times of tension in 'choke points.' Five were built in Denmark: four for the Danish Royal Navy to lay mines in the Baltic Approaches and one for the Turkish Navy for a similar task in the Dardanelles. The four Danish ships were ordered in 1960-61 and launched 1962-63, they are named after Danish islands. The four Danish ships were funded 50:50 by the US and Danish governments, an arrangement which had recently taken over from the 100% US-funded Military Aid Program (MAP).

DESIGN

The ships have a steel, flush-decked hull with a raking stem, a prominent knuckle forward and a full stern. The mine deck forms a large internal hangar and there are four mine rails, enabling the mines to be laid speedily. The hull has been specially strengthened for ice navigation.

MODIFICATIONS

In 1987 *Sjaelland's* mainmast was raised, *Falster* and *Fyen* were similarly modified in 1989-91, and *Møen* completed in 1993.



Sjaelland *(N 83) (H M Steele)*

In 1976 *Sjaelland* was converted to act as a depot ship for submarines and fast attack craft, but retained its minelaying capability.

MODERNISATION

The ships have been refitted allowing them to serve until the late 1990s, possibly longer. This included installing a Terma command and control system.

Mine stocks have been updated in collaboration with Germany.

Twin Stinger SAM mountings may be fitted in due course.

OPERATIONAL

Sjaelland is used as a Command ship. *Møen* and sometimes *Fyen* are employed on midshipmen's training.

NUSRET (FALSTER)

GENERAL SPECIFICATIONS

Country of origin: Denmark
Operator: Turkey
Type: Falster (Minelayer)

Class: NUSRET

Purchased: 1
Active: 1

Displacement:
full load: 1,880 t

Dimensions
Length: 77 m (252.6 ft)
Beam: 12.6 m (41.34 ft)
Draught: 3.4 m (11.15 ft)

Speed: 17 kts

Complement: 153 (13 officers)

SHIPS

NUSRET (N 110)
Builder Frederikshavn Vaerft, Frederikshavn, Denmark
Launched 1964
Commissioned 16 Sep 1964

MINELAYING

SYSTEM

The minelaying system is fully automated and hydraulically operated. The ship will normally lay defensive minefields composed of both bottom and anchored mines, each preferably of two or more different types.

Bottom mines are laid at 17 knots (also the maximum speed of the 'Falster' class) or less in shallow waters. Anchored mines are launched at a speed of 10 to 12 knots. The time to lay a complete load of mines depends on the configuration of the minefield, navigational and weather conditions and type of mine, but would certainly be 'some hours'.

MINES

Average load is 400 mines, the actual number depending on the type of mine to be laid.

WEAPONS SYSTEMS

GUNS

US 76 mm (3 in) 50 Mk 33

Two twin 76 mm (3 in) 50: one on the foredeck in 'A' position, the second aft in 'Y' position. The Mk 33 is a twin-gun, power-driven, base-ring mount with local or remote control. All Mk 33 mounts use amplidyne elevation and training power drives. The guns used are the Mk 22 Mods 4 to 9 and each has an automatic loader Mk 2, capable of handling up to 50 rds/min. Four drum ammunition magazines are available.

Specifications

Traverse: 360° at 30°/s (manual)
Elevation: −14/15 to +85° at 24°/s (manual)
Mounting weight: 15.8 t
Rate of fire: 100 rds/min

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

2 Mk 63 GFCS

RADARS

Plessey CWS-2 (AWS-1)

This ship is sometimes reported as having either Selenia (now Alenia) RAN-7S or Selenia CWS-2 radars. In fact, the radar is a Plessey AWS-1 (designated CWS-2 by the Danish Royal Navy) with an Alenia antenna, which had originally been designed for the RAN-7S radar. It did not, however, pass the prototype stage. Similar combinations of Plessey AWS-1, with Alenia antennas, were installed in other Danish ships.

Specifications

CWS-2 (AWS-1)
Role: Air search
Frequency: D/E-band
Beam: 1.5 × 40°
Peak power: 750 kW
Gain: 32 dB
Pulsewidth: 0.35/1.5 µs
PRF: 1,000/400 pps
Scan rate: 10/20 rpm
Range: 60 n miles (110 km)

Manufacturer/Contractor

Siemens-Plessey, UK.

NAVIGATION

One I-band navigation radar; type unknown.

Western Electric AN/SPG-34

The Western Electric SPG-34 is associated with the Mk 63 GFCS. It works in the I/J-bands and produces a 3 × 3° conical scan beam for target acquisition and a 0.75° conical scan beam for target tracking.

Manufacturer/Contractor

Western Electric, USA.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 General Motors GM/EMD 16-567D3 diesels; 3.58 MW (4,800 hp) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

This is a Danish design for a large fast minelayer to lay mines in times of tension in 'choke points.' Five were built in Denmark: four for the Danish Royal Navy and one for the Turkish Navy to lay mines in the Dardanelles. The Turkish ship was fully funded by the USA.

DESIGN

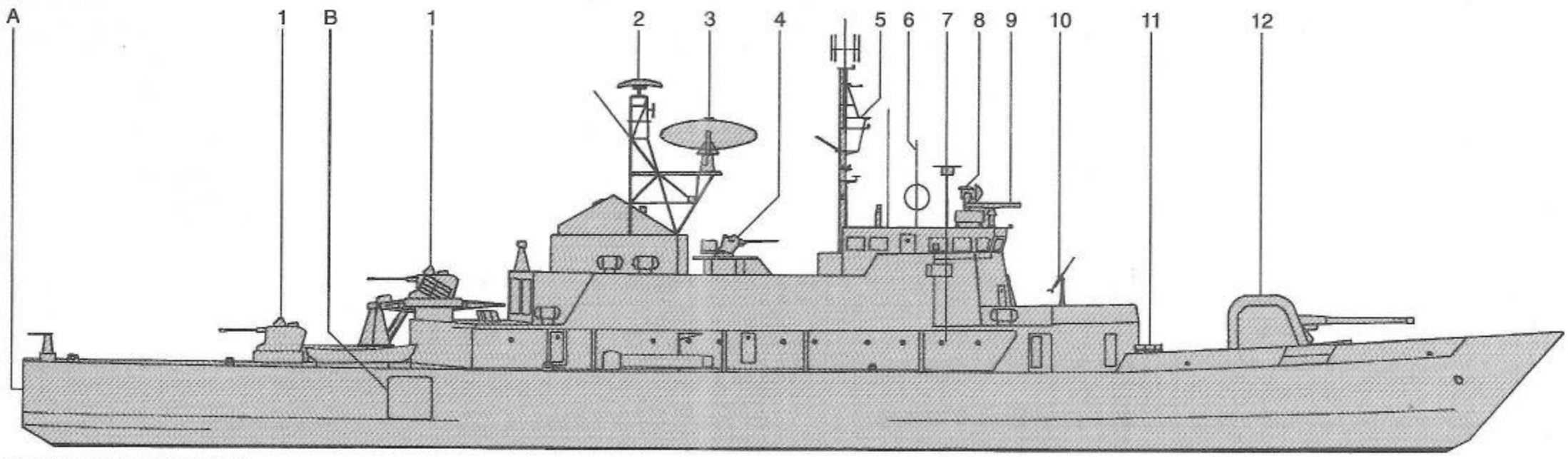
The ship has a steel, flush-decked hull with a raking stem, a prominent knuckle forward and a full stern. The mine deck forms a large internal hangar and there are four mine rails.

TURKISH MINELAYERS

This ship is the only purpose-built minelayer in the Turkish Navy, but there are also three 'Mordogan' class coastal minelayers, which are converted LSM1s. However, minelaying tends to be an activity where the major effort is required at the very start of hostilities (or, perhaps, even earlier). Thus, a number of ships have a secondary minelaying capability, enabling them to lay their mines and then proceed on their primary missions. These include: 'Cakabey', 'Sarucabey' and 'Osman Gazi' class amphibious warfare ships; the ex-German 'Rhein' class support ships; and Mehmetcik, a controlled mineplanter.

Nusret *(N 110) built in Denmark for the Turkish Navy in 1964* (Turkish Navy)

POHJANMAA



Pohjanmaa (Ian Sturton)
Minelaying A *Minelaying doors in transom* **B** *Mine loading port*

General 1 *Twin 23 mm/87 cannon* **2** *Celsius Tech 9LV 220 fire-control search radar* **3** *Signaal DA-05 air/surface search radar* **4** *Bofors SAK 40L/70-350 anti-air gun* **5** *ARGOSystems ESM (radar intercept)* **6** *DF loop* **7** *Log periodic antenna* **8** *Celsius Tech 9L220 fire-control director* **9** *Two unidentified radars* **10** *12.7 mm machine guns* **11** *RBU-1200 ASW rocket launcher (two)* **12** *Bofors 120 mm (4.7 in) gun*

GENERAL SPECIFICATIONS

Operator: Finland
Type: Minelayer

Class: POHJANMAA

Built: 1
Active: 1

Displacement:
standard: 1,000 t
full load: 1,100 t

Dimensions
Length: 78.2 m (255.8 ft)
Beam: 11.6 m (37.7 ft)
Draught: 3 m (9.8 ft)

Speed: 19 kts
Range: 3,500 n miles at 15 kts

Complement: 90

SHIPS

POHJANMAA (01)
Builder Wärtsilä, Helsinki, Finland
Laid down 4 May 1978
Launched 28 Aug 1978
Commissioned 8 Jun 1979

MINELAYING

SYSTEM

Minelaying system is not known.

MINES

120 mines can be carried, of which the only identified type is the GEC-Marconi Stonefish.

GEC-Marconi Stonefish mines

Stonefish warstock mines have a plastic-bonded explosive warhead, which, together with the appropriate launch kit and a standard tail unit containing the sensors, signal-conditioning and processor package, can be configured to cover the range of launch vehicles, depths and targets. The basic sensor pack comprises acoustic, magnetic and pressure sensors. The signal processing includes signal conditioning and information processing, the setting of thresholds, mine logic and sterilisation delay times. The mine programme can be modified by means of a portable presetter, changing threat and operational conditions before the mine is deployed.

Stonefish warstock versions have a laid life of over 700 days and are intended to be laid at depths between 10 and 90 m (32.8 and 295 ft) for surface targets and down to depths of 200 m (656 ft) for submarine targets. They are up to 2 m (6.56 ft) in length, 533 mm (21 in) in diameter, with all-up weights up to 770 kg (1,698 lb), depending on configuration. The Stonefish presetter, designed as a self-contained unit, employs a microprocessor and incorporates built-in data checking during input and automatic test facilities.

Finnish minelayer Pohjanmaa *(01) was commissioned in 1979. Note the mixed equipment sources: Bofors 120 mm gun from Sweden; RBU-100 ASW mortar (just visible above pennant number) from Russia; EW equipment from the USA (cylindrical radome above cross trees on foremast); air search radar from the Netherlands (elliptical open mass radar between masts); main mine type is the British Stonefish.* (Pär-Henrik Sjöström)

Specifications
Stonefish Mk II Warstock Mine
Length: 1.8 m (5.94 ft)
Diameter: 533 mm (21 in)
Weight: 770 kg (1,698 lb)
Warhead: 500 kg (1,103 lb) PBX

Manufacturer/Contractor
GEC-Marconi Naval Systems, Waterlooville, Hampshire, UK.

SONARS

Simrad

Two hull-mounted, active, high-frequency sonars; one for bottom classification.

WEAPONS SYSTEMS

GUNS

Bofors TAK 120 mm (4.7 in)/46

There is a single Bofors 120 mm (4.7 in) gun in 'A' position on the foredeck, which is capable of firing 80 rds/min to a range of 10 n miles (18.5 km). The turret is also fitted with 103 mm (4 in) rails for illuminants. The water-cooled TAK 120 L/46 has two feed tables each holding six rounds, located on the sides of the automatic loader and beneath the ammunition compartments. They can be fed from either magazine, permitting the loading of two different kinds of ammunition.

The gun is normally served by two loaders and an operator; during manual operation the operator acts as the layer in training, while an additional man is responsible for elevation.

Specifications

Calibre: 120 mm
Length of barrel: 46 calibres
Muzzle velocity: 800 m/s (2,625 ft/s)
Traverse: 360° at 40°/s
Elevation: −10 to +80° at 32°/s
Mounting weight: 28.8 t
Crew: 3-4
Range: 10 n miles (18.5 km)
Rate of fire : 80 rds/min/barrel

Manufacturer/Contractor

CelsiusTech, Sweden.

Bofors SAK 40L/70-350

Two single Bofors 40 mm anti-air guns are mounted. The SAK 40L/70-350 mounting is equipped with electrohydraulic laying machinery and is remotely controlled from a central fire-control system or an optical director. It features gyrostabilised local control with hand-cranks for emergency use. Junction boxes for power, remote control and communications are built into the mounting.

Specifications

Mounting
Weight (unloaded): 2.89 t
Traverse: Nominal 360° at 85°/s
Elevation: −9 to +85° at 45°/s
Crew: 4

Specifications

Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000-1,025 m/s (3,280-3,363 ft/s)
Range:
anti-surface: 6.75 n miles (12.5 km)
anti-air (nominal): 6,900 m (22,632 ft)
Rate of fire: 300 rds/min (practical)
Ammunition: 2.21 kg (4.87 lb)

23 mm/87

There are two twin ZU-23-Sako mountings on the *Pohjanmaa*, consisting of two guns installed one above the other in separate cradles and on their sides so that it is fed from the side. The guns have 1.5 m (4.9 ft) long air-cooled barrels of monobloc construction with flash suppressors at one end and an exposed spring recuperator wrapped around the barrel near the breech. The mounting may be either hydraulically or manually operated. With ammunition the mounting weighs 1.735 tonnes and it has two on-mount operators and five loader-carriers.

Specifications

Calibre: 23 mm
Length of barrel: 87 calibres
Traverse: 360° at 80°/s
Elevation: −15 to +80° at 50°/s
Rates of fire: 200 rds/min/barrel
Projectile: 0.19 kg (0.42 lb)
Range:
anti-surface: 1.1 n miles (2 km)
anti-air: 1,500 m (4,920 ft)

12.7 mm machine guns

Two 12.7 mm machine guns are carried.

ANTI-SUBMARINE MORTARS

RBU 1200

Two Russian RBU 1200 launchers are mounted. RBU 1200 is believed to have a range not exceeding 1,200 m (3,936 ft).

Specifications

Length: 1.4 m (4.59 ft)
Range: 1,200 m (1,312 yd)
Warhead: 34 kg (74.95 lb)

DEPTH CHARGES

There are two depth charge racks.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

ArgoSystems Intercept

One radar intercept equipment; type not known.

ELECTRONIC COUNTERMEASURES (ECM)

Philax (Protean) 9CM/100 decoy launchers

The 9CM system is based upon the Philax fixed launcher which consists of four magazines similar to those used in DAGAIE and also uses Lacroix munitions. Usually the magazines contain chaff munitions but one may be replaced by an Infra-Red (IR) munitions magazine. The munitions are fired by a single cartridge in each of the four chaff groups or each of the three to six IR containers. Each chaff magazine has 36 × 40 mm grenades which are fired at an interval of 0.1 second per group and within 1 second begin to create a cloud with a 1,000 m² (10,800 sq ft) radar cross-section. This is complete within 5 seconds at a height of 40 to 60 m (130-197 ft).

Specifications

Philax
Length: 87.5 cm (2.9 ft)
Height: 72 cm (2.3 ft)
Width: 95 cm (3.1 ft)
Weight (unloaded): 180 kg (396.8 lb)

Manufacturer/Contractor

CelsiusTech, Sweden.

COMMAND AND CONTROL SYSTEMS

RADARS

Signaal DA-05

Specifications

DA-05
Role: Air/surface search
Frequency: E/F-band
Beam: 1.5 × 8°
Peak power: 1,200 kW
Gain: 32.2 dB
Pulsewidth: 1.3/2.6 µs
PRF: 1,000/500 pps
Scan rate: 10/20 rpm
Typical range (air target): 2 m² at 84 n miles (156 km) at 18,000 m (60,000 ft)

Manufacturer/Contractor

Hollandse, Signaalapparaten BV, Hengelo, Netherlands.

Celsius Tech 9LV 220

J-band fire-control radar.

Navigation radar

This is one I-band navigation radar; type unknown.

PROPULSION

Specifications

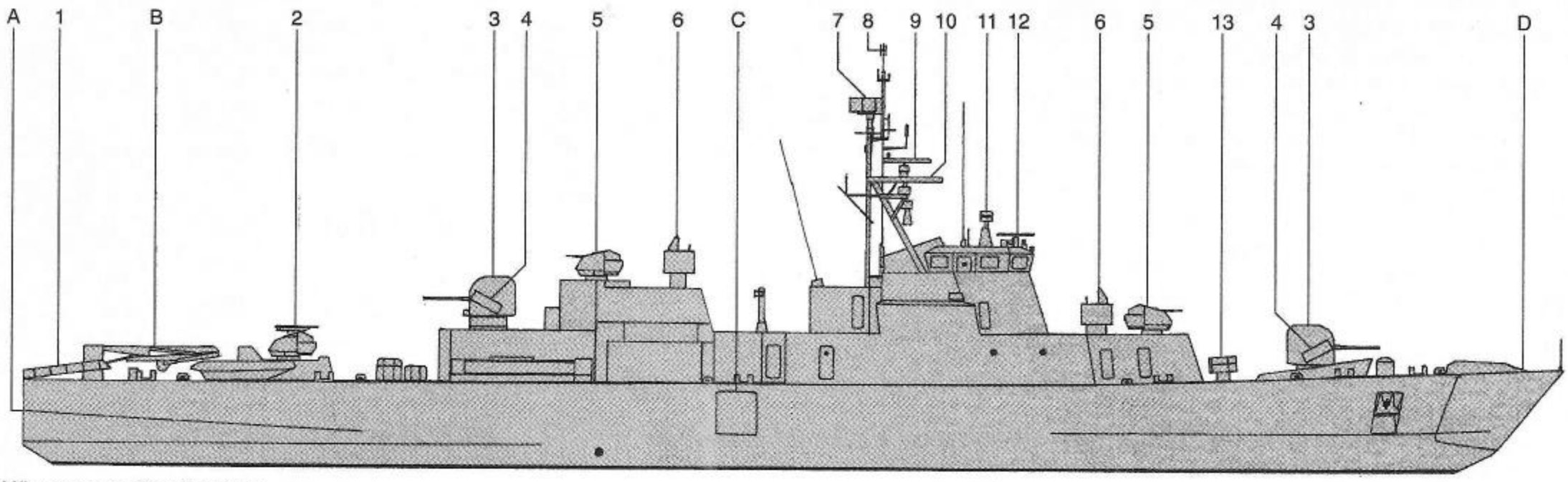
System: Diesel
Main machinery: 2 Wärtsilä-Vasa 16V22 diesels; 4.64 MW (6,300 hp(m)) sustained
Shafts: 2
Propellers: cp
Thruster: 1 bow thruster

FURTHER INFORMATION

The design was completed in 1976 and the ship was ordered in late 1977. The ship has a secondary role as a peacetime training ship, accommodating 70 trainees in Portacabins on the mine deck. There is a helicopter flight deck aft, but no other facilities.

Some modernisation was undertaken in 1992, including replacing the two forward 23 mm guns by 12.7 mm MGs.

HÄMEENMAA



Hämeenmaa (Ian Sturton)
Minelaying A *Stern door/ramp* **B** *Crane* **C** *Mine-loading door* **D** *Bow door and internal ramp*

General 1 *Depth-charge rack (two)* **2** *Matra Sadral/Mistral SAM launcher* **3** *Bofors 40 mm/70-315 cannon* **4** *Flare launcher* **5** *Sako 23 mm/87 twin mounting* **6** *Galileo fire director (for 23 mm cannon)* **7** *Log periodic antenna* **8** *Thorn-EMI MATILDA ESM (radar warning)* **9** *Radar* **10** *Surface search radar* **11** *Radamec 2400 electro-optic fire director* **12** *Navigation radar* **13** *RBU-1200 ASW mortar*

GENERAL SPECIFICATIONS

Operator: Finland
Type: Minelayer

Class: HAMEENMAA

Built: 2
Active: 2

Displacement:
standard: 1,000 t
full load: 1,330 t

Dimensions
Length: 77 m (252.6 ft) (oa); 69.6 m (228.3 ft)
Beam: 11.6 m (38.1 ft)
Draught: 3 m (9.8 ft)

Speed: 19 kts

Complement: 70

SHIPS

HÄMEENMAA (02)

Builder	Finnyards, Rauma, Finland
Laid down	2 Apr 1991
Launched	11 Nov 1991
Commissioned	15 Apr 1992

UUSIMAA (05)

Builder	Finnyards, Rauma, Finland
Laid down	12 Nov 1991
Launched	Jun 1992
Commissioned	2 Dec 1992

MINELAYING

SYSTEM

There are four minerails, discharging the mines over the stern ramp.

MINES

Between 100 and 150 mines can be carried depending on the type.

SONARS

Simrad
These ships have a Simrad hull-mounted, active, mine detection, high-frequency sonar. Model is not known.

Hämeenmaa *(02), nameship of a class of three minelayers for the Finnish Navy. These ships have bow and stern doors which enable them to be employed as both minelayers and as ro-ro transports* (Pär-Henrik Sjöström)

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Sadral/Mistral
The Sadral launcher, for Mistral IR-homing anti-aircraft missiles is located on the quarterdeck. Sadral is a remotely operated system on a two-axis stabilised mount. It is designed to provide self-protection for smaller second-echelon warships. The Sadral has six launcher-containers and a closed-circuit television camera. The deck mounting weighs 1,080 kg (2,380 lb) and is controlled from a below-deck console with the aid of a servo control unit.

Specifications
Length: 1.81 m (5.94 ft)
Diameter: 9.2 cm (3.6 in)
Wing span: 1.9 cm (6.23 in)
Weight: 18.4 kg (40.6 lb)
Speed: Mach 2.6
Range: 700 m to 5 km (2,300-16,400 ft)

Manufacturer/Contractor
Matra, France.

GUNS

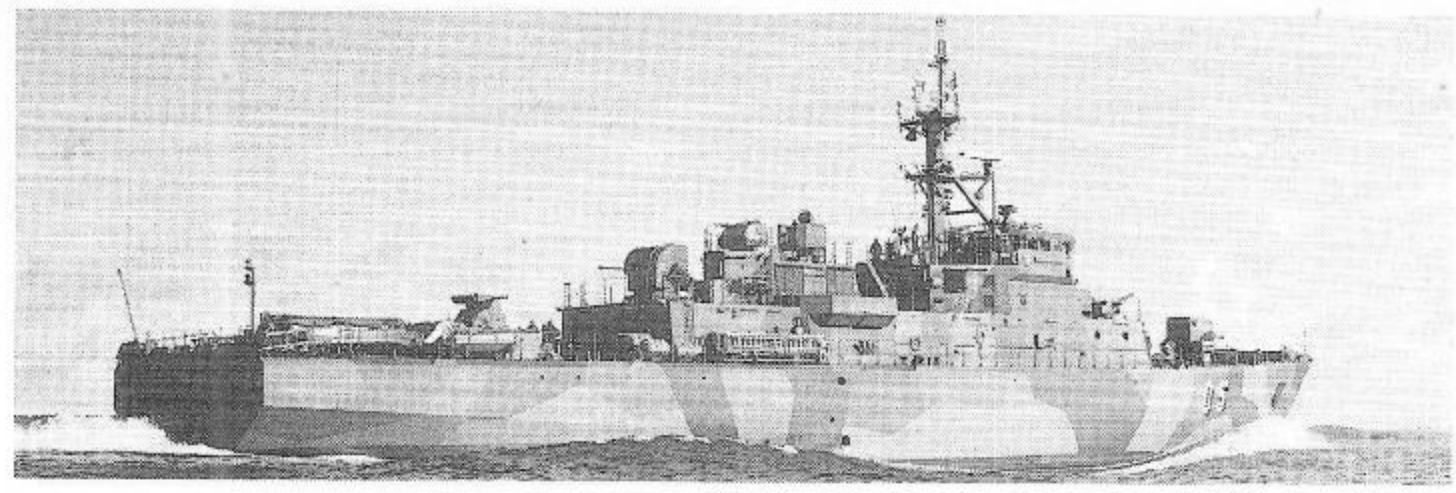
Bofors 40 mm/70-315
There are two SAK 40L/70-315 mountings; one on the foredeck, the second at the after end of the superstructure.

Specifications
Traverse: 360° (nominal) at 30°/s
Elevation: −3 to +85° at 24°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 12 km (6.5 n miles)
anti-air: 4,000 m (2.2 n miles)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Manufacturer/Contractor
Bofors Weapon Systems, Sweden.

Sako 23 mm/87
Two or three twin mountings are usually fitted per ship. The third mounting is interchangeable with the Sadral launcher.

Specifications
Calibre: 23 mm
Length of barrel: 87 calibres
Traverse: Unlimited at 80°/s
Elevation: −15 to +80° at 50°/s
Rates of fire: 200 rds/min/barrel
Projectile: 0.19 kg (0.42 lb)
Range:
anti-surface: 2 km (1.1 n miles)
anti-air: 1,500 m (4,900 ft)



Uusimaa *(05). Note the Sadral launcher on the quarterdeck, Bofors 40 mm and 23 mm twin mount. The object to the right of the 23 mm mount is the associated Officine Galileo fire-control director* (Pär-Henrik Sjöström)

ANTI-SUBMARINE MORTARS

RBU 1200
Two fixed five-tube RBU 1200 launchers are fitted per ship. This mounting is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm (9.8 in), is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (75 lb) warhead and a range of about 0.8 n miles (1.47 km).

Specifications
RBU-1200
Calibre: 250 mm (9.84 in)
Launcher tubes: 5
Elevation: +65°
Warhead: 34 kg (75 lb)
Range: 0.8 n miles (1.5 km)

DEPTH CHARGES

Two launchers.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

MATILDA radar threat warning receiver
MATILDA (Microwave Analysis Threat Indication and Launch Direction Apparatus), also known as Outfit UAR in the UK Royal Navy, covers the frequency range 7.5 to 18 GHz, and is intended to act primarily as a trigger for short-range chaff systems. It detects and recognises the threat, indicates bearing, and, if required, activates chaff launchers. There are three elements: a small, lightweight antenna covering 360° in azimuth; a processing unit; and a display. The antenna unit consists of four antenna horns which are circularly polarised for the detection of vertical-, horizontal- and circular-polarised signals. The warning unit consists of a small indicator panel designed to be located at any convenient position in the operations room. On detecting a threat, the unit sounds an audio warning and provides an indication of the threat and bearing sector channel. Total processing/warning time is claimed to be under 1 second.

Specifications
MATILDA
Frequency range: 7.5-18 GHz
Frequency resolution: 1.5 GHz
Pulsewidth range: 100 ns-6.4 µs
Pulsewidth resolution: 200 ns
Bearing coverage: 360°
Bearing resolution: 45°
Sensitivity (referred to isotropic): −30 dBm
Dynamic range: 40 dB
Antenna gain: 6-8 dB
Voice module: Programmable to any warning required in any language

Manufacturer/Contractor
THORN EMI Electronics Ltd, Sensors Group, Crawley, West Sussex, UK.

DECOYS

ML Aviation Superbarricade countermeasures system
Two launchers are fitted to each of the 'Hameenmaa' class. Superbarricade is an improved version of the widely used Barricade system and provides ships with means of deploying chaff and Infra-Red (IR) decoys to counter missile attacks, using a layered defence against the various types of anti-ship missile. The system uses a 102 mm rocket and a redesigned launcher with four sets of triple-cell launchers. The system has a similar control unit to Barricade Mk III and the same tactical computer. The ammunition lockers each contain 24 rockets. There are four decoy modes: confusion, distraction, dump and centroid.

Manufacturer/Contractor
ML Wallop Defence Systems, Andover, Hampshire, UK.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Radamec System 2400
System 2400 is a remotely operated electro-optic director equipped with thermal imager, daylight TV camera and laser rangefinder. It is designed for multiweapon use and includes a dedicated console which has the Ferranti GP250 digital predictor, a 14 in (35.5 cm) raster scan display.

Manufacturer/Contractor
Radamec Defence Systems Ltd, UK.

Officine Galileo electro-optic directors
There are two Officine Galileo directors for the 23 mm mounts, which are located immediately behind the mounts they serve. Model is believed to be OG.R7.

RADARS

Selesmar ARPA
Three Selesmar ARPA I-band surface search and navigation radars.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Wärtsilä 16V22 diesels; 4.64 MW (6,300 hp(m)) sustained
Shafts: 2
Propellers: 2 KaMeWa cp
Thruster: 1 bow thruster; 184 kW (247 hp(m))

FURTHER INFORMATION

PROGRAMME

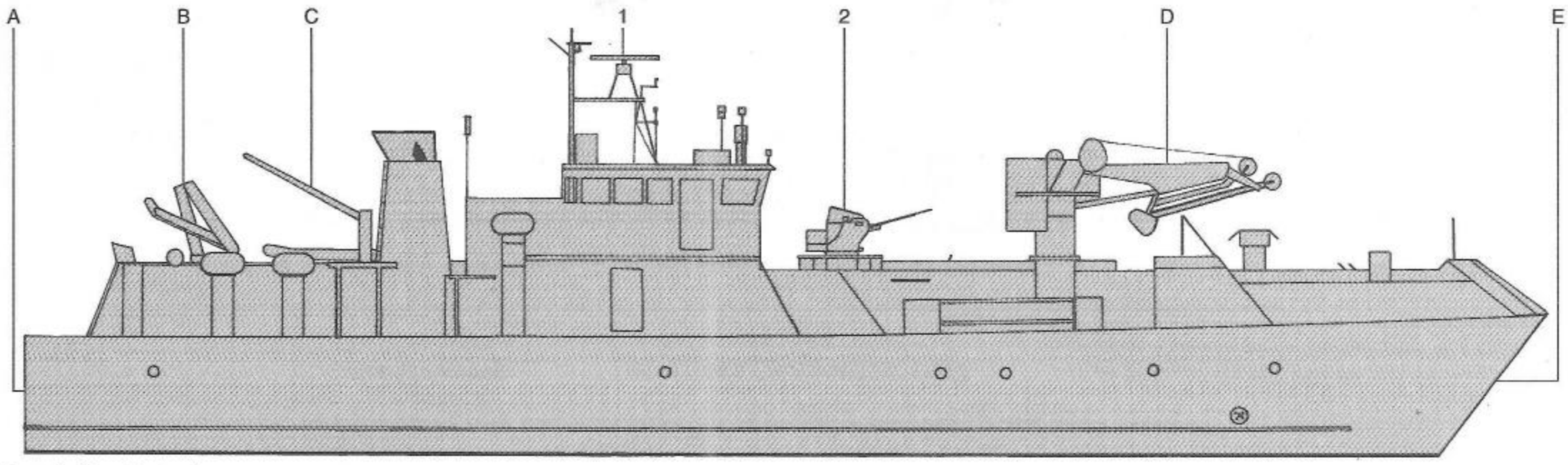
These were originally ordered from Wärtsilä, but when that yard experienced financial difficulties the order was transferred to Finnyards at Rauma.

DESIGN

These seagoing ships have a dual role as minelayers and as transport/support ships. They have a steel hull, which is ice-strengthened (Ice Class 1A), and are capable of breaking up to 40 mm ice, employing a special cut-back stern. The superstructure is constructed from aluminium alloy.

There are ramps in both bow and stern. The stern ramp is used for minelaying, while the combination of bow and stern ramps enables them to be used as ro-ro transports.

PANSIO



Pansio (Ian Sturton)
Minelaying A *Stern ramp* **B** *1.2 tonne crane* **C** *Light crane* **D** *15 tonne crane* **E** *Bow ramp*

General 1 *Raytheon navigation radar* **2** *Sako 23 mm/37 twin mounting*

GENERAL SPECIFICATIONS

Operator: Finland
Type: Minelayers

Class: PANSIO

Built: 3
Active: 3

Displacement:
full load: 450 t

Dimensions
Length: 44 m (144.3 ft) (oa); 39.2 m (128.2 ft)
Beam: 10 m (32.8 ft)
Draught: 2 m (6.6 ft)

Speed: 10 kts

Complement: 12

SHIPS

PANSIO (876)
Builder Olkiluoto Shipyard, Telakka, Finland
Commissioned 25 Sep 1991

PYHARANTA (475)
Builder Olkiluoto Shipyard, Telakka, Finland
Commissioned 26 May 1992

PORKKALA (777)
Builder Olkiluoto Shipyard, Telakka, Finland
Commissioned 29 Oct 1992

MINELAYING

SYSTEM

Automated system, laying mines over stern ramp.

MINES

- Number of mines depends on type and size but average is well in excess of 50.
- Mines are loaded through ports in side of ship or over bow ramp.
- Four minerails

GENERAL FACILITIES

- One 15 tonne crane; one 1.2 tonne crane aft (starboard); one light crane aft (port).
- large bow and stern ramps.

WEAPONS SYSTEMS

GUNS

Sako 23 mm/87
One twin mounting per ship.

Specifications
Calibre: 23 mm
Length of barrel: 87 calibres
Traverse: Unlimited
Elevation: −15 to +80°
Traverse speed: 80°/s
Elevation speed: 50°/s
Rates of fire: 200 rds/min/barrel
Projectile: 0.19 kg
Range:
anti-surface: 1.1 n miles (2 km)
anti-air: 1,500 m (4,920 ft)

12.7 mm machine gun
One per ship; type unknown.

COMMAND AND CONTROL SYSTEMS

RADARS

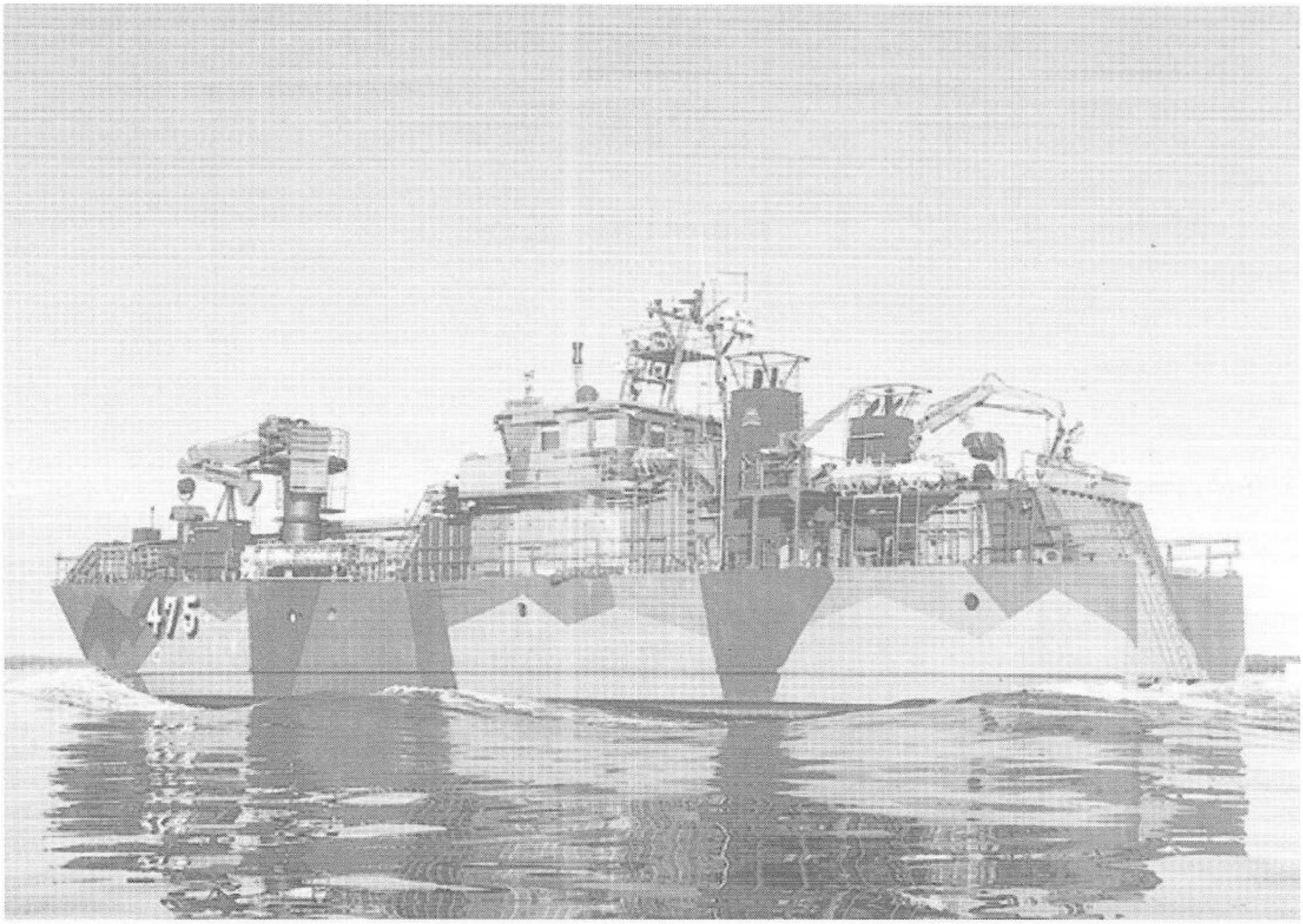
Raytheon ARPA
I-band navigation radar.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 12V 183 TE62 diesels; 1.1 MW (1,500 hp(m))
Thruster: 1 bow thruster
Shafts: 2

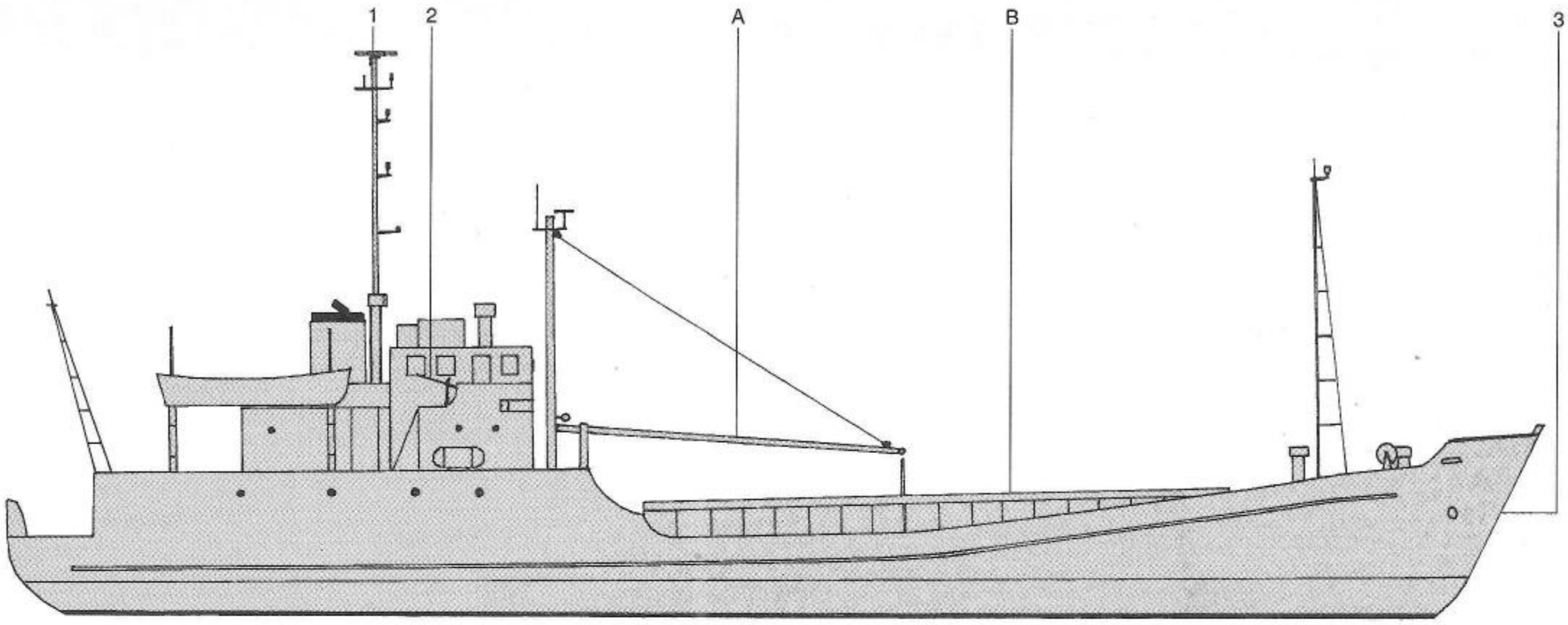
FURTHER INFORMATION

These ships were ordered in May 1990 and delivered in 1991-92. They are used for inshore minelaying and transport with a cargo capacity of 100 tonnes. They are ice-strengthened. For the transport role they have bow and stern ramps giving them a ro-ro capability.



Pyhäranta *(475) of the 'Pansio' class. These three ships can be employed as minelayers, transports for vehicles and cargo, or in the anti-pollution role* (Pär-Henrik Sjöström)

IRAN AJR



Iran Ajr Class (Ian Sturton)
Minelaying A *Derrick (two)* **B** *Hold cover (used to store mines)*

General 1 *Navigation radar* **2** *12.7 mm machine gun (two)* **3** *Bow ramp*

GENERAL SPECIFICATIONS

Country of origin: Japan
Operator: Iran
Type: Minelayer/amphibious transport

Class: IRAN AJR

Purchased: 5
Active: 2

Displacement:
full load: 2,310 t
Measurement: 1,718 t gross

Dimensions
Length: 53.7 m (176 ft)
Beam: 10.8 m (35.4 ft)
Draught: 3 m (9.9 ft)

Speed: 12.5 kts

Complement: 30

SHIPS

IRAN ASIR

Builder	Teraoka, Japan
In commercial service	1978
Purchased by Iran	1980

IRAN GHAYDR

Builder	Teraoka, Japan
In commercial service	1978
Purchased by Iran	1980

MINELAYING CAPABILITIES

SYSTEM

Moored mines are stored on the hatch cover and are launched by derrick over the side. Others may be stowed in the hold.

MINES

They have only been seen carrying moored mines but there is no reason they could not launch other types.

WEAPONS SYSTEMS

GUNS

12.7 mm (0.50 in) machine guns
These two ships are armed with two 12.7 mm (0.5 in) machine guns. Like most Iranian equipment these are probably of Russian origin. Typically, their effective range will be approximately 1,500 m (1,600 yd), with a practical firing rate of 100 rounds/min.

ELECTRONIC SENSORS

RADAR

These ships appear to carry an I-band navigation radar.

PROPULSION

Specifications
System: Diesel
Main engines: 2 diesels, 1.62 MW (2,200 hp(m)) (see 'Further Information' below)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

Five of these ships were bought on the commercial market in 1980. They were built by Teraoka in Japan and operated commercially for approximately 10 years. They were then taken over by the navy and used primarily as minelayers although they also retain an amphibious capability.

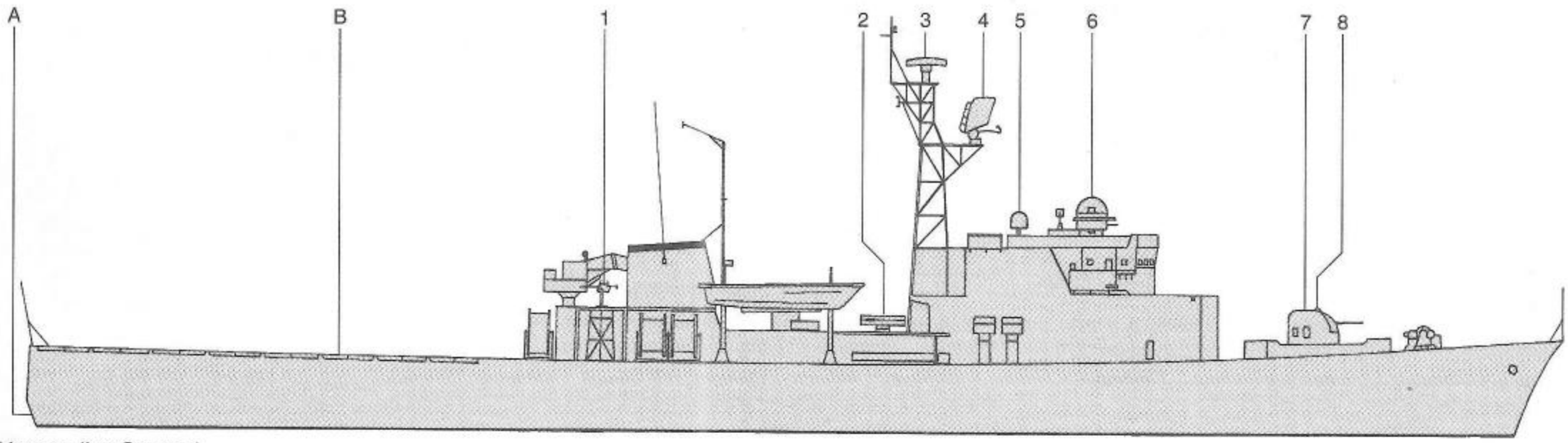
DESIGN

These are rudimentary amphibious ships, with a flat bow door, a cargo hold, and machinery and superstructure aft. It would appear that the ships are intended to off-load onto sloping ramps, rather than onto a beach. The engines in these ships may well be Ikegai MTU engines, as these were used in many other ships of this size, built in Japan in the 1970s.

DEPLOYMENT

Two were sunk in 1980 by Iraq at the start of the Iran-Iraq war, while a third, Iran Ajr, was captured by US Navy forces in 1987 while actually engaged in minelaying and was scuttled by them. The remaining two are both in service.

HAYASE



Hayase (Ian Sturton)
Minelaying A *Five minerails launching through transom* **B** *Flight deck for S-80M-1 Sea Dragon MCM helicopter*

General 1 *Hughes Sea Vulcan* **2** *324 mm torpedo tubes* **3** *JRC OPS-16 surface search radar* **4** *MELCO OPS-14B air search radar* **5** *Satcom* **6** *GFCS Mk 63* **7** *US 76 mm (3 in)/50 gun* **8** *AN/SPG-34 tracking radar (on port side of gun shield)*

GENERAL SPECIFICATIONS

Operator: Japan
Type: Minelayer

Class: HAYASE

Built: 1
Active: 1

Displacement:
standard: 2,000 t

Dimensions
Length: 99 m (324.8 ft)
Beam: 14.5 m (47.6 ft)
Draught: 4.2 m (13.8 ft)

Speed: 18 kts

Complement: 180

SHIPS

HAYASE (MST 462)
Builder Ishikawajima Harima, Tokyo, Japan
Commissioned 6 Nov 1971

MINELAYING

SYSTEM

Five rails, discharging mines through the stern door.

MINES

- The JMSDF uses mainly US-designed mines manufactured under licence in Japan. Mines in service include: Type 55 moored, horned mine: Type 56 moored, antenna contact mine; Type 70 bottom-lying influence mines.
- Stated load is 116 mines although this seems unlikely. The 'Souga' class minelayer, with a virtually identical hull is stated to carry 460 mines.

SONARS

AN/SQS-11A

AN/SQS-11A is a 1960s-vintage US Navy sonar, operating at 20 kHz with a range of some 1,500 m (1,600 yd). It is a hull-mounted, active, search and attack set.

WEAPONS SYSTEMS

TORPEDOES

324 mm Type 68 (2 triple) tubes

Six 324 mm Type 68 (2 triple) tubes for Mk 46 Mod 5 Neartip torpedoes:

Specifications

Mk 46 Mod 5
Length: 2.59 m (8.5 ft)
Diameter: 324 mm
Weight: 230 kg (507 lb)
Warhead: 44 kg (97 lb) HE
Propulsion: Liquid propellant
Speed: 45 kts (max)
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,508 ft) (estimated)

Manufacturers/Contractors

Alliant TechSystems, USA.
Mitsubishi Heavy Industries, Japan.

GUNS

US 76 mm (3 in)/50 Mk 33

One twin 76 mm (3 in) 50 on the foredeck in 'A' position. The Mk 33 is a twin-gun, power-driven, base-ring mount with local or remote control. All Mk 33 mounts use amplidyne elevation and training power drives. The guns used are the Mk 22 Mods 4 to 9 and each has an automatic loader Mk 2, capable of handling up to 50 rds/min. Four drum ammunition magazines are available. The Mods 4 and 7 mountings have environmental shields made from either GRP and aluminium, for protection against icing and bad weather.

Specifications

Traverse: 360° at 30°/s (manual)
Elevation: −14/15° to +85° at 24°/s (manual)
Mounting weight: 15.8 t
Rate of fire: 100 rds/min

Hughes 20 mm/76 Sea Vulcan 20P/ JM-1MB

Two Hughes 20 mm/76 Sea Vulcan 20P mountings, with three barrels per mounting. The Sea Vulcan 20P is a manually operated weapon which has been adopted by the Japanese Maritime Self-Defense Force as JM 61MB, and is, in essence, an M-197 gun on the mounting of the old 20 mm single US Navy Oerlikon Mk 10. The M-197 gun is an externally powered weapon using a cluster of three 20 mm barrels. Each barrel is 1.52 m (5.0 ft) long and weighs 8.18 kg (18 lb). The weapon uses Mk 149 APDS, Mk 220 TPT and Mk 246 HEI-TSD and each barrel has a life of 15,000 rounds.

Specifications

Calibre: 20 mm
Length of barrel: 76 calibres
Muzzle velocity: 1,030 m/s (3,380 ft/s)
Rate of fire: 600-1,200 rds/min
Weight of shell: 294 g (10.4 oz)
Range (effective):
anti-surface: 1 n mile (1.85 km)
anti-air: 1,200 m (4,000 ft)
Traverse: 360°
Elevation: −15 to +75°

Manufacturer/Contractor

General Electric Company, Armament Systems Department (Sea Vulcan).

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

US GFCS Mk 63
Provides control of 76 mm guns.

Manufacturer/Contractor
Mitsubishi Electric Corporation (MELCO), Tokyo, Japan.

RADARS

Mitsubishi OPS 14B
OPS-14B is a B/C-band air search radar. Peak power is 400 kW and beamwidth is 5°.

JRC OPS 16
OPS-16 is a surface search radar, operating in the D-band.

Western Electric SPG-34
The Western Electric SPG-34 is associated with the Mk 63 GFCS. It works in the I/J-bands and produces a $3 \times 3°$ conical scan beam for target acquisition and a 0.75° conical scan beam for target tracking.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: There is a large flight deck aft
Hangar: No hangar

Helicopters: The flight deck will accommodate one Mitsubishi/Sikorsky S-80M-1 Sea Dragon, a licence-built version of the Sikorsky MH-53E mine counter-measures helicopter.

PROPULSION

Specifications
System: Diesel
Main machinery: 4 Kawasaki-MAN V6V22/30ATL diesels; 4.7 MW (6,400 hp(m))
Shafts: 2

FURTHER INFORMATION

PROGRAMME

Hayase (MST 462) and *Souya* (MMC 951) were laid down and built at the same time, are approximately the same size, and both serve as MCM Flotilla flagships. They are, however, of quite different design.

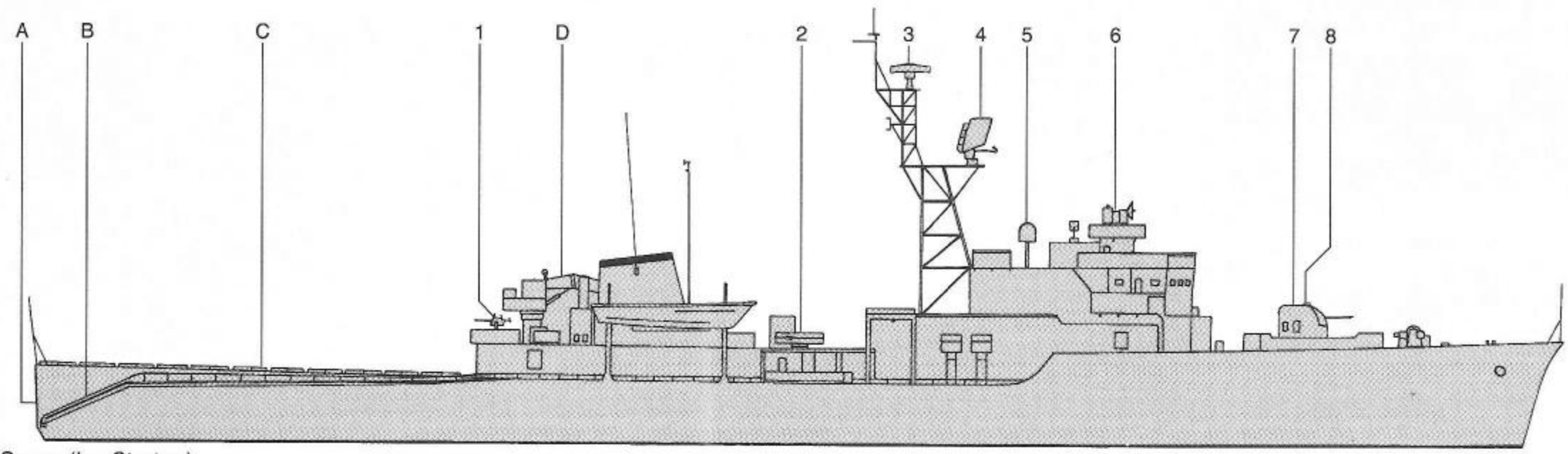
DEPLOYMENT

Hayase served as flagship of the JMSDF deployment to the Gulf in 1991, and is normally employed as flagship for Minesweeper Flotilla One based at Kure.

THE FUTURE

Two new minelayers/MCMV support ships are under construction. *Souya* will be replaced by the first and *Hayase* by the second.

SOUYA



Souya (Ian Sturton)

Minelaying A *Stern door; four minerails* **B** *Side minelaying rails (two)* **C** *Flight deck for S-80M-1 Sea Dragon MCM helicopter* **D** *Crane*

General 1 *Hughes 20 mm/76 Sea Vulcan, JM-1MB* **2** *324 mm torpedo tubes* **3** *JRC OPS-16 surface search radar* **4** *MELCO OPS-14B air search radar* **5** *Satcom* **6** *MELCO GFCS-1B fire-control system* **7** *US 76 mm (3 in)/50 gun* **8** *AN/SPG-34 fire-control radar (on port side of gunhouse)*

GENERAL SPECIFICATIONS

Operator: Japan
Type: Minelayer

Class: SOUYA

Built: 1
Active: 1

Displacement:
standard: 2,150 t
full load: 3,300 t

Dimensions
Length: 99 m (324.8 ft)
Beam: 15 m (49.5 ft)
Draught: 4.2 m (13.9 ft)

Speed: 18 kts
Range: 7,500 n miles at 14 kts

Complement: 185

SHIPS

SOUYA (MMC 951)
Builder Hitachi, Maizuru, Japan
Launched 31 Mar 1971
Commissioned 30 Sep 1971

MINELAYING

SYSTEM

There are six internal mine rails in the mine deck which discharge through doors in the transom. There are also two external rails discharging down sloping ramps on either side of the stern.

MINES

460 buoyant

SONARS

AN/SQS-11A
AN/SQS-11A is a 1960s vintage US Navy sonar, operating at 20 kHz, with a range of some 1,500 m (1,600 yd). It is a hull-mounted, active, search and attack set.

ZQS-1B
The ZQS-1B bow-mounted, active, search and attack, high-frequency set is the standard JMSDF mine avoidance sonar. It is a licence-produced version of the British Type 193M.

WEAPONS SYSTEMS

TORPEDOES

324 mm Type 68 (2 triple) tubes
Six 324 mm Type 68 (2 triple) tubes for Mk 46 Mod 5 Neartip torpedoes.

Specifications
Mk 46 Mod 5
Length: 2.59 m (8.5 ft)
Diameter: 324 mm
Weight: 230 kg (507 lb)
Warhead: 44 kg HE (97 lb)
Propulsion: Liquid propellant
Speed: 45 kts (max)
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,508 ft) (estimated)

Manufacturer/Contractor
Alliant TechSystems, USA.
Mitsubishi Heavy Industries, Japan.

GUNS

US 76 mm (3 in)/50 Mk 33
One twin 76 mm (3 in) 50 on the foredeck in 'A' position. The Mk 33 is a twin-gun, power-driven, base-ring mount with local or remote control. All Mk 33 mounts use amplidyne elevation and training power drives. The guns used are the Mk 22 Mods 4 to 9 and each has an automatic loader Mk 2, capable of handling up to 50 rds/min. Four drum ammunition magazines are available. The Mods 4 and 7 mountings have environmental shields made from either GRP or aluminium, for protection against icing and bad weather.

Specifications
Traverse: 360° at 30°/s (manual)
Elevation: −14/15 to +85° at 24°/s (manual)
Mounting weight: 15.8 t
Rate of fire: 100 rds/min

Hughes 20 mm/76 Sea Vulcan 20P/ JM-1MB
Two Hughes 20 mm/76 Sea Vulcan 20P mountings, with three barrels per mounting. The Sea Vulcan 20P is a manually operated weapon which has been adopted by the Japanese Maritime Self-Defense Force as JM 61MB, and is, in essence, an M-197 gun on the mounting of the old 20 mm single US Navy Oerlikon Mk 10. The M-197 gun is an externally powered weapon using a cluster of three 20 mm barrels. Each barrel is 1.52 m (5.0 ft) long and weighs 8.18 kg (18.0 lb). The weapon uses Mk 149 APDS, Mk 220 TPT and Mk 246 HEI-TSD and each barrel has a life of 15,000 rounds.

Specifications
Calibre: 20 mm
Length of barrel: 76
Muzzle velocity: 1,030 m/s (3,379 ft/s)
Rate of fire: 600-1,200 rds/min

Weight of shell: 294 g (10.4 oz)
Range (effective):
anti-surface: 1 n mile (1.85 km)
anti-air: 1,200 m (4,000 ft)

Traverse: 360°
Elevation: −15 to +75°

Manufacturer/Contractor
General Electric Company, USA.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Mitsubishi GFCS-1B fire-control system
Souya is fitted with the Gunfire Control System Model 1B (GFCS-1B), also known as the Type 72.

Manufacturer/Contractor
Mitsubishi Electric Corp (MELCO), Tokyo, Japan.

RADARS

Mitsubishi OPS 14B
OPS-14B is a B/C-band air search radar. Peak power is 400 kW and beamwidth is 5°.

Manufacturer/Contractor
Mitsubishi Electric Corporation (MELCO), Tokyo, Japan.

JRC OPS 16
OPS-16 is a surface search radar, operating in D-band.

Manufacturer/Contractor
JRC, Tokyo, Japan.

Western Electric SPG-34
The Western Electric SPG-34 is associated with the GFCS-1B. It works in the I/J-bands and produces a 3 × 3° conical scan beam for target acquisition and a 0.75° conical scan beam for target tracking.

Manufacturer/Contractor
Western Electric, USA.

IFF
US Mk 10.

AVIATION

AVIATION FACILITIES

Specifications
Flight deck: There is a large flight deck aft
Hangar: No hangar

Helicopters: The flight deck will accommodate one Mitsubishi/Sikorsky S-80M-1 Sea Dragon, a licence-built version of the Sikorsky MH-53E mine counter-measures helicopter

PROPULSION

Specifications
System: Diesel
Main machinery: 4 Kawasaki-MAN V6V 22/30 ATL diesels; 4.7 MW (6,400 hp(m))
Shafts: 2

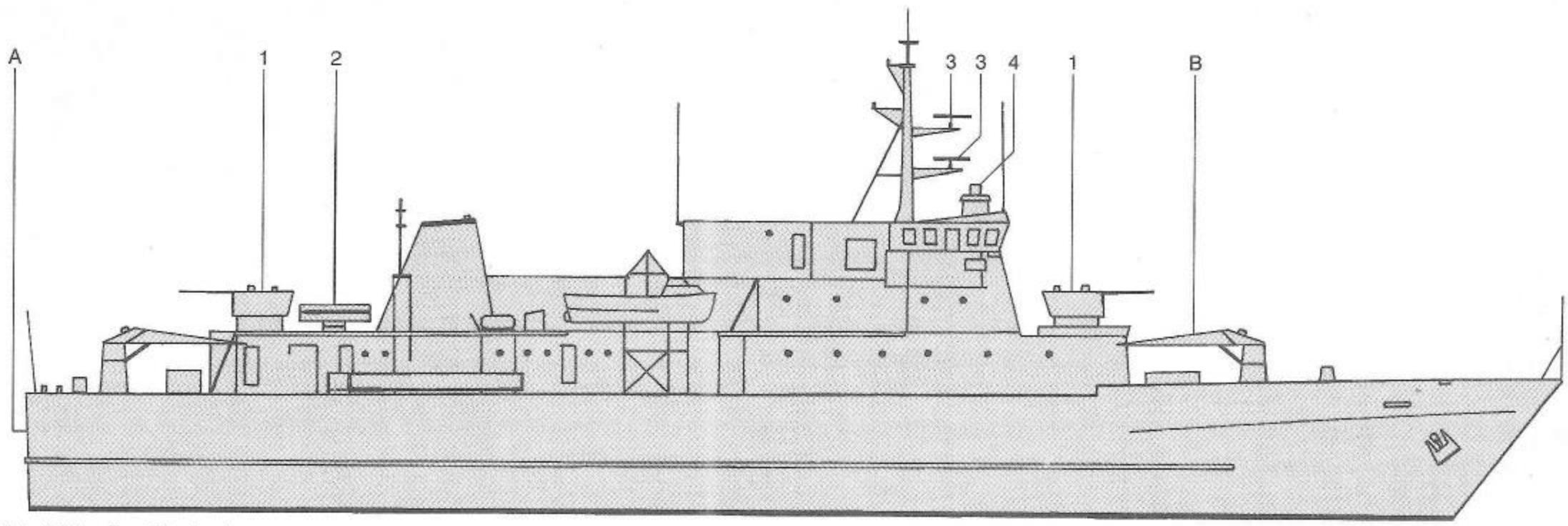
FURTHER INFORMATION

Souya was built in the same time-frame as *Hayase*, but differs in having a forecastle, two sonars and a greater mine capacity. Like *Hayase*, however, *Souya* is a dual-purpose ship, used as a minelayer with a minesweeper support ship, in which role it also serves as flagship for Minesweeper Flotilla Two based at Yukosuka.

THE FUTURE

It is planned that *Souya* will be paid off in 1997, being replaced by the first of the new minelayers.

VIDAR



Vale/Vidar (Ian Sturton)
Minelaying A *Stern door; three rails* **B** *Cranes (two)*

General 1 *Bofors 40 mm/70-315* **2** *324 mm torpedo tubes* **3** *Racal-Decca TM 1226 surface search/navigation radar* **4** *Saab TV3-300 electro-optic director*

GENERAL SPECIFICATIONS

Operator: Norway
Type: Minelayer

Class: VIDAR

Built: 2
Active: 2

Displacement:
standard: 1,500 t
full load: 1,673 t

Dimensions
Length: 64.8 m (212.6 ft)
Beam: 12 m (39.4 ft)
Draught: 4 m (13.1 ft)

Speed: 15 kts

Complement: 50

SHIPS

VIDAR (N 52)

Builder	Mjellem and Karlsen, Bergen, Norway
Launched	18 Mar 1977
Commissioned	21 Oct 1977

VALE (N 53)

Builder	Mjellem and Karlsen, Bergen, Norway
Launched	5 Aug 1977
Commissioned	10 Feb 1978

MINELAYING

SYSTEM

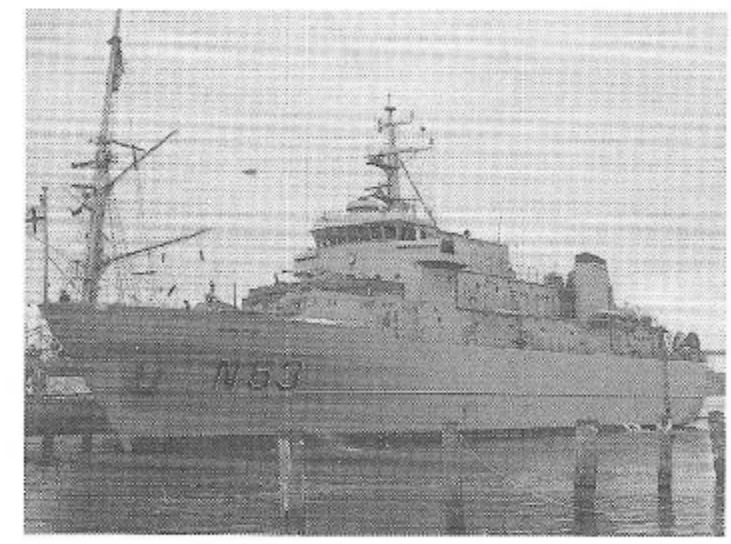
The mines are carried on three decks, with an automatic elevator between them. The mines are loaded through forward and aft hatches, each being served by two cranes. The main deck is equipped with three mine rails which lay the mines through doors in the stern.

MINES

300 to 400 depending on size and type.

SONAR

Simrad SQ-3D
SQ-3D is a hull-mounted search and attack sonar, operating at 24 kHz, with a maximum range of 2,500 m (2,734 yd).



Vale *(N 53)* (H & L van Ginderen Collection)

WEAPONS SYSTEMS

TORPEDOES

324 mm US Mk 32 torpedo tubes
These ships mount six (two triple) 324 mm torpedo tubes for Mk 46 Mod 5 torpedoes. The Mk 46 is a deep-diving, high-speed torpedo fitted with active/passive acoustic homing and is intended mainly for use against submarines.

Specifications
Mk 46 Mod 5
Length: 2.59 m (8.5 ft)
Diameter: 324 mm
Weight: 230 kg (507 lb)
Warhead: 44 kg HE (97 lb)
Propulsion: Liquid propellant
Speed: 45 kts (max)
Range: 5 n miles (9.25 km)
Acquisition range: 460 m (1,508 ft) (estimated)

Manufacturer/Contractor
Alliant TechSystems, USA.

GUNS

Bofors 40 mm/70-315
There are two SAK 40L/70-315 AA guns. This is a manually laid mounting in which the gun platform is on a pedestal. The mounting has a protective shield and includes ammunition racks for 96 rounds.

Specifications
40 mm/70-315
Traverse: 360° (nominal) at 30°/s
Elevation: −3 to +85° at 24°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Manufacturer/Contractor
Bofors Weapon Systems, Sweden.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Saab TVT-300 electro-optic director

The Saab TVT-300 director tracks objects automatically, using the optical contrasts of an object against its background as seen by a TV camera. The system consists of a TV camera on a gyrostabilised platform, a monitor, and an electronics unit containing video processing and servo-control circuits. The operator uses a joystick to place an electronic 'window' on the target. Automatic tracking is then initiated, with the servo-control circuits keeping the 'window' centred on the target contrast and aligning the target to the centre of the camera field of view. The platform angular positions in bearing and elevation are used for automatic tracking of the guns, which are slaved to the system.

Specifications
Traverse: 360°
Elevation: −30 to +85°
Speed (elevation and traverse): 40°/s

Manufacturer/Contractor
Saab Missiles, Linkoping, Sweden.

RADAR

Racal-Decca TM 1226

I-band surface search/navigation radar. Two per ship.

Specifications
TM 1226
Role: Surface search
Frequency: I-band
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1 µs
Scan rate: 28 rpm

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Wichmann 7AX diesels; 3.1 MW (4,200 hp(m))
Thruster: 1 bow thruster, 312 kW (425 hp(m))
Shafts: 2

FURTHER INFORMATION

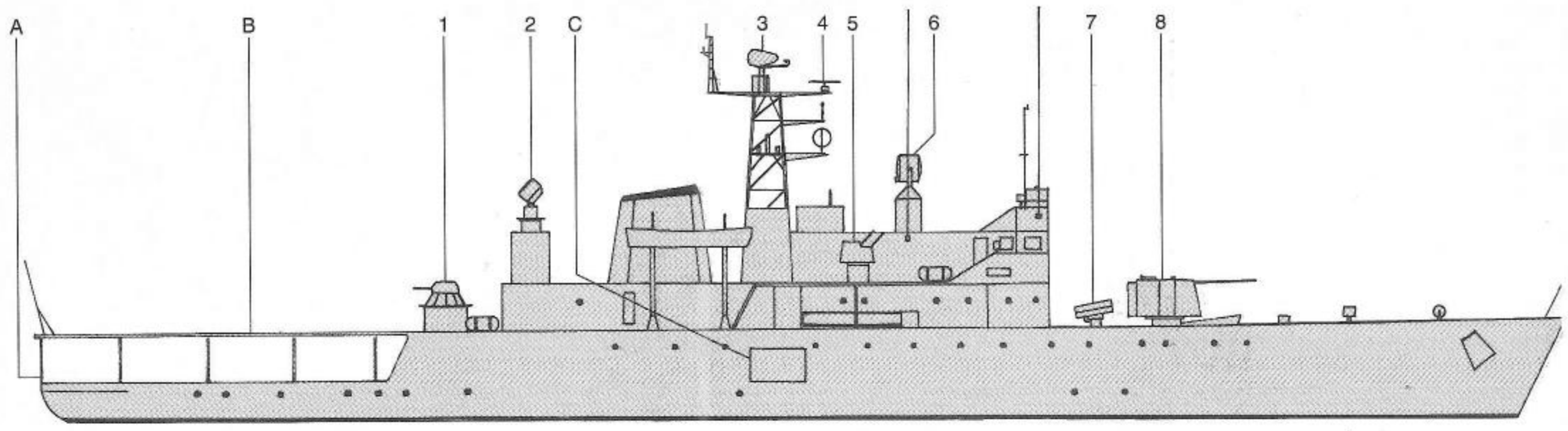
PROGRAMME

These two ships were ordered on 11 June 1975, laid down in 1976 and entered service in 1977 *(Vidar)* and 1978 *(Vale)*.

DESIGN

These are versatile ships that can perform a number of roles in addition to minelaying, including transports, ASW escorts (for which they mount six ASW torpedo tubes), torpedo recovery, offshore patrols and fishery protection. In war they would be supplemented as minelayers by commercial ships such as ro-ro ferries.

COSAR



Cosar (Ian Sturton)
Minelaying A *Two mine rails, discharging over the stern* **B** *Flight deck* **C** *Mine loading ports*

General 1 *AK-230 twin 30 mm CIWS (two)* **2** *Drum Tilt radar fire director (AK-230)* **3** *Strut Curve air/surface search radar* **4** *Don 2 navigation radar* **5** *Type 82 twin 14.5 mm machine gun (two)* **6** *Muff Cob radar fire director (76 mm gun)* **7** *RBU 1200 ASW mortar* **8** *57 mm/70 gun*

GENERAL SPECIFICATIONS

Operator: Romania
Type: Minelayer/MCM support

Class: COSAR

Built: 2
Active: 2

Displacement:
standard: 1,200 t
full load: 1,450 t

Dimensions
Length: 79 m (259.1 m)
Beam: 10.6 m (34.8 ft)
Draught: 3.6 m (11.8 ft)

Speed: 19 kts

Complement: 75

SHIPS

VICE ADMIRAL IOAN MURGESCU (271)
Builder Mangalia Shipyard, Mangalia, Romania
Commissioned 30 Dec 1980

VICE ADMIRAL CONSTANTIN BALESCU (274)
Builder Mangalia Shipyard, Mangalia, Romania
Commissioned 16 Nov 1981

MINELAYING

SYSTEM

In these Romanian ships the mines are discharged from the after deck over the stern, whereas virtually all other dedicated minelayers have their mine rails inside an enclosed mine deck and discharge them through doors in the transom. There are two sets of mine rails and in view of the number of mines these rails must extend well inside the superstructure.

MINES

Up to 200 mines, depending on type.

SONAR

Tamir II
This hull-mounted active search sonar was originally based on a copy of a British wartime searchlight sonar. It is a general purpose sonar, but is probably used in this application for bottom survey.

WEAPONS SYSTEMS

GUNS

57 mm/70
These ships have a single 57 mm in a 'tub' mounting in 'A' position. The air-cooled 57 mm ZIF-31B is a conventional weapon using a vertical wedge breech block with the casing containing part of the loading system while the elevation gear is below it. Rounds are fed into the loading system at the top of the gun with the clips being removed as the individual rounds are fed onto the loading tray. The round is automatically fed into the breech where the block is locked as it moves forward from recoil. Subsequently the breech opens and extractor arms remove the spent round and eject it.

Specifications
ZIF-31B
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Traverse: 360° at 25°/s
Elevation: −10 to +85° at 40°/s
Crew: 5
Range:
anti-surface: 4.52 n miles (8.4 km)
anti-air: 4,500 m (14,760 ft)
Rate of fire: 120 rds/min
Ammunition: 2.81 kg (6.2 lb)

30 mm/65 AK-230 twin mounting
There are two twin AK-230 turrets. The AK-230 is a remotely operated, twin barrel, automatic anti-aircraft gun designed to engage air targets at heights of up to 4,000 m (13,120 ft). It is also capable of engaging surface targets at ranges up to 2.2 n miles (4 km). There are two 64.2 calibre, water-cooled, NN30 guns, each with a liner and a rotating breech with four chambers. The elevating mechanism is on the carriage together with a compressed air tank and associated equipment for the loading system. Russian ammunition for this weapon consists of two rounds; BR-83 and OF-83D (see Specifications). The fire-control radar is the I/J-band *Rys* (NATO = Drum Tilt), whose maximum acquisition range is approximately 22 n miles (40 km), with each radar director controlling two gun mountings.

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)

Vice Admiral Ioan Murgescu (271) is one of two combined minelayers and MCMV support ships, but is the only one with a flight deck (Romanian Navy)

Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-6,248 lb)
Crew: 2 (off mount)

Type 82 14.5 mm machine guns

Two twin mounts. These are Russian-designed weapons, produced in China and exported to Romania.

Specifications

Type 82
Calibre: 14.7 mm
Length of barrel: 93 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Range (max): 7,000 m (7,700 yd)
Rate of fire: 600 rds/min/barrel
Traverse: 360°
Elevation: −5 to +90°

ANTI-SUBMARINE MORTARS

RBU 1200

Two fixed five-tube RBU 1200 launchers are fitted per ship. This mounting is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm, is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (75 lb) warhead and a range of about 0.8 n miles (1.5 km).

Specifications

RBU-1200
Calibre: 250 mm
Launcher tubes: 5
Elevation: +65°
Warhead: 34 kg (75 lb)
Range: 0.8 n miles (1.5 km)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog

One Watch Dog radar warning receiver covering the band 1 to 12 MHz. There is also at least one DF loop antenna.

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve

Strut Curve is an F-band air/surface search radar.

Don 2

A standard Russian I-band navigation radar.

Muff Cob

Muff Cob is the fire-control system for the 57 mm gun. Its antenna array is in a 1 m (3.28 ft) wide, weatherproof mounting suspended from a trunnion-yoke carried on a traversing mounting on the mast. The radar is supplemented by an electro-optic sensor. The height of the mounting is about 3 m (9.8 ft) and the H-band radar can probably tilt from −10 to +50° as with the gun mounting.

Drum Tilt

Drum Tilt is the H/I-band radar used in the fire-control system for the AK-630 CIWS. Normally there is one Drum Tilt to each pair of AK-630s, but it appears that in this ship the single Drum Tilt controls both pairs.

AVIATION

Specifications

Vice Admiral Ioan Murgescu (271) only
Flight deck: There is a flight deck at the stern, which, coincidentally, provides some shelter for the mine rails underneath.
Hangar: There is no hangar
Helicopters: The only aircraft likely to be used is the IAR-316, a licence-built version of the Alouette IIIB.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 diesels; 4.7 MW (6,400 hp(m))
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These two minelayers were part of the major warship-building programme undertaken by the Ceausescu regime in the early 1980s.

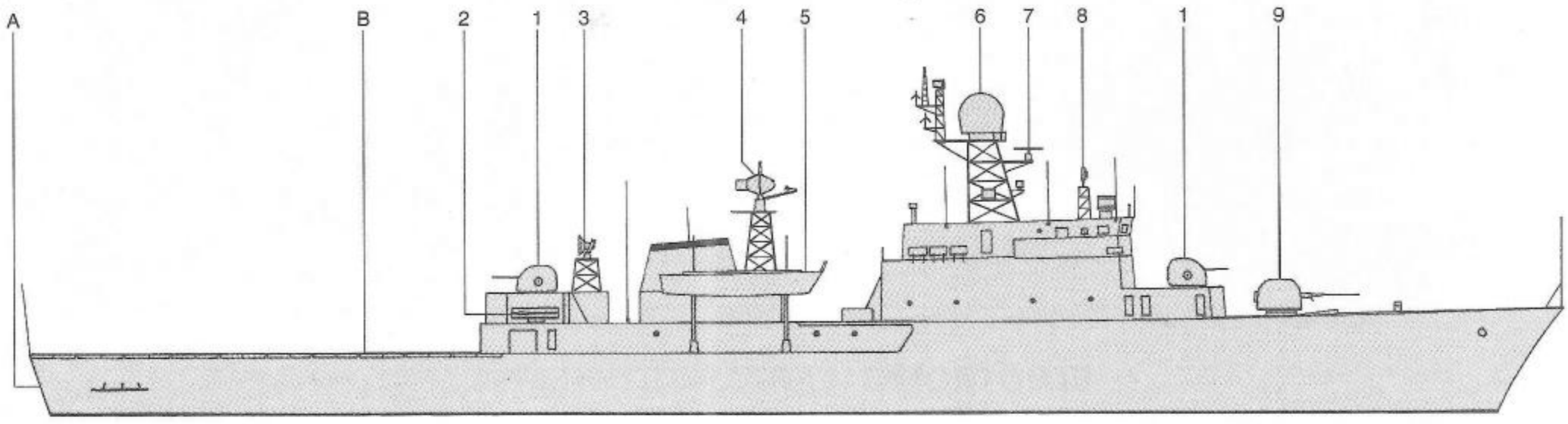
DESIGN

These ships appear to use the same hull as the survey/research ship *Grigore Antipa;* the particulars are virtually identical, although there are, of course, differences in the superstructure and layout.

The two ships in the class are different from each other in that *Vice Admiral Ioan Murgescu* (271) has a helicopter platform aft, while *Vice Admiral Constantin Balescu* (274) does not, mounting a large crane on the after deck, instead.

Recognising that the minelaying tasks will be completed soon after the outbreak of hostilities, these ships have a secondary role as Mine CounterMeasure Vessel (MCMV) command and support ships.

SOUTH KOREA MINELAYER



Korean Minelayer (Ian Sturton)
Minelaying A *Stern doors for two mine rails* **B** *flight deck*

General 1 *OTOBREDA 40 mm/70 compact* **2** *Triple 324 mm torpedo tubes (two)* **3** *Electro-optic director* **4** *Air search radar* **5** *LCVP* **6** *Surface search radar* **7** *Navigation radar* **8** *Electro-optic director* **9** *OTOBREDA 76 mm (3 in)/62 gun*

GENERAL SPECIFICATIONS

Operator: South Korea
Type: Minelayer

Building: 1
Ordered: 3
Active: 0

Displacement:
full load: 3,300 t

Dimensions
Length: 103.8 m (340.5 ft)

Beam: 15 m (49.2 ft)
Draught: 3.4 m (11.2 ft)

Speed: 22 kts
Range: 4,500 n miles at 15 kts

Complement: 160

MINELAYING

SYSTEM

There will be two mine rails in the hull, laying mines through two large doors in the transom. Loading will be done using two derricks forward.

MINES

Estimated 300 to 400, depending on type.

AVIATION FACILITIES

There will be a large helicopter flight deck, but no hangar.

WEAPON SYSTEMS

TUBES

Six 324 mm US Mark 32 Mod 5 (two triple) torpedo tubes will be fitted in each ship.

Specifications
Length: 3.43 m (11.25 ft)
Height: 1.26 m (4.13 ft)
Width 94.3 cm (3.09 ft)
Tubes: 3
Tube diameter: 324 mm (12.75 in)

GUNS

OTOBREDA 76 mm (3 in)/62 Compact
There is one OTOBREDA 76 mm (3 in) gun sited in the 'A' position on the foredeck for use in either air defence or anti-surface roles. If the weapon is designated to the air-defence solution, the command and control system will decide whether the target should be engaged by gun, missile or electronic emission.

Specifications
Calibre: 76 mm (3.0 in)
Length of barrel: 62 calibres
Traverse: 360° at 70°/s
Elevation: −15 to +85° at 40°/s
Muzzle velocity: 900 m/s (2,952 ft/s)
Maximum rate of fire: 85 rds/min
Range:
anti-surface: 8.6 n miles (16 km)
anti-air: 6.5 n miles (12 km)

Manufacturer/Contractor
OTOBREDA, La Spezia, Italy.

OTOBREDA 40 mm L/70 Compact (Type 70)
Two single 40 mm turrets are mounted, one in 'B' position, the other aft in 'X' position.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −13° to +85° at 60/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Effective range:
anti-surface: 3.25 n miles (6 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 2

SENSORS AND ELECTRONIC SYSTEMS

No details of electronic warfare and command systems have yet been announced, but will include:

- Decoys. Two chaff launchers
- Electronic warfare. Complete suite, with both ESM and ECM components.
- Weapons control. Electro-optic director.
- Radars. Radar sets will include air/surface search, fire control, and navigation functions.
- Sonar. A model shows a bow-mounted sonar.

PROPULSION

System: Combined diesel and diesel (CODAD)
Main machinery: 4 diesels, 12.64 MW (17,200 hp(m))
Shafts: 2

FURTHER INFORMATION

PROGRAMME

This is the RoK Navy's first purpose-built minelayer design, and will be one of the most sophisticated of its type in any navy. The project design contract was placed with Hyundai in 1991 and completed in mid-1993. The order for the first of class was placed in 1994 with Hyundai and the ship is due to be completed in September 1997.

A model shows the flight deck occupied by a Sikorsky MH-53, although this is not a type currently operated by the South Korean Navy. This seems to suggest that these ships will be used as MCMV support ships once they have discharged their minelaying tasks.

ALESHA (ALYOSHA POPOVICH)

GENERAL SPECIFICATIONS

Operator: Russia
Type: 617
National type name: *Zagraditel Minny* (Minelayer)

Class: ALYOSHA POPOVICH (RUSSIA); ALESHA (NATO)

Displacement:
full load: 3,860 t

Dimensions
Length: 99 m (324.8 ft)
Beam: 13.5 m (44.3 ft)
Draught: 5.4 m (17.7 ft)

Speed: 24 kts
Range: 4,000 n miles at 16 kts

Complement: 150

SHIPS

VYCHEGDA
SUKONA

MINELAYING

SYSTEM

These ships are fitted with four mine tracks running through the hull and launching the mines over the transom. There is an arch-like device across the stern which is clearly part of the mine-launching system.

MINES

An average of 400 mines can be carried, depending upon the type

WEAPONS SYSTEMS

GUNS

Quad 57 mm/70
The only armament is a single quad 57 mm/50 mount on a pedestal on the foredeck. This mount was obtained from army stocks and is the only known remaining example of the type in naval use.

Specifications
Length of barrel: 77 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Traverse: 360° at 30°/s
Elevation: −10 to +85° at 25°/s
Crew: 5

Range:
anti-surface: 4.52 n miles (8.4 km)
anti-air: 4,500 m (15,000 ft)
Rate of fire: 120 rds/min/barrel
Ammunition: 3.81 kg (6.2 lb)

COMMAND AND CONTROL SYSTEMS

RADARS

Strut Curve search radar
The air search radar is the Russian MR-302 (NATO = Strut Curve) a medium-range, general-purpose, F-band, air search radar. The elliptical lattice reflector is mounted at the masthead. Range performance against a 2 m² aircraft target at medium altitude is about 60 n miles (110 km) with a likely maximum range of 150 n miles (280 km).

Don 2
Don 2 is an I-band navigation radar

Muff Cob
Muff Cob is the director for the 57 mm fire-control system and is the large cylindrical radome atop the small tower overlooking the quarterdeck. The radome is supported by a trunnion yoke in a traversing mounting and is thus capable of both elevation and traverse. There is a device to the left of the radome (from the front), with a remotely-controlled cover, which may be a TV camera. The F/G-band radar is named Muff Cob by NATO and Bars (Wildcat) by the Russian Navy.

IFF
High Pole B.

PROPULSION

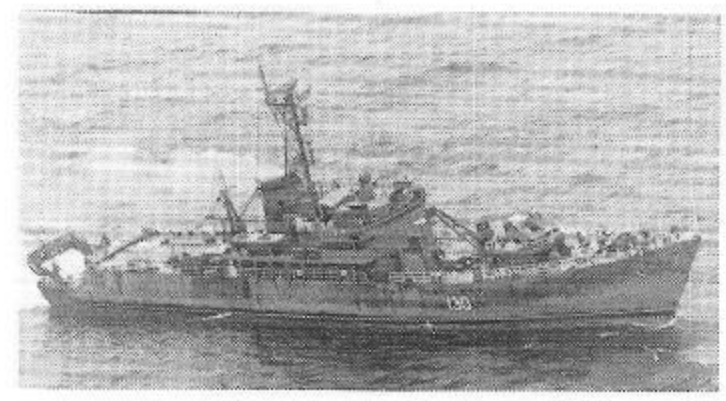
Specifications
System: Diesel
Main machinery: 4 diesels; 22.4 MW (30,000 hp(m))
Shafts: 2

FURTHER INFORMATION

Three of these ships were built between 1967 and 1976, and while their primary mission is minelaying, they have been designed to meet a number of other requirements, as well. These alternative roles include: MCMV support; netlayers; command ships; and ELINT (*Vychegda* was sighted in the Pacific in 1991 with Elint vans on the foredeck).

DEPLOYMENT

The three ships were originally deployed with one to each of the major fleets (Northern, Baltic and Pacific) but only the Northern (*Sukhona*) and Pacific Fleet (*Vychegda*) ships are now operational.



Vychegda. *Note the arch-like device over the stern, which is part of the minelaying system* (G Jacobs)

ÄLVSBORG

GENERAL SPECIFICATIONS

Operator: Sweden
Type: Minelayer

Class: ÄLVSBORG

Built: 2
Active: 1

Displacement:
standard: 2,400 t
full load: 2,650 t

Dimensions
Length: 92.4 m (303.1 ft)
Beam: 14.7 m (48.2 ft)
Draught: 4 m (13 ft)

Speed: 16 kts

Complement: 95 (plus accommodation for 158 Admiral's staff)

SHIPS

VISBORG (M 03)

Builder	Karlskronavarvet, Karlskrona, Sweden
Laid down	16 Oct 1973
Launched	25 Jan 1975
Commissioned	6 Feb 1976

MINELAYING

SYSTEM

Two mine rails inside the hull, laying through doors in the transom.

MINES

Up to 300 depending on type.

AVIATION

Specifications
Flight deck: There is a T-shaped flight deck aft
Hangar: No hangar
Helicopters: No specific helicopter is allocated to the ship

WEAPONS SYSTEMS

GUNS

Bofors SAK 40 L/70
There are three Bofors 40 mm, one each in 'A', 'B' and 'X' positions, respectively.

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Rate of fire: 300 rds/min
Range: 6.75 n miles (12.5 km)

Mounting
Weight: 2.89 t (unloaded)
Traverse: 360°
Elevation: −9 to +85°

Manufacturer/Contractor
Bofors Ordnance, Sweden

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES

CelsiusTech Philax
The Philax fixed launcher has four magazines similar to those used in Dagaie with Lacroix munitions. Usually the magazines contain chaff munitions but one may be replaced by an Infra-Red (IR) munitions magazine. Philax systems use Lacroix munitions, which are fired by a single cartridge in each of the four chaff groups or each of the three to six IR containers. Each chaff magazine has 36 × 40 mm grenades, which are fired at intervals of 0.1 second per group and within 1 second begin to create a cloud with a 1,000 m² radar cross-section, which is complete within 5 seconds at a height of 40 to 60 m (131 to 197 ft).

Specifications
Launchers
Length: 87.5 cm (34.5 in)
Height: 72 cm (28.35 in)
Width: 95 cm (37.4 in)
Weight (unloaded): 180 kg (397 lb)

Control
Length: 32.9 cm (12.95 in)
Height: 40.8 cm (16.1 in)
Width: 49 cm (19.3 in)
Weight: <20 kg (<44.1 lb)

Manufacturer/Contractor
CelsiusTech, Sweden.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

CelsiusTech 9LV 200 Mk 2
The weapons control system is the 9LV 200 Mk 2, which uses electro-optical and computing elements from the 9LV 100 electro-optic director. It can engage two air targets simultaneously and for surface engagements, using surface-to-surface missiles, it features a track while scan capability.

Manufacturer/Contractor
CelsiusTech, Sweden.

RADAR

Surface Search
One Raytheon E/F band radar is used for surface search; type unknown.

PROPULSION

Specifications
System: diesel

Main machinery: 2 Nohab-Polar diesels; 3.1 MW (4,200 hp (m))
Shafts: 1

FURTHER INFORMATION

First of class *Älvsborg* was ordered in 1968, followed shortly after by the order for *Visborg*. *Älvsborg's* role was changed in 1994 to that of general support ship with no minelaying capability, while *Visborg* now serves as Command Ship for C-in-C Coastal Fleet and as a minelayer.

CARLSKRONA

GENERAL SPECIFICATIONS

Operator: Sweden
Type: Minelayer/Training ship

Built: 1
Active: 1

Displacement:
standard: 3,300 t
full load: 3,550 t

Dimensions
Length: 105.7 m (346.7 ft)
Beam: 15.2 m (49.9 ft)
Draught: 4 m (13.1 ft)

Speed: 20 kts

Complement: Minelayer — 118, Training ship — 50 plus 136 trainees

SHIPS

CARLSKRONA (M 04)

Builder	Karlskronavarvet, Karlskrona, Sweden
Launched	28 Jun 1980
Commissioned	11 Jan 1982

MINELAYING

SYSTEM

The mine rails are inside the hull and eject the mines through doors in the transom.

MINES

Can lay approximately 105 mines, depending on size.

AVIATION FACILITIES

Specifications
Flight deck: There is a T-shaped flight deck aft
Hangar: No hangar
Helicopters: No specific helicopter is allocated to the ship

WEAPONS SYSTEMS

GUNS

Bofors SAK 57/70 Mk 1
There are two Bofors 57 mm/70 Mk 1, one in 'A' position, the other in 'Y' position.

Specifications
Gun
Calibre: 57 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,020 m/s (3,346 ft/s)
Rate of fire: 200 rds/min
Range: 9 n miles (17 km)

Mounting
Weight: 6.3 t
Traverse: 360°
Elevation: −10 to +75°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

Bofors SAK 40 L/70
There are two Bofors 40 mm, one each in 'B' and 'X' positions, respectively.

Specifications
Gun
Calibre: 40 mm
Length of barrel: 70 calibres
Muzzle velocity: 1,000 m/s (3,280 ft/s)
Rate of fire: 300 rds/min
Range: 6.75 n miles (12.5 km)

Mounting
Weight: 2.89 t (unloaded)
Traverse: 360°
Elevation: −9 to +85°

Manufacturer/Contractor
Bofors Ordnance, Sweden.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

CelsiusTech Philax
The Philax fixed launcher consists of four magazines similar to those used in Dagaie with Lacroix munitions. Usually the magazines contain chaff munitions but one may be replaced by an Infra-Red (IR) munitions magazine. Philax uses Lacroix munitions, which are fired by a single cartridge in each of the four chaff groups or each of the three to six IR containers. Each chaff magazine has 36 × 40 mm grenades, which are fired at intervals of 0.1 second per group and within 1 second begin to create a cloud with a 1,000 m² radar cross-section, which is complete within 5 seconds at a height of 40 to 60 m (131 to 197 ft).

Specifications
Launchers
Length: 87.5 cm (34.5 in)
Height: 72 cm (28.35 in)
Width: 95 cm (37.4 in)
Weight (unloaded): 180 kg (397 lb)

Control Unit
Length: 32.9 cm (12.95 in)
Height: 40.8 cm (16.1 in)
Width: 49 cm (19.3 in)
Weight: <20 kg (<44.1 lb)

Manufacturer/Contractor
CelsiusTech, Sweden.

ARGOsystems AR 700 radar detection system
AR 700 is a modular ESM system covering frequencies from 0.5 to 18 GHz, which is designed to detect most known radar threats. It is fully automatic, identifying threat emitters using a variety of IFM receivers. The antenna array consists of a mast-mounted ESM antenna assembly with two DF arrays, on omnidirectional unit and two monopulse units.

Specifications
ESM frequency coverage: 0.5-18 GHz
High sensitivity: up to −67 dBm
Detection range: 200 n miles (370 km) (ships); 50 n miles (92.5 km) (aircraft)
DF accuracy: 4° RMS; 2° RMS fine DF
Automatic tracking: 500 active signals in dense signal environment
Signal identification speed <1s

Manufacturer/Contractor
ARGOsystems Inc, Sunnyvale, California, USA.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

CelsiusTech 9LV 200 MK 2

The weapons control system is the 9LV 200 Mk 2, which uses electro-optical and computing elements from the 9LV 100 electro optic director. It can engage two air targets simultaneously.

Manufacturer/Contractor

CelsiusTech, Sweden.

RADARS

CelsiusTech Sea Giraffe 50 HC

The Sea Giraffe is used for air and surface search, with the antenna sited at the masthead.

Specifications

Operating frequency: G/H-band
Output power: 60 kW; average power 1200 W
Antenna rotation rate: 60/30 rpm
Instrumented range: 13.6, 27.2, 54.4, 81.4 n miles (25, 50, 100 and 150 km)
Tracking capacity: More than 30 automatically initiated air targets; more than 50 manually initiated surface targets
Antenna sidelobe levels: −45 dB
Beamwidth, bearing: 1.8°
Elevation coverage: 0-70°
Accuracy: 20 m range; 0.3° azimuth

Manufacturer/Contractor

CelsiusTech, Sweden

Surface search

One Raytheon E/F band radar is used for surface search; type unknown.

PROPULSION

Specifications

System: Diesel
Main machinery: 4 Nohab F212 D825 diesels; 7.76 MW (10,560 hp(m))
Shafts: 2
Propellers: cp
Thruster: 1 bow thruster

FURTHER INFORMATION

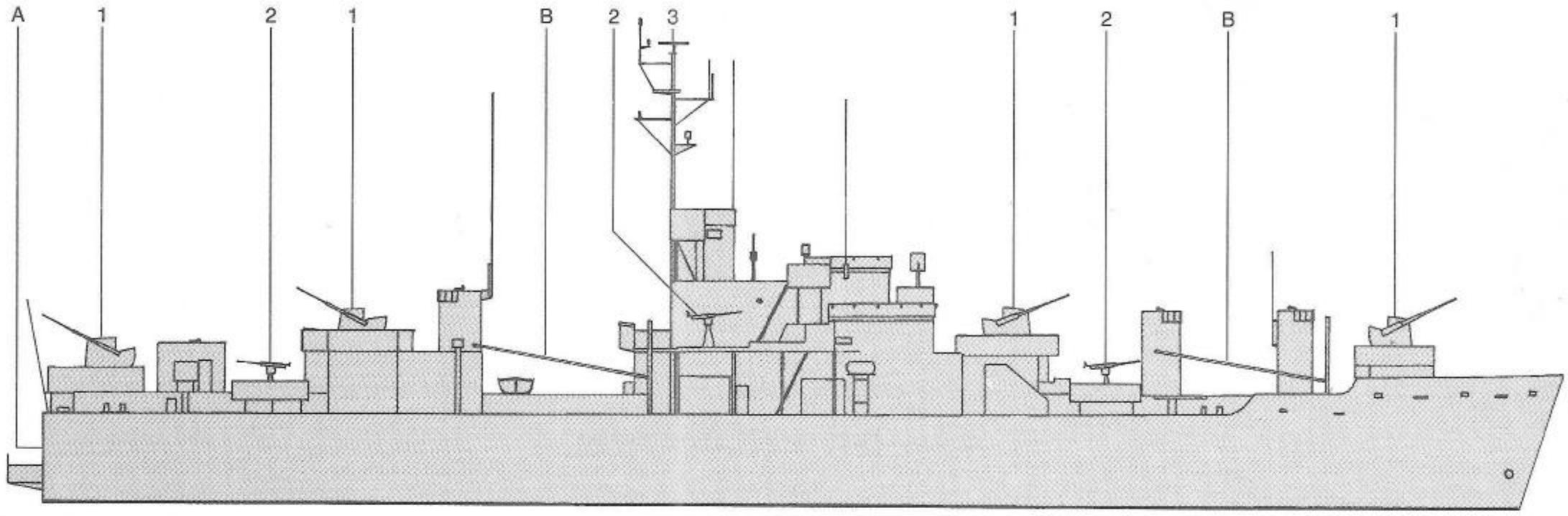
PROGRAMME

Carlskrona was ordered on 25 November 1977, laid down in sections late 1979 and launched to coincide with the Karlskrona company's tercentenary. It is employed as a Midshipmen's training ship as well as a minelayer, and the hull is reinforced below the waterline to enable it to be used also as a 'padded' target for exercise torpedoes. The sonar, which was originally fitted, has now been removed.

The ship's name was originally 'Karlskrona' (the modern spelling of the town's name), but the ship's name was later changed to 'Carlskrona' to honour the present king, Carl Gustav.

Carlskrona *(M 04) is used in peace as the Royal Swedish Navy's major training ship and undertakes an annual 'round-the-world' cruise* (Karlskrona)

LSM 1 MINELAYER CONVERSIONS



Aktion, Amvrakia (Ian Sturton)
Minelaying A *Stern doors (twin rails)* **B** *Derricks*

General 1 *Bofors 40 mm/60 cannon* **2** *Oerlikon 20 mm/70 cannon* **3** *Racal-Decca navigation radar*

GENERAL SPECIFICATIONS

Country of origin: USA
Operators: Greece, Turkey
Type: LSM 1

Displacement:
standard: 720 t
full load: 1,100 t

Dimensions
Length: 62.1 m (203.5 ft)
Beam: 10.4 m (34.2 ft)
Draught: 2.5 m (8.3 ft)

Speed: 12.5 kts
Range: 3,000 n miles at 12 kts

Complement: 65

SHIPS

Greece

AKTION (N 04)
Builder Charleston Navy Yard, Charleston, USA
Commissioned (US Navy) 1 Jan 1945 (LSM 301)
Transferred to Greece 1 Dec 1953

AMVRAKIA (N 05)
Builder Charleston Navy Yard, Charleston, USA
Commissioned (US Navy) 6 Jan 1945 (LSM 303)
Transferred to Greece 1 Dec 1953

Turkey

MERSIN (N 104)
Builder Brown Shipbuilding Company, Houston, Texas, USA
Commissioned (US Navy) 8 May 1945 (LSM 494)
Transferred to Turkey 1 Oct 1952

MINELAYING

SYSTEM

There are two minerails in the hull, laying mines through two large doors in the transom. Loading is done using two derricks forward.

MINES

Greece: 100 to 130 mines, depending on type
Turkey: Up to 400 mines, depending on type

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60

There are eight 40 mm/60 automatic cannon in four twin mountings for air defence roles, which may also be used to engage surface targets.

Specification
Calibre: 40 mm
Length of barrel: 56.25 calibres
Muzzle velocity: 881 m/s (2,890 ft/s) (new gun); 850 m/s (2,788 ft/s) (mid-life)
Range:
anti-surface: 5.5 n miles (10 km)
anti-air: 6,900 m (22,600 ft)

Rate of fire: 60 rds/min (practical), 120 rds/min (cyclic)
Ammunition: 2.21 kg (4.87 lb)

Oerlikon 20 mm cannon

There are six Oerlikon 20 mm cannon.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 0.8 n miles (1.5 km)
anti-air: 1,150 m (3,770 ft)

Rate of fire: 450 rds/min
Round weight: 241 g (8.5 oz)
Projectile: 122 g (4.3 oz)

Mounting
Elevation: −15 to +90°
Total weight: 497 kg (1,095 lb) (including shield)

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca
One Racal-Decca, I-band, navigation radar is carried; type unknown.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 16-278A diesels, 2.24 hp (3,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

In the early 1950s NATO instigated a rapid programme to enhance the ability of a number of member states to lay mines in their littoral waters, particularly 'choke points'. With no suitable ships immediately to hand, it was decided to convert a number of LSM 1s, which were fairly new, of a suitable size, and in plentiful supply. Nine LSM 1s were converted, which were supplied under the Mutual Aid Pact (MAP) to: Denmark — 2; Greece — 2; Norway — 2; and Turkey — 3. The two Norwegian ships were returned to the USA in October 1960 and transferred to the Turkish Navy one month later. Of these, three now survive: two in Greece and one in Turkey.

The German Navy met a similar requirement in a slightly different way, by acquiring three former LSTs from the USA in 1960 and then converting the hulls in Germany.

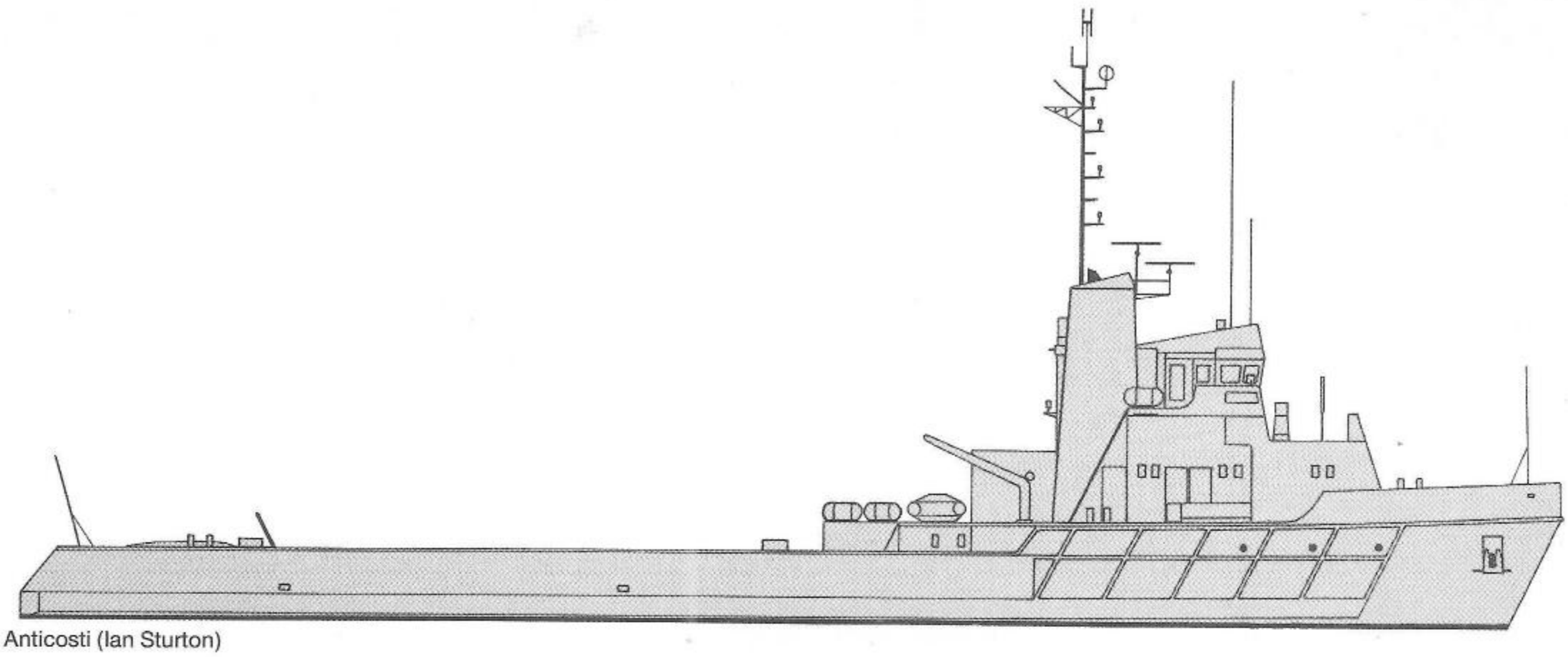
LSM 1 conversion programme

Country	Name	Original Number	Hull Commissioning date	Transfer date	Current status
Denmark	*Beskytteren* (N 50)	LSM 390	1945	8 Jun 1954	Stricken 1966
	Vindhunden (N 51)	LSM 392	1945	1954	Stricken 1966
Greece	*Aktion* (N 04)	LSM 301	1 Jan 1945	1 Dec 1953	In service 1996
	Anvrakia (N 05)	LSM 303	6 Jan 1945	1 Dec 1953	In service 1996
Norway	*Vale* (N 45)	LSM 492	1945	Oct 1952	Returned to USA 1 Oct 1960. To Turkey 1 Nov 1960
	Vidar (N 46)	LSM 493	1945	Oct 1952	Returned to USA 1 Oct 1960. To Turkey 1 Nov 1960
Turkey	*Mordogan* (N 101)	LSM 484	1945	1952	Stricken 1993
	Meric (N 102)	LSM 490	1945	1952	Stricken 1980
	Marmaris (N 103)	LSM 481	1945	1952	Stricken 1980
	Mersin (M 104)	LSM 494	8 May 1945	1 Nov 1960	In service 1996
	Mürefte (M 105)	LSM 492	1945	1 Nov 1960	Stricken 1993

Mersin (N104), the last remaining LSM 1 conversion still in the service of the Turkish Navy

MINE COUNTERMEASURES VESSELS (MCMV)

ANTICOSTI



Anticosti (Ian Sturton)

GENERAL SPECIFICATIONS

Operator: Canada
Type: Minesweepers auxiliary

Class: ANTICOSTI

Purchased: 2
Active: 2

Displacement:
full load: 2,205 t

Dimensions
Length: 58.2 m (191 ft)
Beam: 13.1 m (43 ft)
Draught: 5.2 m (17 ft)

Speed: 13 kts
Range: 12,000 n miles at 13 kts

Complement: 41 (5 officers)

SHIPS

ANTICOSTI (MSA 110)
Builder Allied Shipbuilding, Vancouver, Canada
Entered service (civil) 1973
Purchased Mar 1988
Commissioned 7 May 1989

MORESBY (MSA 112)
Builder Allied Shipbuilding, Vancouver, Canada
Entered service (civil) 1973
Purchased Mar 1988
Commissioned 7 May 1989

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

BAe-SEMA Wire Sweep Mk 9 system
The British Wire Sweep Mk 9 has been purchased for use in these two ships, which, from their supply-ship design, offer what is almost certainly the largest sweep deck in any navy. WS Mk 9 was developed to enable the wire to be operated much closer to the seabed and at far greater depths than had been possible with previous systems. This required the minesweeper to control not only the height of the sweep wire above the seabed, but also its flatness, otherwise it would drag on the seabed and either break or cause the explosive cutters to detonate needlessly. This was achieved by using an additional device, the Wire Sweep Monitoring Equipment (WSME).

MINEHUNTING SONARS

These two ships are fitted with a towed side-scan variable depth sonar.

WEAPONS SYSTEMS

GUNS

These two ships are each armed with two 7.62 mm machine guns.

COMMAND AND CONTROL SYSTEMS

RADARS

Brighttrack 502
There are two Brighttrack 502, I-band, civil navigation radars.

PROPULSION

Specifications
System: Diesel
Main machinery: Four Wärtsilä Nohab Polar SF 16RS diesels; 3.38 MW (4,600 hp(m))

Shafts: Two
Thruster: One Gil Jet bow thruster; 429 kW (57 hp)

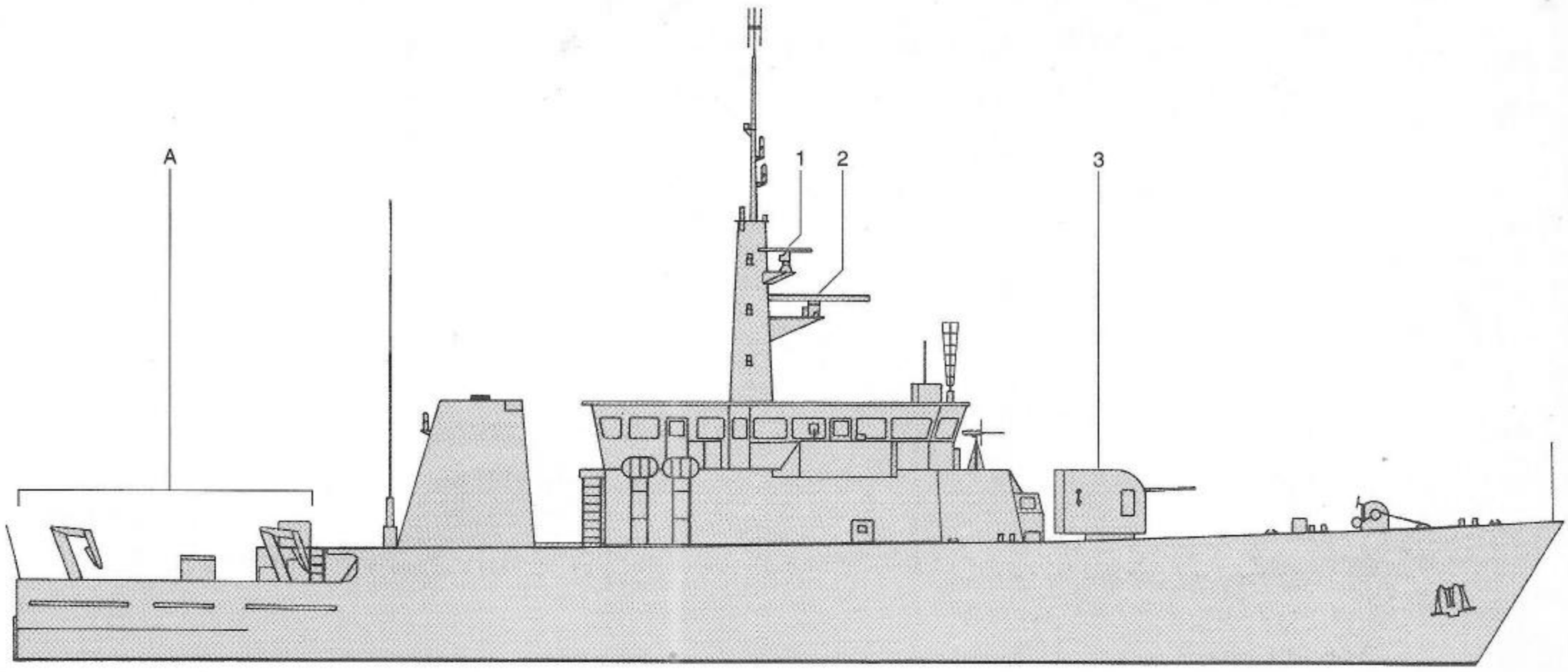
FURTHER INFORMATION

PROGRAMME

These former offshore supply/towing vessels were acquired by the Canadian Maritime Command in 1988, commissioned in 1989, and completed their conversion to MSAs in 1991. They carry the British Wire Sweep Mk 9, and are fitted with Hyperfix and PINS 2000 navigation system. *Anticosti* was also fitted for astern refuelling in mid-1995. Both are designed for use in light ice.

Anticosti *(MSA 110) is a converted Arctic supply ship now used as a minesweeper* (H & L van Ginderen Collection)

KINGSTON



Kingston (Ian Sturton)
MCM A *Mine equipment deck*

General 1 *Kelvin Hughes Type 1007 navigation radar* **2** *Kelvin Hughes Type 6000 surface search radar* **3** *Bofors 40 mm/60 Mk 5C cannon*

GENERAL SPECIFICATIONS

Operator: Canada
Type: Maritime/Coastal Defence Vessel (MCDV)

Class: KINGSTON

Active: 5
Building: 7

Displacement:
full load: 962 t

Dimensions
Length: 55.3 m (181.4 ft)
Beam: 11.3 m (37.1 ft)
Draught: 3.4 m 11.2 ft)

Speed: 15 kts; 10 kts sweeping
Range: 5,000 n miles at 8 kts

Complement: 31 (patrol) 37 (mine counter-measures)

SHIPS

KINGSTON (700)
Builder Halifax Shipyards, Halifax, Canada
Laid down 20 Oct 1994
Launched 12 Aug 1995
Completed 7 Dec 1995

GLACE BAY (701)
Builder Halifax Shipyards, Halifax, Canada
Laid down 28 Apr 1995
Launched 22 Jan 1996
Completed 5 Apr 1996

NANAIMO (702)
Builder Halifax Shipyards, Halifax, Canada
Laid down 10 Aug 1995
Launched Mar 1996
Completed Jul 1996

EDMONTON (703)
Builder Halifax Shipyards, Halifax, Canada
Laid down 7 Dec 1995
Launched Jul 1996
Completed Sep 1996

SHAWINIGAN (704)
Builder Halifax Shipyards, Halifax, Canada
Laid down 28 Mar 1996
Launched Nov 1996
Completed Jan 1997

WHITEHORSE (705)
Builder Halifax Shipyards, Halifax, Canada
Laid down Jul 1996
Launched Feb 1997
Completed Apr 1997

YELLOWKNIFE (706)
Builder Halifax Shipyards, Halifax, Canada
Laid down Nov 1996
Launched Jun 1997
Completed Aug 1997

GOOSE BAY (707)
Builder Halifax Shipyards, Halifax, Canada
Laid down Mar 1997
Launched Oct 1997
Completed Dec 1997

MONCTON (708)
Builder Halifax Shipyards, Halifax, Canada
Laid down Jun 1997
Launched Jan 1998
Completed Mar 1998

SASKATOON (709)
Builder Halifax Shipyards, Halifax, Canada
Laid down Oct 1997
Launched May 1998
Completed Jun 1998

BRANDON (710)
Builder Halifax Shipyards, Halifax, Canada
Laid down Jan 1998
Launched Aug 1998
Completed Oct 1998

SUMMERSIDE (711)
Builder Halifax Shipyards, Halifax, Canada
Laid down May 1998
Launched Dec 1998
Completed Feb 1999

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

MacDonald Dettwiler Integrated Minehunting System

The mine countermeasures suite for the 'Kingston' class comprises the MCDV vessel itself, a shipboard mine warfare control system, a route survey sonar payload, a remotely operated vehicle (ROV) and a mine warfare data centre.

For route surveying the MCDV deploys a towed side scan sonar which provides the necessary data to build up and maintain a sonar image of the seabed. During minehunting, a remotely controlled vehicle tows the sonar and radio the sonar imagery to the ship's command and control centre. Mine neutralisation may be carried out by an ROV or expendable mine destructor.

Each MCDV has a permanently installed mine warfare control system comprising tactical MCM sensor positioning, data analysis and database management subsystems (DBMS). The tactical subsystem integrates all navigation sensor inputs and generates a local operations plot, based on electronic charts. This plot displays 'own ship's' position, sonar towfish position, radar contacts and mine warfare contacts. The data analysis subsystem includes Digital Equipment of Canada multifunction detection and classification consoles for the display and analysis of real-time and historic

Glace Bay *(701)* (H & L van Ginderen Collection)

sonar imagery. The DBMS retrieves all sonar imagery and contacts from previous missions for display by the data analysis subsystem. As new objects are detected and classified they are stored by the DBMS.

Manufacturer/Contractor
MacDonald Dettwiler, Canada.

Side scan sonar
The primary requirement for the side scan sonar for the 'Kingston' class was that it should be capable of detecting buried ground mines, mines with anechoic coatings and irregularly shaped mines in conditions of high background clutter. The sonar is required to operate at depths of 200 m (656 ft) and close to the seabed, providing good object shadowing for accurate classification and to avoid thermal and salinity layers.

The sonar system for the route survey payload has been developed by AlliedSignal Inc, with C-Tech responsible for wet-end electronics, transmitter/receiver, digitiser and beamformer algorithms. Resolution in the classification mode is 12.5 × 12.5 cm and high coverage rates dictate a speed of advance of 10 knots with a 400 m (1,312 ft) swath width.

To meet these requirements a multibeam side scan sonar has been selected. The array is housed in a hydrodynamically stable towfish body based on the US Navy's AN/AQS-20 prototype side scan sonar system, incorporating active control surfaces for bottom following and comprehensive position monitoring instrumentation.

In the route survey mode the sonar towfish is stored in a standard 6 m (19.7 ft) ISO container module incorporating its own deployment crane and winch. During both launch and recovery the crane maintains positive control of the towfish, release and recovery taking place below the surface. The module can be installed on the MCDV within 12 hours.

The route survey inspection payload comprises a towfish complete with launch and recovery system. The towfish is electrohydraulically powered through an umbilical which gives it unlimited endurance. Manoeuvrability in three axes is provided by four thrusters. Sensors include a side scan sonar, colour and LLTV cameras. The towfish is monitored and controlled from the ship's command centre while deployed. Its maximum operating depth is 300 m (984 ft) at a range of 600 m (1,968 ft).

The geocoding and mosaicking technology applied to the sonar imagery has been developed by Macdonald Dettwiler using surveillance satellite technology. Algorithms have been developed that automatically fuse geocoded imagery, from sensors of different resolution, into a single image. Geocoding is sensor independent and the technology can be used to enhance the performance of sector scan sonars and to integrate side scan sonar data with that of sector scan sonars.

Geocoding allows sonar imagery to be registered precisely to a chosen map projection and absolute geographic locations assigned to targets identified in the imagery. The sonar towfish groundspeed, its position relative to the towing platform and the seabed, its roll, pitch and yaw, together with differential GPS and gyro navigational data are integrated into the geocoding process to position each pixel of sonar imagery in a geographic reference grid. Geocoding permits sonar images acquired during earlier missions to be compared with those of the present mission, with changes detected semi-automatically. Geocoded sector scan images may also be mosaicked, either for the purpose of building up a continuous map of the seabed or to smooth out background noise to improve the detection and classification range of the sonar.

Mosaicking is the process of combining swaths of geocoded imagery to create a continuous sonar image map database. Mosaicking fills in gaps in the sonar map with new mission data and discards duplicate imagery. The best data can thus be used to create the mosaic. Large areas which are in shadow from one aspect can be replaced by usable imagery acquired from a different aspect. The single mosaicked database is faster to access and the preparation of mission databases simplified.

Manufacturer/Contractor
MacDonald Dettwiler, Canada.

Other MCM roles
These ships are also designed to undertake:
- Route survey
- Mine inspection
- Minesweeping

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60 Mk 5C
One Bofors gun is mounted on the foredeck.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −3 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Manufacturer/Contractor
Bofors, Sweden

M2HB 12.7 mm machine gun
Two M2HB 12.7 mm (0.50 in) machine guns are carried in each ship. The M2HB is a selective short recoil automatic operation weapon using 110-round belts.

Specifications
Calibre: 12.7 mm
Length of barrel: 90 calibres
Gun weight: 38.1 kg (84.0 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

RADARS

Kelvin Hughes Type 6000
E/F-band surface search

Manufacturer/Contractor
Kelvin Hughes, Hainault, Essex, UK.

Kelvin Hughes Type 1007
Navigation radar is the Kelvin Hughes Type 1007.

Specifications
(Type 1007)
Role: Navigation
Frequency: H/I-band (9,410 MHz)
Beam: 1.0 × 18°/0.75 × 18°
Peak power: 25 kW
Pulsewidth: 0.08/0.3/0.8 µs
PRF: 1,600/800/400 pps
Scan rate: 26 rpm

Manufacturer/Contractor
Kelvin Hughes, Hainault, Essex, UK.

PROPULSION

Specifications
System: Diesel-electric
Main machinery: 4 Wärtsilä-SACM UD 23V12 diesels; 4 alternators, 7.2 MW; 2 Jeumont electric motors, 2.2 MW (3,000 hp(m))

Thrusters: 2 LIPS Z-drive azimuth thrusters
Shafts: 2
Ship's services: Wärtsilä-SACM UD 19 diesel-generator set, 300 kW
Emergency: Wärtsilä-SACM UD 60 diesel, 106 kW

FURTHER INFORMATION

PROGRAMME

The requirement which these ships are to meet was altered several times. They were originally planned as MCMVs to replace the 1950s-vintage ships ('Bay' class and 'Porte' class), then they were to be reservist training ships. But they have emerged finally as offshore patrol vessels with a secondary mine clearance role.

The contract was awarded to Fenco MacLaren on 2 October 1991 but the first of class was not laid down until 1994 and was commissioned in December 1995.

DEPLOYMENT

These ships are predominantly manned by reservists, with six ships deployed to each coast. 700, 701, 704, 707, 708 and 711 are based in the Atlantic and on the St Lawrence and the remainder on the Pacific coast

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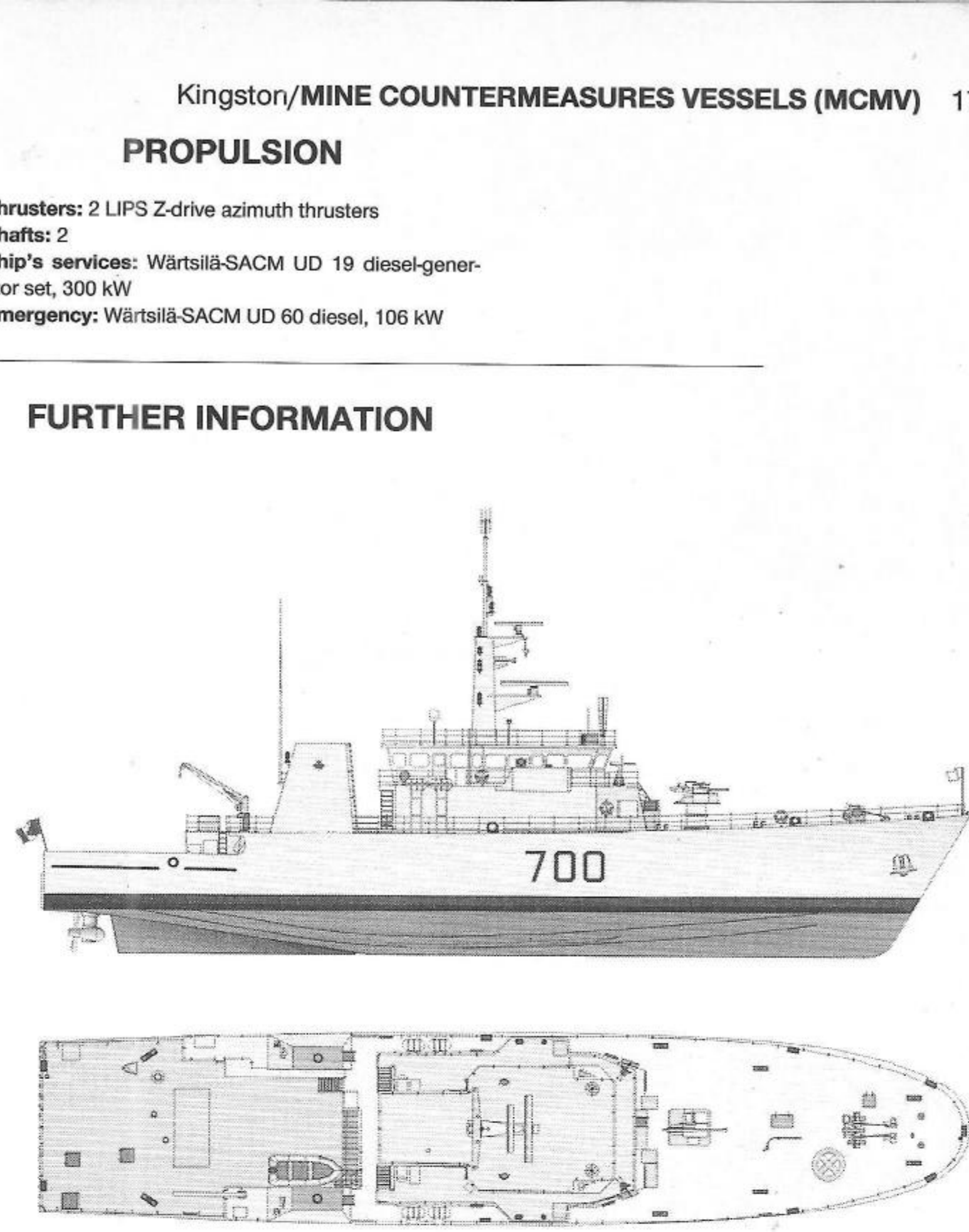
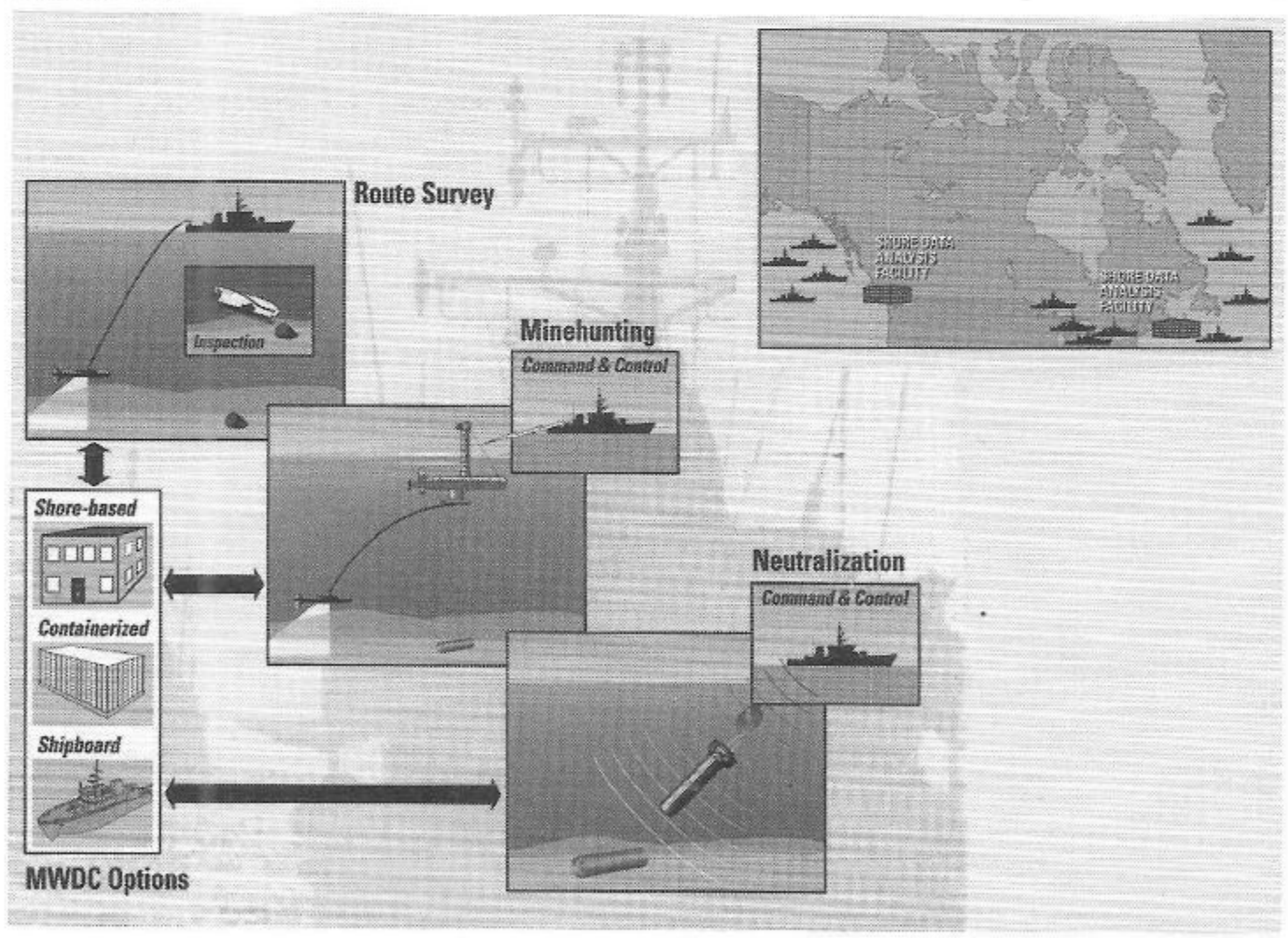
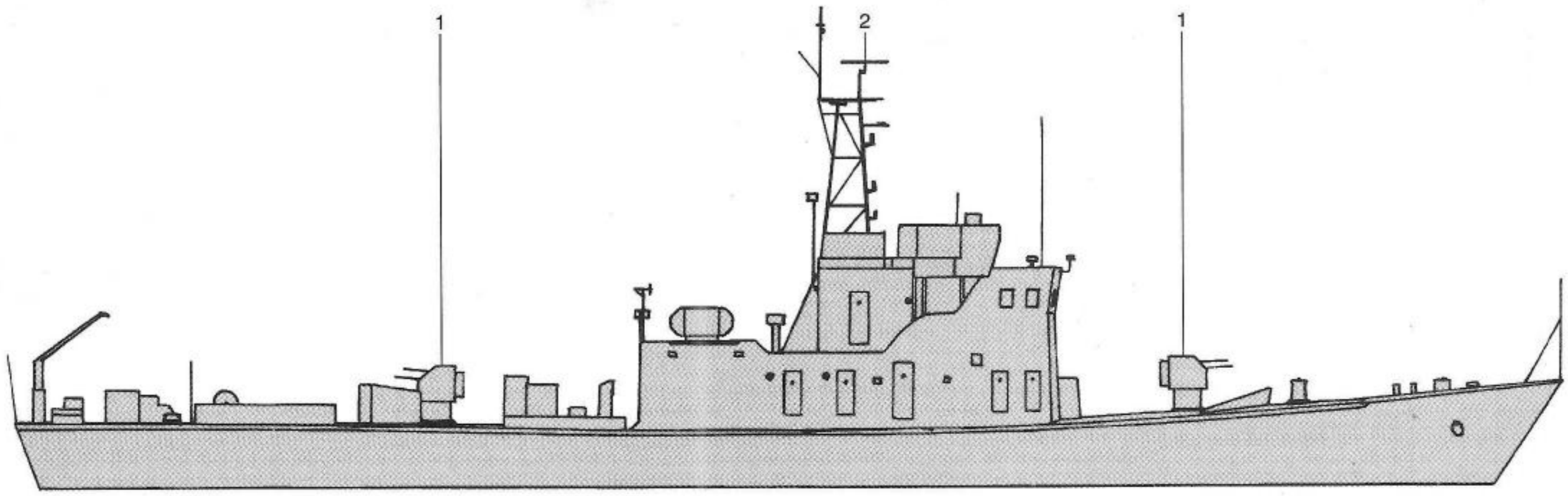


General arrangement of the new Canadian Maritime Coastal Defense Vessel (MCDV) (St John's Shipbuilding)



The twelve MCDVs are an integral part of the Canadian 'Minehunting 2000' programme. The three phases comprise (i) Route survey, using towed side scan sonar to build up and maintain a seabed sonar image map of all Q routes (ii) Minehunting, using an ROV to tow the sonar and radio data to the shoreside C² centre (iii) Neutralisation, using an ROV or expendable destructor

WOSAO



General 1 *Twin 25 mm/60 cannon* **2** *Type 753 navigation radar*

GENERAL SPECIFICATIONS

Operator: China, People's Republic
Type: Minehunter/sweeper

Class: WOSAO

Built: ?
Active: 1

Displacement:
full load: 310 t

Dimensions
Length: 44.79 m (146.95 ft)
Beam: 6.2 m (20.34 ft)
Draught: 2.27 m (7.45 ft)

Speed: 15 kts
Range: 500 n miles at 15 kts

Complement: 40 (6 officers)

SHIPS

4422

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

The ship has been offered for export with:

One small-size cutting-explosive sweeping gear
One electromagnetic sweeping gear
One sound frequency acoustic sweeping gear
One subsonic frequency acoustic sweeping gear

MINEHUNTING SONAR

One Chinese hull-mounted, active minehunting sonar.

WEAPONS SYSTEMS

GUNS

Chinese Type 61 25 mm/60
Two twin mounts per ship.

Specifications
Calibre: 25 mm
Length of barrel: 60 calibres

Traverse: 360° at 25°/s
Elevation: −10 to +85° at 15°/s
Rates of fire: 450 rds/min/barrel
Projectile: 0.28 kg HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,190 ft)

MINES

Six mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Chinese Type 753
I-band navigation radar.

PROPULSION

Specifications
System: Diesel

Main machinery: 4 M 50 diesels; 3.23 MW (4,400 hp(m))
Shafts: 4

FURTHER INFORMATION

This building programme started in 1986, with the first of class commissioned in 1988. Reports have suggested that building continued at a rate of one a year, but this cannot be confirmed and only one of the class (4422) has ever been seen. It appears that it has a hull constructed of steel with low magnetic properties.

Publicity brochures state that the vessel is "...to be used for clearing influence mines and moored mines with sweeping gears in coastal waters, harbour areas, and rivers. Influence mines may include those fitted with acoustic, subsonic, electromagnetic or combined fuzes."

FLYVEFISKEN (MCM VERSION)

GENERAL SPECIFICATIONS

Operator: Denmark
Type: STANFLEX 300

Class: FLYVEFISKEN

Built: 14
Active: 14 (6 in MCM role)

Displacement:
full load: 480 t

Dimensions
Length: 54 m (177.2 ft)
Beam: 9 m (29.5 ft)
Draught: 2.5 m (8.2 ft)

Speed: 30 kts (20 on diesels, 10 on hydraulic propulsion)
Range: 2,400 n miles at 18 kts

Complement: 19-29, depending on role (4 officers)

SHIPS

FLYVEFISKEN (P 550)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 19 Dec 1989

HAJEN (P 551)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 19 Jul 1990

HAVKATTEN (P 552)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 1 Nov 1990

LAXEN (P 553)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 22 Mar 1991

MAKRELEN (P 554)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 1 Oct 1991

STOREN (P 555)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 24 Apr 1992

SVAERDFISKEN (P 556)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 1 Feb 1993

GLENTEN (P 557)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 29 Apr 1993

GRIBBEN (P 558)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 1 Jul 1993

LOMMEN (P 559)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 21 Jan 1994

RAVNEN (P 560)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 17 Oct 1994

SKADEN (P 561)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 10 Apr 1995

VIBEN (P 562)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 15 Jan 1996

SOLOVEN (P 563)
Builder Danyard A/S, Aalborg, Denmark
Commissioned 2 Apr 1996

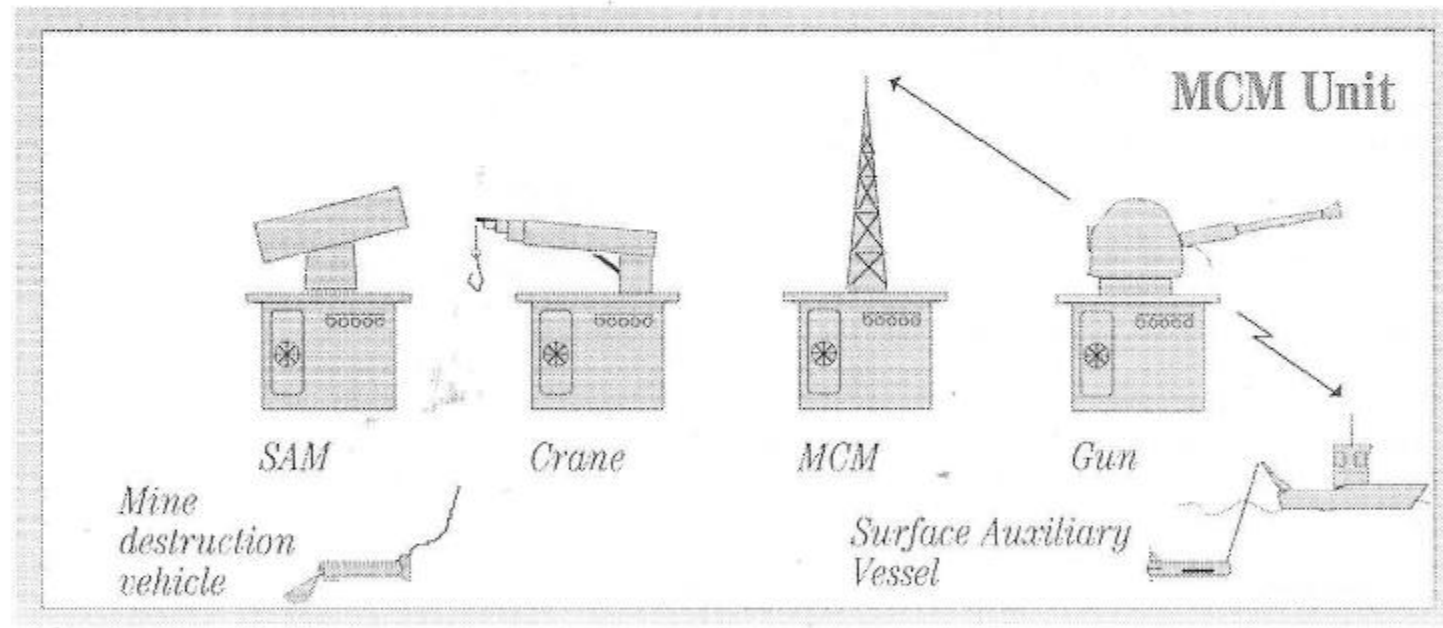
MINE COUNTERMEASURES SYSTEMS

StanFlex 300 — MCM version

The StanFlex 300 (MCM version) (SF 300MCM) uses four containers from the StanFlex range:

- 76 mm gun
- MCM unit
- crane unit
- SAM unit

Two Surface Auxiliary Vessels (SAV) and a mine destruction vehicle are also part of the MCM outfit. The control systems of the side-scan sonars and the underwater vehicles are interfaced with the SF 300(MCM)'s command and control system, as are the communication links and the data from the sonar sensors. In this way, all operations are conducted from the standard consoles of the system in the combat information centre (CIC).



Flyvefisken MCM outfit

MINESWEEPING

Surface Auxiliary Vessels (SAV)

Each SF 300(MCM) is designed to control two SAVs. Like the StanFlex 300s, the SAVs are of GRP sandwich construction. They are powered by a Schottel pump-jet propulsor, which is installed well aft so that it flushes with the bottom. The SAVs are deployed in the detection phase, operating their sonars so that the suspected mined area is searched systematically. They may also be used in the classification phase but are withdrawn prior to the neutralisation phase. They have a Terma datalink to the parent Flyvefisken ship.

The sonar is a Thomson CSF TSM 2054 active, side scan, minehunting sonar, which is mounted in a special 'fish.' The fish is deployed from the stern of the SAV using an A-frame gantry.

A total of 12 of these drones is planned: six are in service, and four more are planned for delivery in 1998. All are being built by Danyard at Aalborg.

Specifications

(SAV)
Displacement: 32 t (full load)
Dimensions: 18.2 × 4.8 × 1.2 m (59.7 × 15.6 × 3.9 ft)
Main machinery: 1 Schottel pump-jet propulsor
Speed: 12 kts
Complement: 4 (passage)

MINEHUNTING

IBIS 43 minehunting system

IBIS 43 includes the Thomson CSF TSM 2061 tactical system and the TSM 2054 side scan sonar, which is towed by the SAV. Detection and classification of mine-like objects is performed at a maximum speed of 15 kts with a 200 m (656 ft) swept channel. The sonar towfish is 3 m (9.8 ft) in length, and weighs less than 300 kg (661.4 lb).

Specifications

Water depth: 6 m (19.7 ft) to more than 200 m (656 ft)
Speed in relation to water: 4-15 kts
Sonar range: 2 × 50 m (2 × 164 ft); 2 × 100 m (2 × 328 ft)
Resolution: 2 × 10 cm (2 × 3.9 in) or 2 × 20 cm (2 × 7.8 in), according to sonar range
Coverage: Up to 2.9 n miles (5.4 km)

Manufacturer/Contractor

Thomson Sintra-CSF, France.

SuTech Double Eagle ROV

Double Eagle is fitted with powerful high-speed thrusters for use in currents up to at least 3 kts, the eight thrusters giving over 5 kts forward, 3 kts astern, 3 kts lateral and 1 kt vertical movement. The ROV is fitted with a computerised stabilisation control system and is extremely manoeuvrable, exhibiting unlimited movement in six degrees of freedom (pitch ±180°, roll ±180°).

There are two monitors, one displaying the picture from a colour TV camera, the other the picture from a monochrome TV camera mounted at the tip of a telescopic arm. Digital data such as heading, depth, pitch and roll angle, cable twist, leakage warnings, real-time clock with date and time and diagnostics are

superimposed on the TV monitor. High-quality video is available using the fibre optic link in the umbilical cable. The standard umbilical is 600 m (1,968 ft) long, but there is also an optional 1,000 m (3,280 ft) cable. The vehicle is fitted with one colour CCD camera as standard, and tilt arrangement with colour and SIT camera is available as an optional extra. Optional sensors include echo-sounder, and electronic scanning or conventional sonar.

The vehicle uses a unique precision charge placement technique, using a small mine disposal charge which also features several advantages. The vehicle can also carry a heavy standard NATO mine disposal charge as well as cable cutters.

Specifications
(Double Eagle)
Length: 1.90 m (6.2 ft)
Width: 1.30 m (4.2 ft)
Height: 0.80 m (2.6 ft)
Weight: 400 kg (881.8 lb)
Payload: 80 kg (176 lb)
Speed: 5 kts
Service depth: 500 m (1,640 ft)

Manufacturer/Contractor
Bofors Underwater Systems, Sweden.

MINEHUNTING SONARS

C-Tech CTS-36 Sonar
CTS-36 hull-mounted sonar is optimised for shallow water operation. It is a scanning and multibeam sonar, using narrow receiving beams, high-speed scanning and digital processing techniques to provide instantaneous detection, classification and target data in a full 360° field of view. Simultaneous video and audio information is available in both active and passive modes. A minimum of three tracking channels is provided with target and ship's track, target range, depth, bearing, speed and heading instantaneously displayed. CTS-36 also provides:

- Detection of torpedoes and divers
- Detection of targets such as mines, wrecks and rocks on the seabed
- Detection, location and classification of large targets at long ranges
- Electronic tilt and stabilisation of transmit and receiving array
- Interface to ship's own command/communications systems
- A high-resolution control/display unit.

Specifications
Operating frequency: CW mode: dual frequency 36 kHz (39 kHz operator selectable); FM chirp: nominal 1 kHz centred at CW frequency
Beam tilt/stabilisation: Electronic tilt continuously adjustable from 8° above the horizontal to 24° below. Electronically stabilised for roll and pitch
Receiving beamwidth: Horizontal and vertical: 6° transmitting beam omni or directional sector
Transmitter: 270 channels; power output/channel 50 W max
Source level: 223 dB/µPa/m

Modes of operation
Active: Simultaneous audio and video, selectable omni or directional CW or FM transmission. Automatic detection mode in which area on display is automatically outlined where signal reception exceeds operator-selected threshold. Audio continuously steerable through 360°. Transmit sector width and position selectable
Passive: Reception system as above
Tracking: FM chirp or CW. Each of three independent receive channels track automatically one, two or three targets. Position, course and speed provided for each target
Surveillance: Operator-selectable transmit sector width and position, 12° receive beam stepped through operator-selected sector.
Video and audio search: Omni transmission. Broad 30° depressed receive beam facilitates maintenance of contact on close in targets

Manufacturer/Contractor
C-Tech Ltd, Cornwall, Ontario, Canada.

Thomson Sintra TSM 2640 Salmon
Variable depth sonar (VDS) medium frequency for ASW. Salmon is a compact sonar designed for shallow water ASW. The basic version consists of an acoustic array of 24 staves housed in a streamlined fish. Embedded facilities include passive listening, sound ray tracer, integrated onboard simulator and acoustic propagation prediction.

Specifications
Acoustic array: 24 identical staves of 7 transducers, weight 260 kg (573 lb)
Frequency: Approx 19 kHz.
Transmitter: Omnidirectional transmission in CW and FM modes
Receiver: 36 preformed beams; advanced processing coherent in FM with pulse compression and spectrum analysis (FFT) in CW

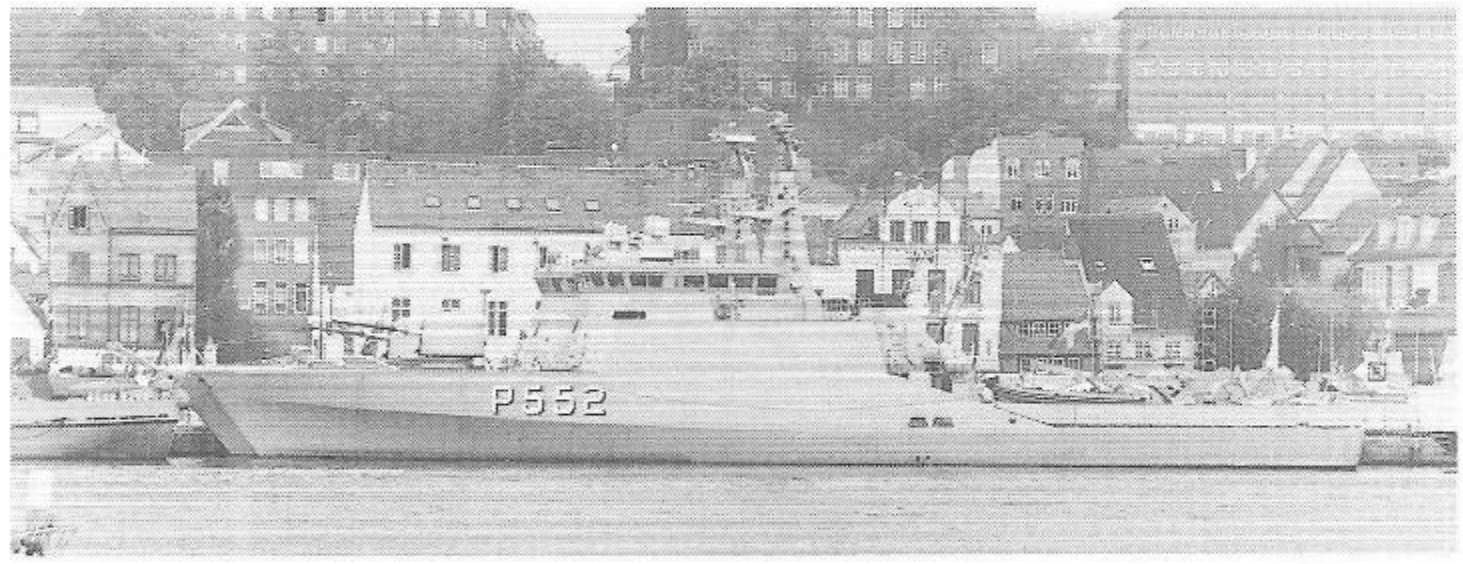
Manufacturer/Contractor
Thomson-CSF, France.

WEAPONS SYSTEMS

GUNS

OTOBREDA 3 in (76 mm)/62 Super Rapid
The containerised OTOBREDA 76 mm gun is part of the MCM package. The 62 calibre barrel is of two-part construction consisting of the tube and a liner with rifling consisting of one turn in 30 calibres. Ammunition is fed from a magazine containing 15 rounds, each of which is moved by a feeding system which can be from 2.5 to 11 m (8.2-36.1 ft) long, to the loading tray where it is automatically rammed into the breech. The mounting is normally under local electrical and hydraulic control but may be controlled remotely if required. The mounting weighs 12 tonnes. The Super Rapid mounting features upgraded hydraulic motors for the feed and hoist systems, rocker arms made from titanium, a redesigned feeder device and loading tray which moves shorter distances for faster action. There is also a new digital console with plasma display for gun control.

Specifications
Elevation: −15 to +85°
Training speed: 60°/s



Havkatten *(P 552) in the MCMV role. This involves one 76 mm gun module forward, and aft an MCM communications module and a crane module (the SAM module has not yet been procured)* (H M Steele)

Elevation speed: 35°/s
Weight (unloaded): 8 t
Muzzle velocity: 925 m/s (3,035 ft/s)
Rate of fire: 120 rds/min
Range: 8.5 n miles (15.75 km)

Manufacturer/Contractor
OTOBREDA, Italy.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Racal SABRE ESM system
The Sabre ESM system covers the 0.5 to 18 GHz frequency range and provides facilities for threat warning, surveillance, identification, intelligence gathering and targeting. It uses the Racal Sadie processor and advanced antenna techniques to achieve a high specification and operational flexibility. It is fully integrated with the ship's AIO and ECM systems including interfacing with the ship's multifunction consoles through standard bus interfaces.

The ESM processor tracks 200 radars automatically and provides a continuous update on status to the ESM operator and the command. Scan analysis is measured on all intercepted transmitters. The ESM library holds 3,000 radar emitter modes, while an auxiliary library of 250 emitter modes is provided to hold operator-loaded data. The operator's console features twin high-resolution colour displays, a normal keyboard, special function keys and a rollerball.

Specifications
(Sabre)
Frequency range: 0.5-18 GHz (option to 40 GHz)
Accuracy: 2° RMS
Sensitivity: −60 dBmi
Dynamic range: 60 dB
Pulse density capability: 500,000 pps
Radar store capacity: 3,000 modes
Processing time: <1 s

Manufacturer/Contractor
Racal Radar Defence Systems, Chessington, Surrey, UK.

ELECTRONIC COUNTERMEASURES (ECM)

Racal Cygnus ECM system
The Cygnus radar jammer operates in the I- or J-bands and was designed for integration with Cutlass ESM equipment. Cygnus uses both responsive noise and deception jamming to provide an effective jamming capability against all types of radar including early warning, target acquisition and missile guidance. It has a narrow beamwidth giving high effective radiated power (300 kW) and is kept on target by a built-in, interferometer-type, passive tracking system in both azimuth and elevation. The tracking system may also be used to relay accurate position data to systems of other ships. RF received by the tracking antennas is also used as the basis for transmitted RF and modulation and power management is under the control of a processor which

also controls the tracking procedure. Types of modulation sequence available include range gate pull off and false target generation.

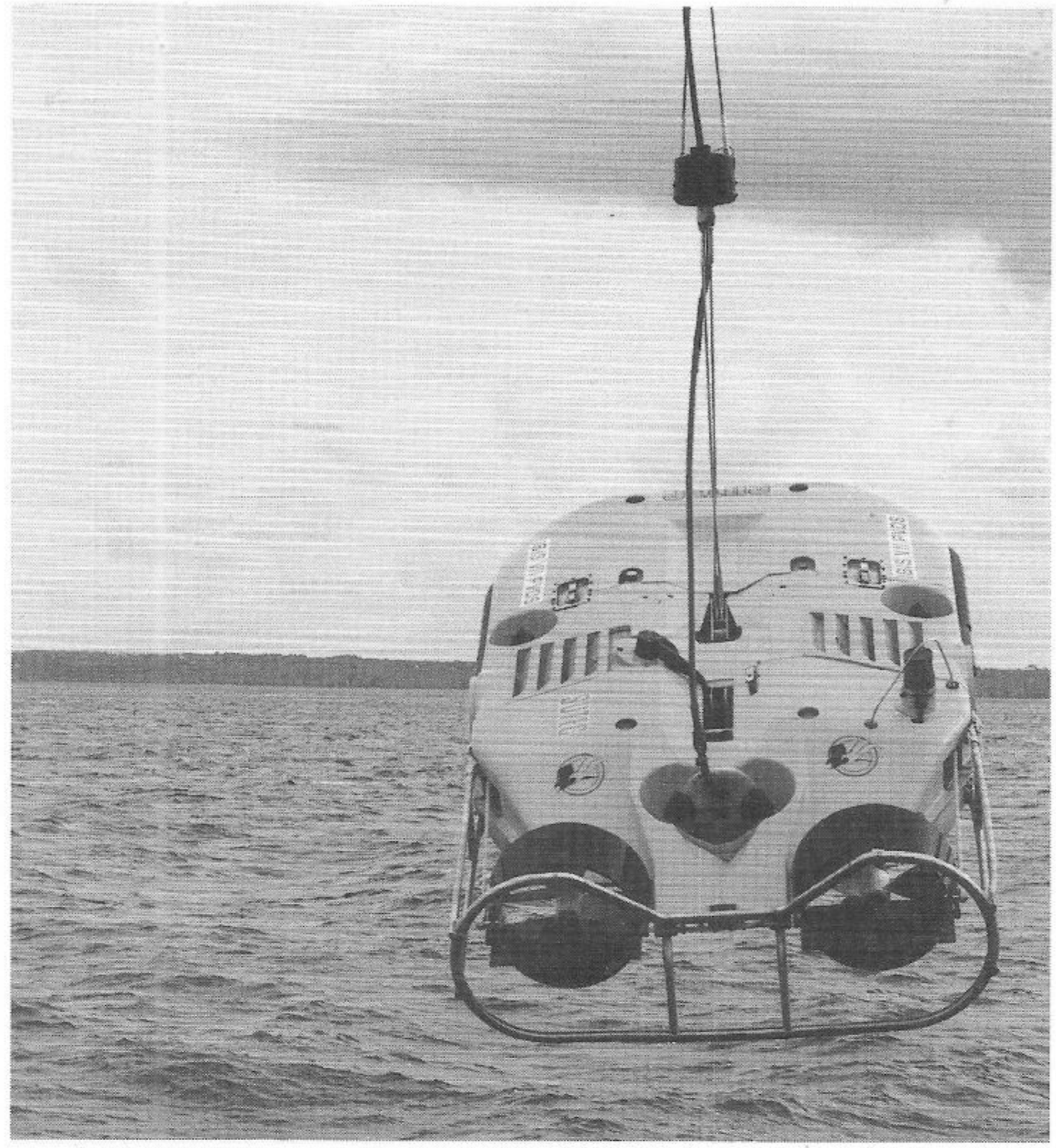
Manufacturer/Contractor
Racal Radar Defence Systems, Chessington, Surrey, UK.

DECOYS

NATO Sea Gnat
NATO Sea Gnat is a long-range chaff/infra-red (IR) decoy launching system for NATO warships. It consists of a control unit, a launcher with 130 mm tubes and munitions. The control unit provides for the launching of the most effective combination of rounds for distraction and centroid/seduction given the type, speed and direction of the threat, the ship's speed and heading as well as wind direction and speed. There are three types of round:

Mk 214 RF seduction
Mk 216 RF distraction
Mk 218 IR seduction

Manufacturers/Contractors
THORN EMI/AB Precision Ltd, UK (control unit).
Hunting Engineering, UK (launchers).
Chemring Ltd, UK (munitions).



SuTech Double Eagle ROV, a joint French/ Swedish development (Jane's/David Miller)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

CelsiusTech 9LV Mk 3
The 9LV Mk 3 command system has a distributed architecture and is based upon a 32-bit computer using Motorola 68020 and 68040 microprocessors and Ada-language software, workstations and an Ethernet IEEE 802.3 standard local area network. Memory consists of 4 Mbyte RAM and 256 k of EPROM. The hardware is used to create nodes which may be workstations, processing or interface nodes with a network interface, one or more processing units, power supply, local PROM and appropriate interfaces. Memory management is by means of the Motorola 68851 while the floating-point processor is the Motorola 68881. All the software programs run independently but communicate through an Inter-Program Communication 2000 (IPC2000) mechanism. The software is in Ada and the basic system has about 500,000 lines of code, although this is usually more than doubled to meet additional requirements.

The dual-redundant LAN interfaces with all sensors, weapon systems and workstations and there are two processors (one redundant) that provide command, communications and control as well as a database. The systems are capable of acting as a data handling system compiling the tactical situation, conducting threat evaluation and target designation, as well as providing navigation and offboard sensor data (the latter via a datalink), while recording and providing a simulation capability.

The fire-control radar is CelsiusTech's Sea Viking director, which acts as a stand-alone system with servo-controlled pedestal, tracking and ballistic computer to control both guns and SAMs. It controls different weapons sequentially and has an automated air defence function for use against multiple targets. It takes sensor data, evaluates the threat and automatically deploys the most effective hard or soft kill countermeasure to neutralise each target.

The Sea Viking tracker radar (see next page) may be supplemented by a range of electro-optical sensors including a Si-Vidicon CCIR-compatible TV camera with 300 mm lens and 42 × 31 mrad field of view, an 8 to 12 µm infra-red camera using Cadmium Mercury Telluride detectors with closed-cycle Sterling cooling and fields of view of 52 × 35 mrad and 157 × 105 mrad. There may also be a 1.06 Nd:YAG laser rangefinder with a peak power of 4 MW and a PRF of 10 Hz.

Also available is an independent G/H or C-band and I/J or X-band search radar with parabolic, horn-fed stabilised 2.4 × 1.0 m (7.9 × 3.28 ft) antenna. This also has a travelling-wave tube transmitter and operates in 5.4 to 5.9 GHz and 8.5 to 9.6 GHz frequency band. An optional I/J-band magnetron transmitter is also available.

On the 'Flyvefisken' class, the prime HCI consists of Terma Standard Consoles, using Motorola 68020 and 68040 microprocessors on a VME bus. The Type I was designed for the SF 300 C3 system and is a one-man console with two 21 in (53.34 cm) 1,024 × 1,224 pixel raster scan displays which can present radar, tactical situation, graphics and electro-optic data as well as providing space of 80 columns and 18 lines for alphanumeric data. There may also be provision for internal and external communications facilities (including a telephone).

Manufacturer/Contractor
CelsiusTech, Sweden.

RADARS

Plessey AWS 6
P 550 to P 556 only.

Specifications
(AWS-6)
Role: Air search
Frequency: G-band
Beam: 1.5°
Peak power: 49 kW
Gain: 29 dB
Pulsewidth: 0.1/4.3 µs
Scan ráte: 30/60 rpm

Manufacturer/Contractor
Plessey, UK.

DASA TRS-3D
P 557 to P 563 only. TRS-3D has several modes of operation:

- Self-defence mode. Combined long- and short-range scanning with high elevation coverage. May be used in sea and ground clutter environment and in light rain; scan time is 2 seconds
- Self-defence/clutter mode. Offers an adapted waveform for severe clutter or chaff conditions; scan time is 3.5 seconds
- Surveillance mode. Provides 49.7 n miles (92 km) instrumented range with 9.2 n miles (17 km) altitude coverage. It is useful up to medium-clutter conditions, scan time is 6 seconds
- Long-range mode: Gives an instrumented range of 97.2 n miles (180 km) for duct conditions with a scan time of 6 seconds.

The antenna group comprises a primary G/H-band planar phased-array antenna, an IFF antenna and an optional I-band navigation radar antenna. The G/H-band radar incorporates a full pulse-to-pulse polarisation agility. Scanning in elevation is performed with a single agile pencil beam; the antenna is scanned in bearing mechanically using a fully stabilised platform rotating at 30 rpm.

Manufacturer/Contractor
Daimler-Benz Aerospace AG, Ulm, Germany.

Terma Scanter
I-band surface search radar

Furuno
I-band navigation radar.

9 LV 200 (Sea Viking)
Prime sensor is a tracking Ku/J-band radar with stabilised cassegrain monopulse antenna and travelling-wave tube transmitter which operates in the 15.9 to 17.1 GHz frequency range and permits the combination of pulse Doppler-MTI operation with batch-to-batch frequency agility. Pulse-to-pulse frequency agility is retained for use when return suppression is not required. Also available is an independent G/H or C-band and I/J or X-band search radar with parabolic, horn-fed stabilised 2.4 × 1.0 m antenna. This also has a travelling-wave tube transmitter and operates in 5.4 to 5.9 GHz and 8.5 to 9.6 GHz frequencies. An optional I/J-band magnetron transmitter is also available.

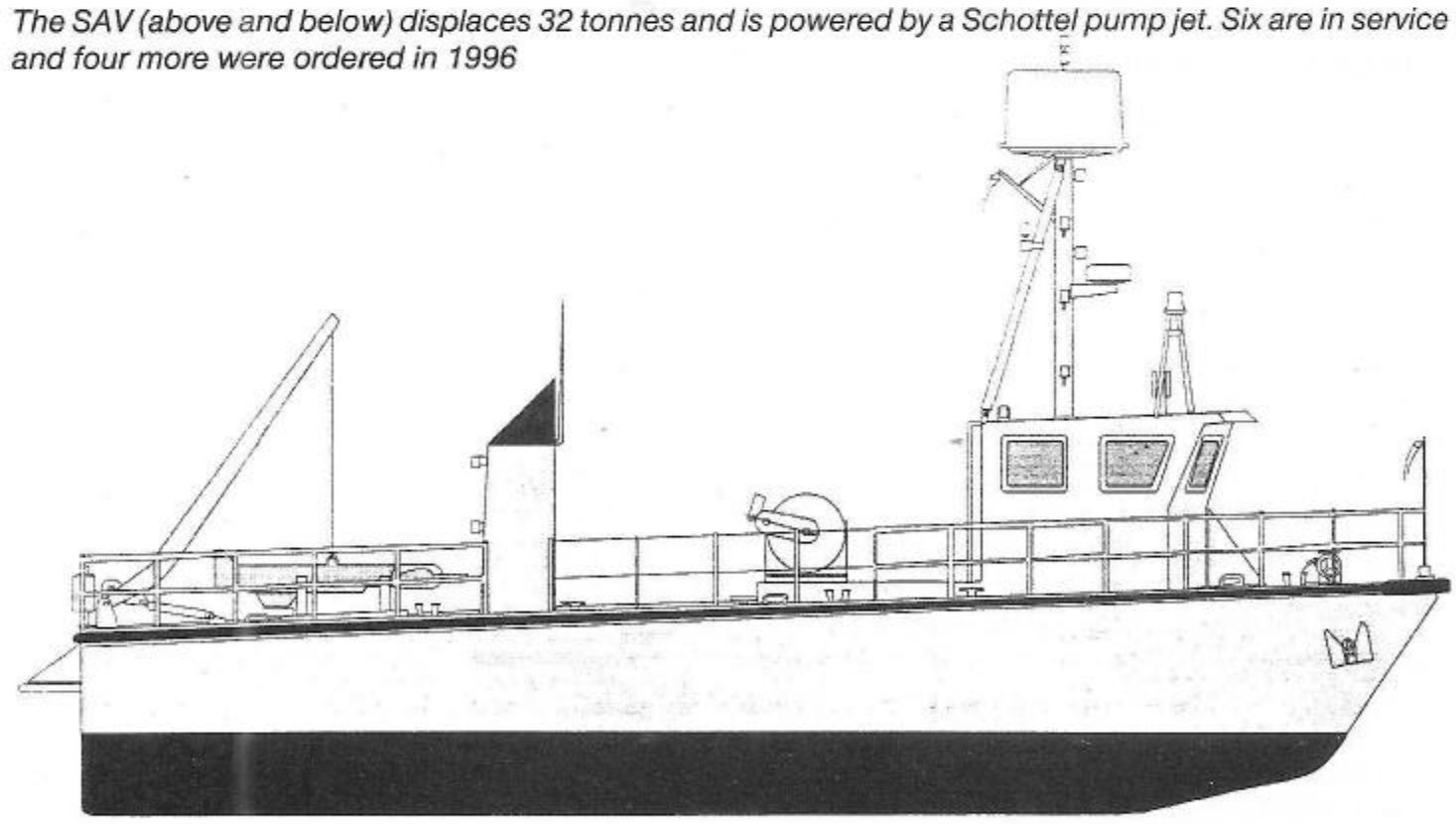
Manufacturer/Contractor
CelsiusTech, Sweden.

PROPULSION

Specifications
System: CODAG
Main machinery: 1 GE LM 500 gas turbine on centre shaft; 2 MTU 16V 396 TB94 diesels on outer shafts; plus auxiliary propulsion by hydraulic motors on outer gearboxes (hydraulic pumps driven by 1 GM 12V-71 diesel)
Power output: 4.1 MW (5,450 hp) from gas turbine; 4.26 MW (5,800 hp) from diesel engines; 375 kW (500 hp) from diesel for hydraulic pumps.
Shafts: 3

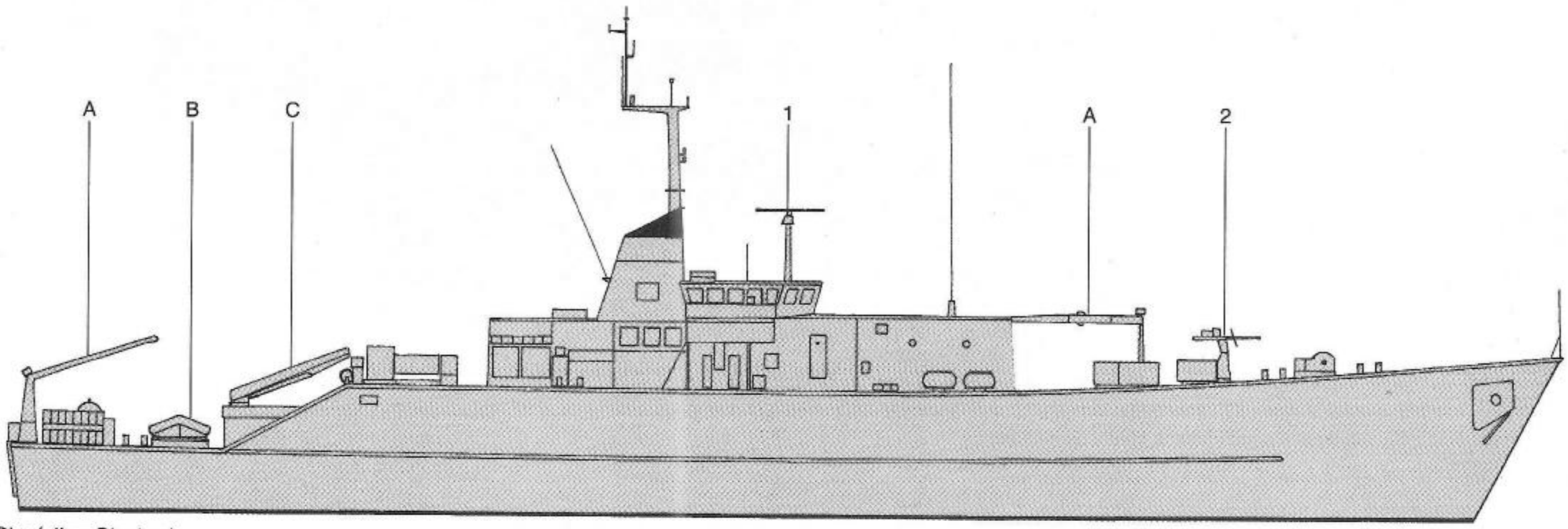
FURTHER INFORMATION

The 14th and final SF 300 was commissioned on 2 April 1996, but acquisition of all the elements of the system has yet to be completed. Thus, only three MCM systems are actually in service, but funds for systems #4 and #5 were granted in mid-1996. These new systems will each comprise a containerised Thomson-CSF IBIS 43, a Double Eagle ROV and two SAVs, each equipped to tow the TSM 2054 side scan sonar. The four new SAVs are likely to be enlarged versions of the current SAV design.



The SAV (above and below) displaces 32 tonnes and is powered by a Schottel pump jet. Six are in service and four more were ordered in 1996

CIRCE



Circé (Ian Sturton)
MCM A *Crane* **B** *Diver support boat* **C** *Crane*

General 1 *Racal-Decca 1229 navigation radar* **2** *Oerlikon 20 mm gun*

GENERAL SPECIFICATIONS

Operator: France
Type: Minehunter

Class: CIRCE

National designation: *Batiments de plongeurs demineurs* (BPD)

Built: 5
Active: 5

Displacement:
standard: 467 t
full load: 518 t

Dimensions
Length: 50.9 m (167 ft)
Beam: 8.9 m (29.2 ft)
Draught: 3.4 m (12.2 ft)

Speed: 15 kts
Range: 3,000 n miles at 12 kts

Complement: 48 (5 officers) (includes 6 combat divers)

SHIPS

CYBELE (M 712)
Builder CMN, Cherbourg, France
Launched 2 Mar 1972
Commissioned 28 Sep 1972

CALLIOPE (M 713)
Builder CMN, Cherbourg, France
Launched 20 Oct 1971
Commissioned 28 Sep 1972

CLIO (M 714)
Builder CMN, Cherbourg, France
Launched 10 Jun 1971
Commissioned 18 May 1972

CIRCE (M 715)
Builder CMN, Cherbourg, France
Launched 15 Dec 1970
Commissioned 18 May 1972

CERES (M 716)
Builder CMN, Cherbourg, France
Launched 10 Aug 1972
Commissioned 7 Mar 1973

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

PAP Mk 4 ROV

'Circé' class MCMVs carry two PAP Mk 4 (PAP = *poisson auto-propulsé*) ROVs, which have the capability to hunt and destroy ground mines by placing and remotely detonating a charge or tethered mines by cutting the mooring rope. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via a tether, which can be either a 2,000 m (6,562 ft) fibre optic cable or a 1,000 m (3,280 ft) coaxial cable. It is horizontally propelled by two side thrusters.

In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide-rope'. The winch in the PAP then deploys a selected length of rope and the operator then uses return signals from the vehicle to maintain the vehicle at the desired height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP is able to carry the 126 kg (277 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution near-field sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

Ceres *(M 716)* (H & L van Ginderen Collection)

Specifications

(PAP Mk 5)
Length: 3 m (9.84 ft)
Diameter: 1.2 m (3.94 ft)
Height: 1.3 m (4.26 ft)

Performance:
Max vehicle velocity
mid-water transit: 6 kts (3 m/s)
bottom-following mode: 5.5 kts (2.75 m/s)
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s (2.3 ft/s)
Ascent velocity (charge released): 1.5 m/s (4.9 ft/s)

Payload:
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Horizontal range:
with fibre optic cable: 2,000 m (6,560 ft)
with coaxial cable: 1,000 m (3,280 ft)
Max continuous endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bar

Manufacturer/Contractor
Société ECA, Colombes, France.

MINEHUNTING SONARS

Thomson-CSF DUBM 20B
This hull-mounted, active search, high-frequency minehunting sonar was the first of its type to be designed and built in France. It can locate a mine at 300 m (984 ft) and classify it at about 100 to 130 m (328 to 426 ft). Operating frequencies are: detection — 100 kHz ±20 kHz; classification — 400 kHz ±30 kHz.

Manufacturer/Contractor
Thomson-CSF, Paris, France.

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm
One 20 mm mounting is carried per vessel, although it is not known which of the many versions of this particular gun is carried. The ships are frequently seen without the gun fitted.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range:
anti-surface: 0.81 n miles (1.5 km)
anti-air: 1,150 m (3,772 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca 1229
The navigation radar is the Racal-Decca Type 1229, which is equipped with a 2.7 m (8.8 ft) antenna and operates in the I/J-band

Specifications
Role: Navigation
Frequency: I/J-band
Beam: 1.3 × 30°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
PRF: 1,300/650 pps
Scan rate: 25 rpm

PROPULSION

Specifications
System: Diesel/diesel-electric
Main machinery: 1 MTU diesel; 1.32 MW (1,800 hp(m))
Shafts: 1
Auxiliary drive: 2 electric-powered, active rudders, 260 hp.

FURTHER INFORMATION

PROGRAMME

These ships were ordered in 1968 and entered service in 1972-73. Their primary mission is the location, classification and destruction of mines at depths of up to 60 m (200 ft). They were due to be deleted in 1991-93 but were retained when the planned BAMO project was cancelled.

DESIGN

Like all MCMVs, these are designed to have a minimal magnetic signature and thus, in line with the practice at the time, their hulls are constructed of laminated wood. They also have two propulsion systems: a diesel-driven propeller is used for high speed and transits, while two electrically driven active rudders are used for MCM operations.

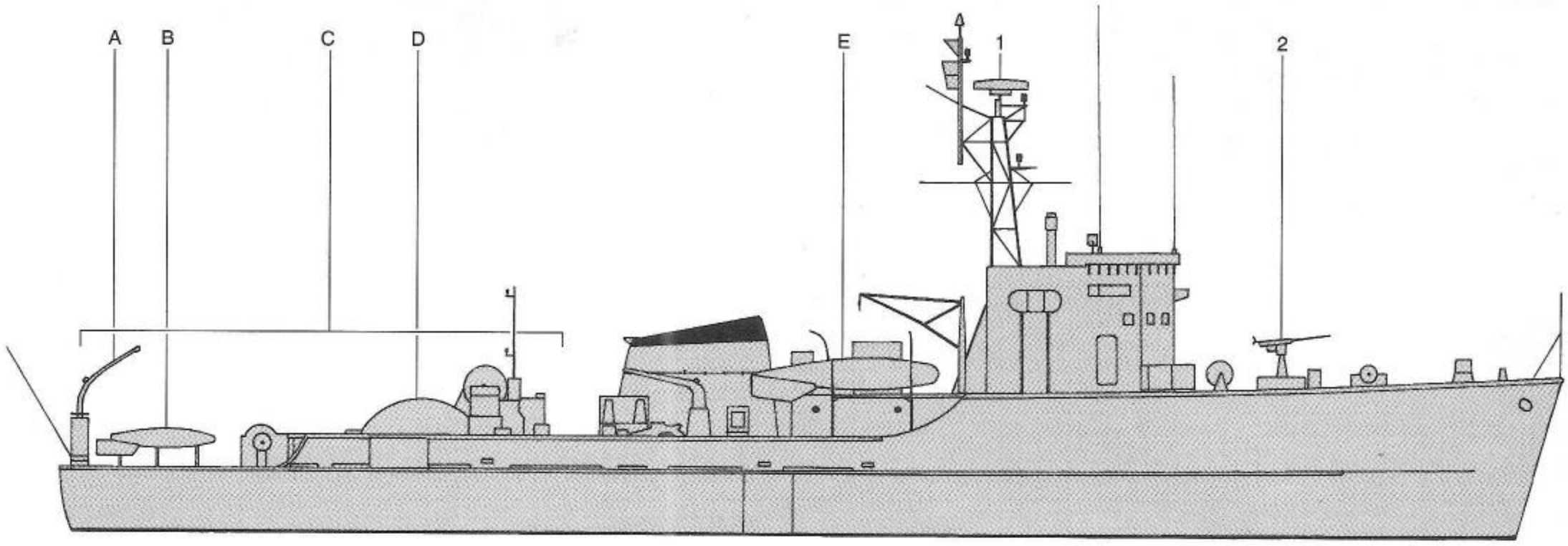
MODERNISATION

A modernisation programme completed in 1989 included the addition of computer-aided sonar classification.

OPERATIONAL

All based at Brest. Planned deletion now in 1997-98.

KARAMÜRSEL (MERCURE)



Karamürsel *(Ian Sturton)*
MCM A *Davit* **B** *Oropesa float* **C** *Sweep deck* **D** *Main sweep winch* **E** *Oropesa float*

General 1 *Racal-Decca 707 navigation radar* **2** *Oerlikon 20 mm cannon*

GENERAL SPECIFICATIONS

Country of origin: France
Operator: Turkey
Type: Mercure (Minesweepers)

Class: KARAMÜRSEL

Acquired: 6
Active: 6

Displacement:
standard: 362 t
full load: 378 t

Dimensions
Length: 47.3 m (155.1 ft)
Beam: 8.6 m (28.2 ft)
Draught: 2.9 m (9.5 ft)

Speed: 15 kts

Complement: 33 (2 officers)

SHIPS

KARAMÜRSEL (M 520)
Builder CMN, Cherbourg, France
Commissioned (Germany) 30 Apr 1960 (*Worms* (M 1253)
Transferred and recommissioned (Turkey) Jan 1974

KEREMPE (M 521)
Builder CMN, Cherbourg, France
Commissioned (Germany) 20 Feb 1960 (*Detmold* (M 1252))
Transferred and recommissioned (Turkey) Mar 1976

KILMLE (M 522)
Builder CMN, Cherbourg, France
Commissioned (Germany) 6 Jul 1960 (*Siegen* (M 1254))
Transferred and recommissioned (Turkey) Mar 1976

KOZLU (M 523)
Builder CMN, Cherbourg, France
Commissioned (Germany) 15 Oct 1959 (*Hameln* (M 1251))
Transferred and recommissioned (Turkey) Mar 1976

KUSADASI (M 524)
Builder CMN, Cherbourg, France
Commissioned (Germany) 16 Sep 1959 (*Vegesack* (M 1250))
Transferred and recommissioned (Turkey) Mar 1976

KEMER (M 525)
Builder CMN, Cherbourg, France
Commissioned (Germany) 15 Oct 1960 (*Passau* (M 1255))
Transferred and recommissioned (Turkey) 1979

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

These six ships carry mechanical sweeps, and are also equipped with acoustic and magnetic sweeps.

MINEHUNTING SONARS

All ships were fitted with a Simrad hull-mounted, active, high-frequency, minehunting sonar.

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm
There is one Oerlikon cannon on the foredeck.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,738 ft/s)

Range:
anti-surface: 0.81 n miles (1.5 km)
anti-air: 1,150 m (3,772 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca 707
There is one I-band, Racal-Decca 707 navigation radar.

PROPULSION

Specifications
System: Diesel
Main machinery: Two MTU MB diesels; 1.1 MW (1,500 hp(m))

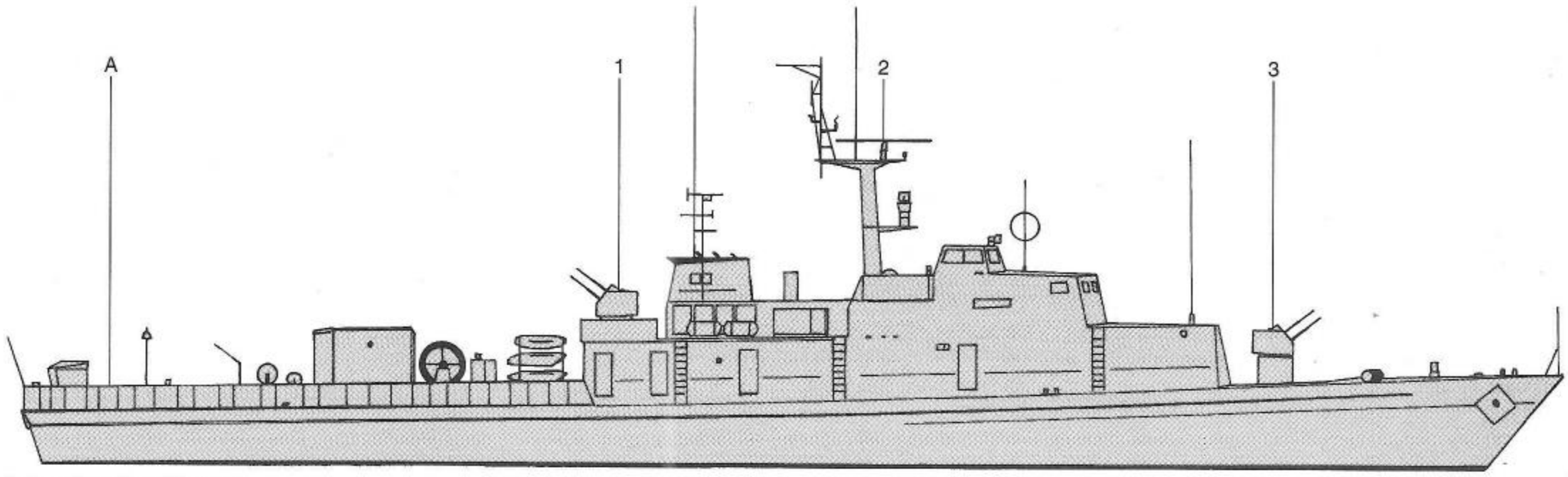
Shafts: 2
Propellers: cp

FURTHER INFORMATION

These wooden-hulled ships have a somewhat curious history. The design originated with the 'Mercure', a French development of the US Navy's MSC class. Only one was built for the French Navy, being launched in 1957, which served for some years, until being scrapped in 1990. Meanwhile the design had attracted the interest of the West German Navy, which ordered six ships from CMN, Cherbourg, as part of the build-up of its MCM force. These entered service with the *Bundesmarine* in 1959/60, but were placed in reserve in 1963 and only recommissioned for mobilisation exercises. They were deleted in 1973, five were passed to the Turkish Navy in 1974/5, followed by the sixth in 1979.

KONDOR II (TYPE 89.200)

OVERVIEW



Pulau Rote (Ian Sturton)
MCM A *Working deck also includes mine rails*

General 1 *Twin 25 mm/80 2-M-3 (two)* **2** *TSR-33 navigation radar* **3** *Twin 25 mm/80 2-M-3 (one)*

The German Democratic Republic (DDR) probably produced more warships than any other Soviet satellite, particularly at the Peenewerft (*werft* = shipyard) at Wolgast. A series of minesweepers was produced starting with the 'Krake' class in the late 1950s, followed by the 'Kondor I' class, of which 22 were built. All were launched in 1970-71. These were followed by the slightly larger 'Kondor II' class, 28 of which were launched between 1971 and 1973. All ships in the class were modernised in 1985-89, which included the addition of an SA-N-5 launcher and a new deckhouse aft.

On German reunification in 1990 the *Volksmarine* was disbanded and the boats were taken over the the German Navy *(Bundesmarine).* Six Kondor IIs were actually taken into service for a short period and given *Bundesmarine* pennant numbers (M 2669 to 2674), while the others were simply laid up.

A number has been sold abroad, all of which were disarmed prior to delivery, but which retained their minesweeping gear. Some remain in Germany and may also be sold abroad. Sales to date are:

- Uruguay — four in 1991
- Indonesia — nine in 1993
- Latvia — two in 1993.

KONDOR II (TYPE 89.200)

GENERAL SPECIFICATIONS

Country of origin: Germany (former DDR)
Operator: Indonesia
Type: 89.200 (Coastal minesweeper)

Class: KONDOR II

Purchased: 9
Active: 9

Displacement
full load: 310 t

Dimensions
Length: 56.7 m (186 ft)
Beam: 7.5 m (24.6 ft)
Draught: 2.4 m (7.9 ft)

Speed: 17 kts
Range: 2,000 n miles at 14 kts

Complement: 31 (6 officers)

SHIPS

PULAU ROTE (721)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR Volksmarine) 1 Jun 1971 (*Wolgast* (V 811))
Purchased (Indonesia) 1992
Delivered 22 Oct 1993

PULAU RAAS (722)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR Volksmarine) 22 Dec 1971 (*Hettstedt* (353))
Purchased (Indonesia) 1992
Delivered 22 Oct 1993

PULAU ROMANG (723)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR Volksmarine) 26 Jun 1972 (*Pritzwalk* (325))
Purchased (Indonesia) 1992
Delivered 22 Oct 1993

PULAU RIMAU (724)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR Volksmarine) 7 Aug 1972 (*Bitterfeld* (332))
Transferred to Bundesmarine 1990 (M 2672)
Purchased (Indonesia) 1992
Delivered 22 Oct 1993

PULAU RONDO (725)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR Volksmarine) 30 Sep 1972 (*Zerbst* (725))
Purchased (Indonesia) 1992
Delivered 22 Oct 1993

PULAU RUSA (726)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR Volksmarine) 1 Nov 1972 (*Oranienburg* (341))
Purchased (Indonesia) 1992
Delivered 22 Oct 1993

PULAU RANGSANG (727)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR Volksmarine) 7 Apr 1973 (*Juterbog* (342))
Purchased (Indonesia) 1992
Delivered 22 Oct 1993

PULAU RAIBU (728)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR Volksmarine) 9 Aug 1973 (*Sommerda* (311))
Transferred to Bundesmarine 1990 (M 2670)
Purchased (Indonesia) 1992
Delivered 22 Oct 1993

PULAU REMPANG (ex-Grimma) (729, ex-336)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR Volksmarine) 10 Nov 1973
Purchased 1992
Delivered (Indonesia) 22 Oct 1993

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

The ships were transferred with their minesweeping equipment, which was of Russian origin, including:

- FRG-1 long-range magnetic sweeping gear
- MSG-3 variable depth sweep device.

MINEHUNTING SONARS

Bendix AN/AQS-17
AN/AQS-17 variable depth minehunting sonar was installed in Germany prior to the departure of the ships for Indonesia. AQS-17 was developed in both helicopter and surface ship versions, and is used for both search and classification, operating at 200 kHz. Maximum search range is 600 m (1,966 ft), classification range is 300 m (984 ft) and maximum operational depth 100 m (328 ft).

Manufacturer/Contractor
Bendix, USA.

WEAPONS SYSTEMS

GUNS

25 mm/80 2-M-3
The ships were transferred without any weapons, but are now definitely armed with three twin 25 mm in 2-M-3 mounts: one is on the foredeck and two are side by side immediately abaft the stack. These were found from Indonesian Navy stocks and installed after arrival.

Specifications
(2-M-3)
Calibre: 25 mm
Length of barrel: 60 calibres
Traverse: 360° at 25°/s
Elevation: −10 to +85° at 15°/s
Rates of fire: 450 rds/min/barrel
Projectile: 0.28 kg HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,184 ft)

MINES

As usual in minesweepers designed in countries of the former Warsaw Pact, there are minerails; in this case, two.

COMMAND AND CONTROL SYSTEMS

RADARS

TSR-333
An I-band navigation radar.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kolomna Type 40-DM diesels; 3.24 MW (4,408 hp(m)) sustained

Shafts: 2
Propellers: cp

FURTHER INFORMATION

DEPLOYMENT

They are currently being employed with a primary role of EEZ patrol, but retain MCM as their secondary mission. Existing MCM equipment is retained and ADI Dyads are being purchased from Australia, with *Pulau Rondo* (725) being used for the trials.

KONDOR II (TYPE 89.200)

GENERAL SPECIFICATIONS

Country of origin: Germany (former DDR)
Operator: Latvia
Type: Coastal minesweeper

Class: KONDOR II

Acquired: 2
Active: 2

Displacement
full load: 310 t

Dimensions
Length: 56.7 m (186 ft)
Beam: 7.5 m (24.6 ft)
Draught: 2.4 m (7.9 ft)

Speed: 17 kts
Range: 2,000 n miles at 14 kts

Complement: 31 (6 officers)

SHIPS

VIESTURS (M 01)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR Volksmarine) 24 July 1971 (*Kamenz* (351))
Transferred (Latvia) 30 Aug 1993
Recommissioned April 1994

IMANTA (324)
Builder Peenewerft, Wolgast, Germany (former DDR)
Commissioned (DDR Volksmarine) 1 Dec 1971 (*Robel* (324))
Transferred (Latvia) 30 Aug 1993
Recommissioned Apr 1994

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

The ships were transferred with their minesweeping equipment, which was of Russian origin, including:

FRG-1 long-range magnetic sweeping gear
MSG-3 variable depth sweep device.

WEAPONS SYSTEMS

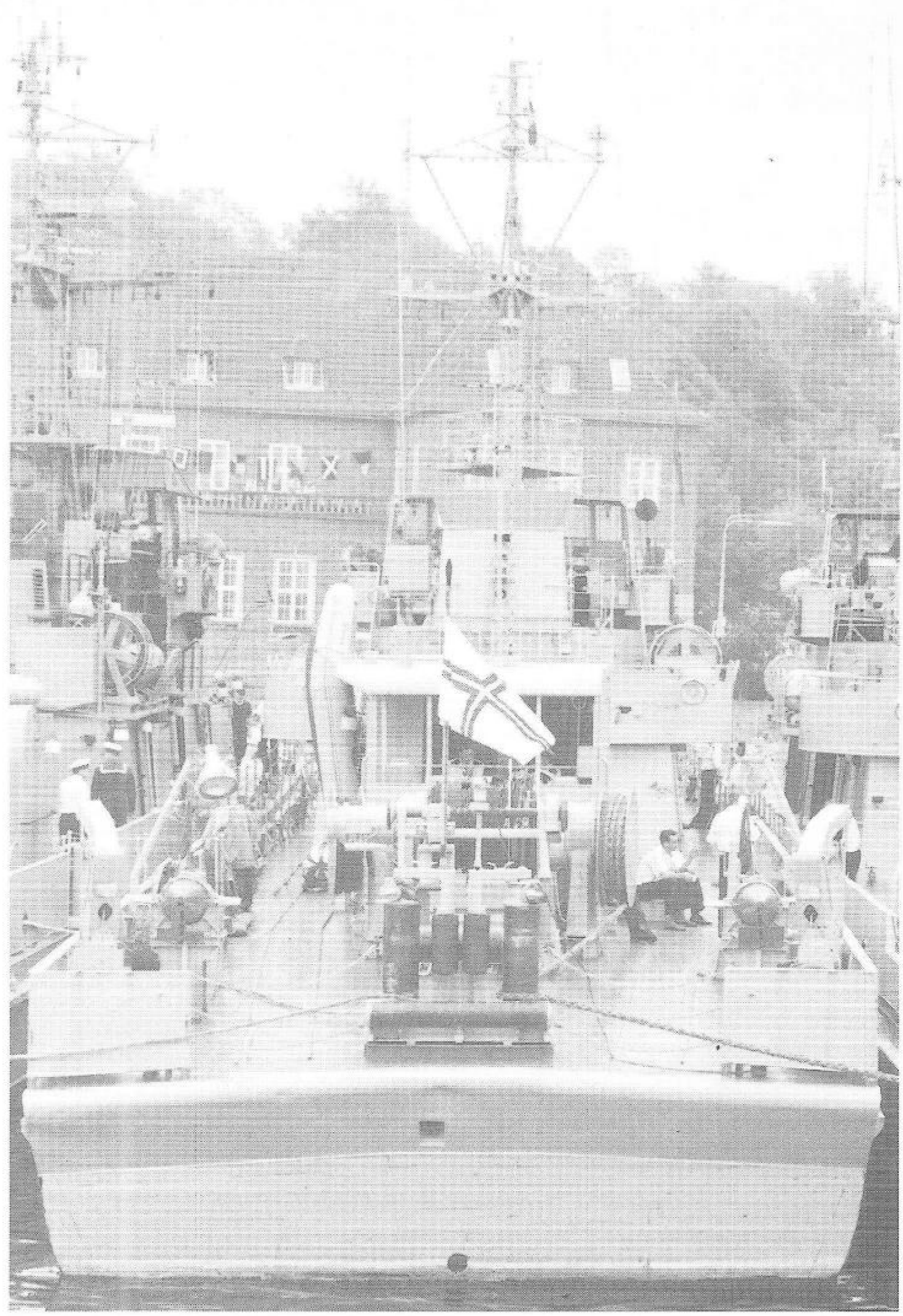
GUNS

Wrobel-I ZU-23-2M twin 23 mm cannon

The ships were supplied from Germany unarmed, but Poland supplied the weapons; Polish Wrobel-I ZU-23-2M 23 mm mounts. One is on the foredeck and two are side by side abaft the stack. The ZU-23-2 was manufactured for some years in Poland and this particular mounting is designated Wrobel-I and consists of twin 23 mm cannon mounted side by side in an open tub-type mounting, but with a clear cover of either glass or plastic. The ZU-23-2 consists of two air-cooled 2A14 cannon of monobloc construction. Each barrel weighs 27.2 kg (60 lb), is 2.01 m (6.6 ft) long including flash suppressor, and they fit into separate cradles. A ZAP-23 optical sight is attached to the rear of the weapon which is on a manually operated firing platform. The mounting has a five-man crew, of whom two are on the mounting and three are ammunition carriers and loaders.

Specifications

(Wrobel I ZU-23-2M)
Calibre: 23 mm
Length of barrel: 87 calibres
Traverse: 360°
Elevation: −10 to +90°
Rates of fire: 200 rds/min/barrel
Projectile: 0.19 kg (0.42 lb)
Range:
anti-surface: 1.1 n miles (2 km)
anti-air: 1,500 m (4,920 ft)



Viesturs *(M 01) of the Latvian Navy* (H M Steele)

COMMAND AND CONTROL SYSTEMS

RADAR

Surface search/navigation

One I-band set; type not known.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Kolomna Type 40-DM diesels; 3.24 MW (4,408 hp(m)) sustained
Shafts: 2
Propellers: 2 cp

KONDOR II

GENERAL SPECIFICATIONS

Country of origin: Germany (former DDR)
Operator: Uruguay
Type: Coastal minesweeper

Class: KONDOR II

Purchased: 4
Active: 4

Displacement
full load: 310 t

Dimensions
Length: 56.7 m (186 ft)
Beam: 7.5 m (24.6 ft)
Draught: 2.4 m (7.9 ft)

Speed: 17 kts
Range: 2,000 n miles at 14 kts

Complement: 31 (6 officers)

SHIPS

TEMERARIO (31)

Builder	Peenewerft, Wolgast, Germany (former DDR)
Launched	2 Oct 1972
Commissioned (DDR Volksmarine)	3 Feb 1973 (*Riesa* (345))
Sold (Uruguay)	1991
Recommissioned	11 Oct 1991

VALIENTE (32)

Builder	Peenewerft, Wolgast, Germany (former DDR)
Launched	31 Aug 1972
Commissioned (DDR Volksmarine)	22 Dec 1972 (*Eilenburg* (344))
Transferred (Bundesmarine)	1990 (M 2674)
Sold (Uruguay)	1991
Recommissioned	11 Oct 1991

FORTUNA (33)

Builder	Peenewerft, Wolgast, Germany (former DDR)
Launched	3 Aug 1972
Commissioned (DDR Volksmarine)	1 Dec 1972 (*Bernau* (343))
Transferred (Bundesmarine)	1990 (M 2673)
Sold (Uruguay)	1991
Recommissioned	11 Oct 1991

AUDAZ (34)

Builder	Peenewerft, Wolgast, Germany (former DDR)
Launched	2 Jan 1973
Commissioned (DDR Volksmarine)	24 May 1973 (*Eisleben* (312))
Transferred (Bundesmarine)	1990 (M 2671)
Sold (Uruguay)	1991
Recommissioned	11 Oct 1991

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

The ships were transferred with their minesweeping equipment, which was of Russian origin, including:

FRG-1 long-range magnetic sweeping gear
MSG-3 variable depth sweep device

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60
One Bofors gun is mounted on the foredeck.

Specifications
Traverse: 360° (nominal) at 90°/s
Elevation: −3 to +85° at 60°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 4,000 m (2.2 n miles)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

MINES

2 rails

COMMAND AND CONTROL SYSTEMS

RADAR

TSR 333 or Raytheon 1900
I-band surface search radars.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kolomna Type 40-DM diesels; 3.24 MW (4,408 hp(m)) sustained

Shafts: 2
Propellers: 2 cp

FRAUENLOB (KLASSE 394)

GENERAL SPECIFICATIONS

Operator: Germany
Type: Inshore minesweeper (Klasse 394)

Class: FRAUENLOB

Built: 10
Active: 5

Displacement:
standard: 238 t
full load: 246 t

Dimensions
Length: 38 m (124.6 ft)
Beam: 8.2 m (26.9 ft)
Draught: 2 m (6.6 ft)

Speed: 12+ kts
Range: 700 n miles at 14 kts

Complement: 25 (2 officers)

SHIPS

FRAUENLOB (M 2658)
Builder Krogerwerft, Rendsburg, Germany
Launched 26 Feb 1965
Commissioned 27 Sep 1966

GEFION (M 2660)
Builder Krogerwerft, Rendsburg, Germany
Launched 19 Jun 1965
Commissioned 17 Feb 1967

MEDUSA (M 2661)
Builder Krogerwerft, Rendsburg, Germany
Launched 25 Jan 1966
Commissioned 17 Feb 1967

UNDINE (M 2662)
Builder Krogerwerft, Rendsburg, Germany
Launched 16 Mar 1966
Commissioned 20 Mar 1967

LORELEY (M 2665)
Builder Krogerwerft, Rendsburg, Germany
Launched 14 Mar 1967
Commissioned 29 Mar 1968

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

- These ships have a mechanical, acoustic and magnetic sweeping capability.
- There is one 260 kW sweep current diesel generator.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/70
The SAK 40L/70-315 is a manually laid mounting in which the gun platform is on a pedestal. The total height to the centre of the barrel from the deck when the gun is horizontal is 1.36 m (4.5 ft). The mounting weighs 2.87 t unloaded, is 1.83 m (6.0 ft) long and has a training radius of 3.31 m (10.8 ft). The mounting has a protective shield and includes ammunition racks for 96 rounds.

Specifications
Traverse: 360° (nominal) at 30°/s
Elevation: −3 to +85° at 24°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Manufacturer/Contractor
Bofors Weapon Systems, Sweden.

MINES

Laying capability.

COMMAND AND CONTROL SYSTEMS

RADAR

STN Atlas TRS-N
One I-band navigation radar.

PROPULSION

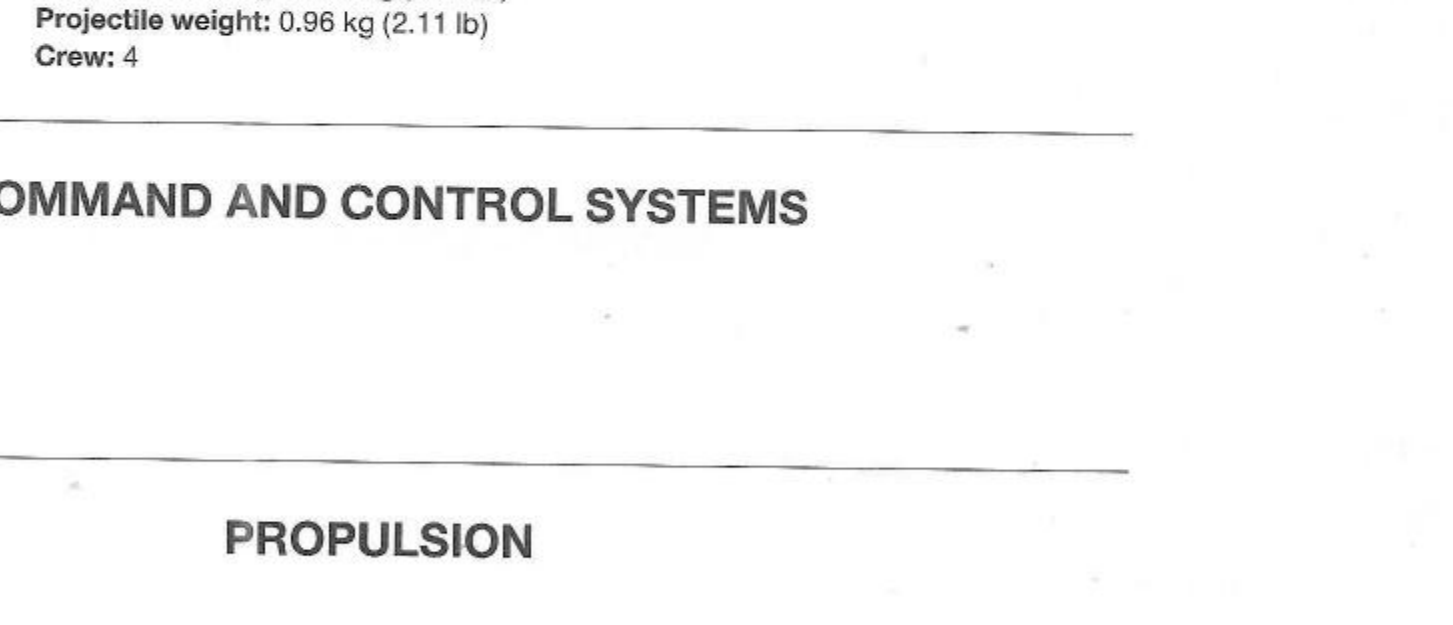
Specifications
System: Diesel
Main machinery: 2 MTU MB 12V 493 TY70 diesels; 1.62 MW (2,200 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

These ten vessels were launched in 1965-67 and were originally designated coastguard boats with the appropriate 'W' pennant numbers. They were then re-rated in 1968 as auxiliaries and allocated 'Y' numbers, but, finally, in 1974, they were again rerated, this time as minesweepers, and given 'M' numbers, which they have retained ever since.

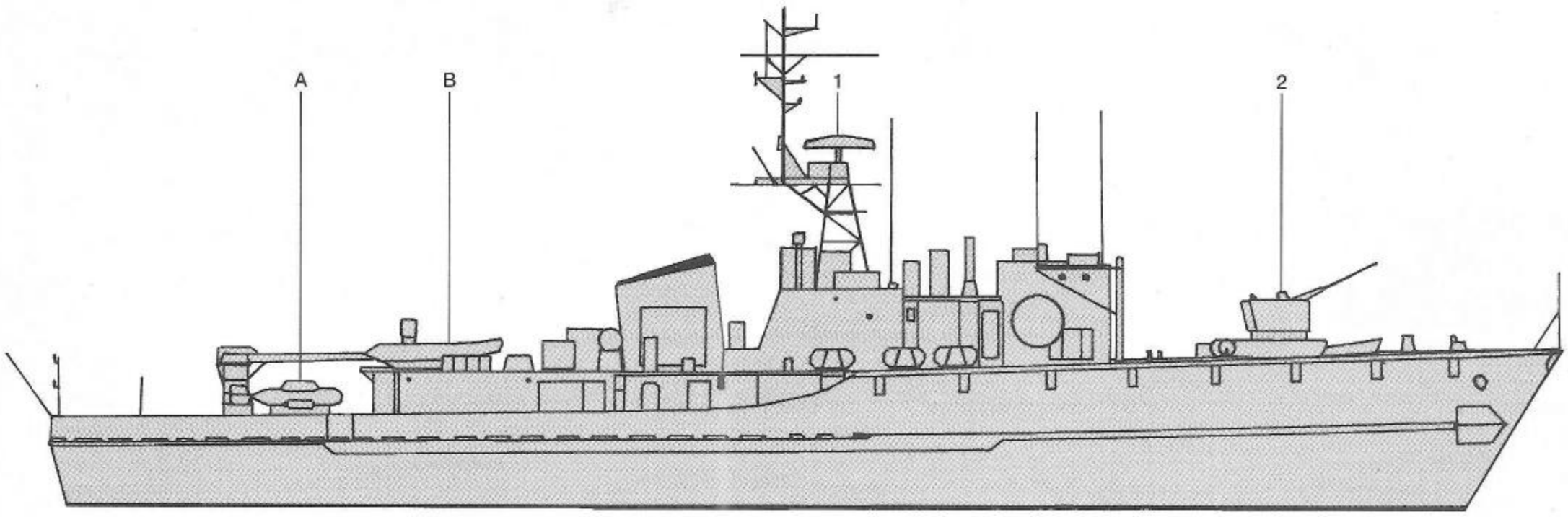
New guns were fitted in 1992.

Five were paid off in 1994/95 and the rest will follow soon.



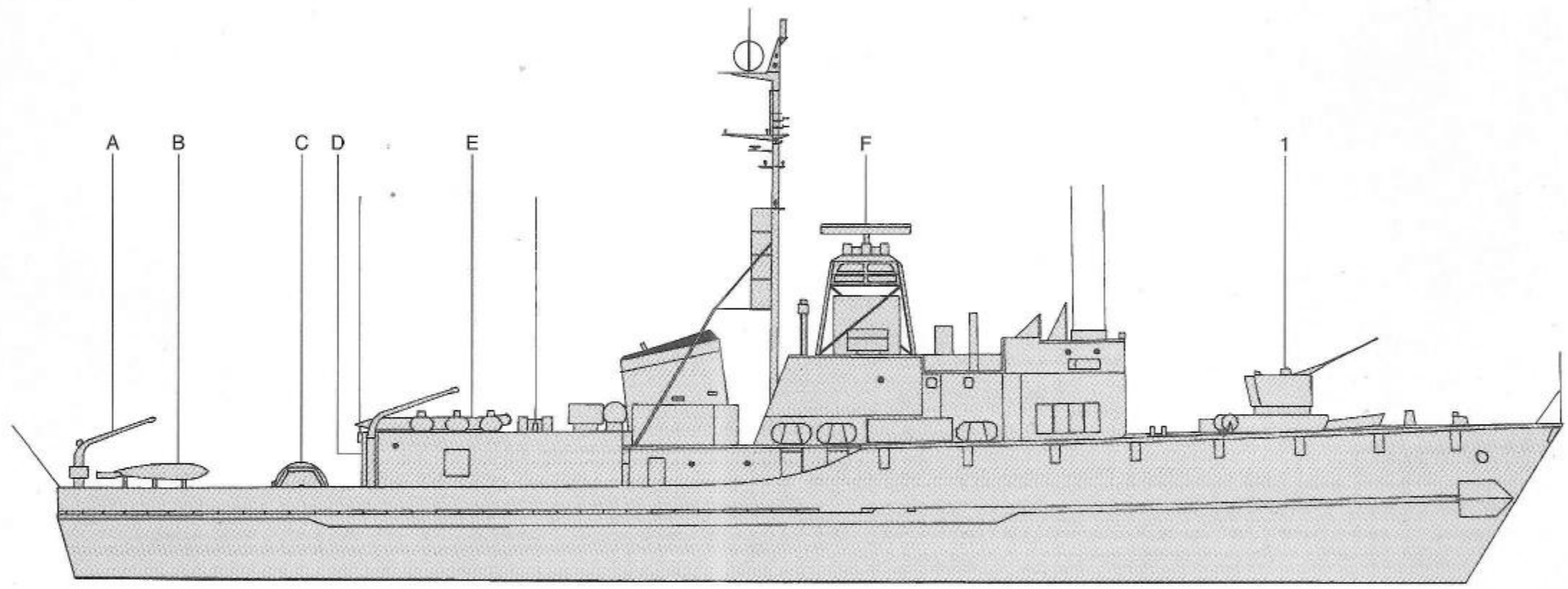
Frauenlob *(M 2658)*
(H & L van Ginderen Collection)

LINDAU (KLASSE 331B/351)



Klasse 331B (Ian Sturton)
MCM A *PAP Mk 5 ROV* **B** *Combat divers' dinghy*

General 1 *Raytheon AN/SPS-64(V)9 navigation radar* **2** *Bofors 40 m/70 cannon*



Klasse 351 (Ian Sturton)
MCM A *Crane* **B** *Oropesa float* **C** *Wire drum* **D** *Hangar* **E** *Divers' dinghy* **F** *Troika control radar*

General 1 *Bofors 40 mm/70*

GENERAL SPECIFICATIONS

Operator: Germany
Type: Minehunter

Class: LINDAU (KLASSE 331B/KLASSE 351)

Built: 18

Converted to minehunter: 12
Active: 8

Converted to Troika: 6
Active: 6

Displacement: (full load)
Minehunter: 463 t
Troika: 465 t

Dimensions
Length: 47.1 m (154.5 ft)
Beam: 8.3 m (27.2 ft)

Draught:
Minehunter: 3 m (9.8 ft)
Troika: 2.8 m (9.2 ft)

Speed: 16.5 kts
Range: 850 n miles at 16.5 kts

Complement:
Minehunter: 43 (5 officers)
Troika: 44 (4 officers)

SHIPS

Klasse 331B Minehunters

GÖTTINGEN (M 1070)

Builder	Burmester, Bremen, Germany
Launched	1 Apr 1957
Commissioned	31 May 1958
Conversion completed	19 Jan 1979

KOBLENZ (M 1071)

Builder	Burmester, Bremen, Germany
Launched	6 May 1957
Commissioned	8 Jul 1958
Conversion completed	21 Jun 1978

LINDAU (M 1072)

Builder	Burmester, Bremen, Germany
Launched	16 Feb 1957
Commissioned	24 Apr 1958
Conversion completed	10 Feb 1978

TÜBINGEN (M 1074)

Builder	Burmester, Bremen, Germany
Launched	12 Aug 1957
Commissioned	25 Sep 1958
Conversion completed	20 Mar 1978

CUXHAVEN (M 1078)

Builder	Burmester, Bremen, Germany
Launched	11 Mar 1958
Commissioned	11 Mar 1959
Conversion completed	6 Jun 1979

MARBURG (M 1080)

Builder	Burmester, Bremen, Germany
Launched	4 Aug 1958
Commissioned	11 Jun 1959
Conversion completed	28 Jun 1979

MINDEN (M 1085)
Builder Burmester, Bremen, Germany
Launched 9 Jun 1960
Commissioned 22 Jan 1960
Conversion completed 31 May 1978

VOLKLINGEN (M 1087)
Builder Burmester, Bremen, Germany
Launched 20 Oct 1959
Commissioned 21 May 1960
Conversion completed 15 Jul 1979

Klasse 351 Troika control minesweepers

SCHLESWIG (M 1073)
Builder Burmester, Bremen, Germany
Launched 2 Oct 1957
Commissioned 30 Oct 1958
Conversion completed 19 Mar 1981

PADERBORN (M 1076)
Builder Burmester, Bremen, Germany
Launched 5 Dec 1957
Commissioned 16 Dec 1958
Conversion completed 17 Sep 1981

DÜREN (M 1079)
Builder Burmester, Bremen, Germany
Launched 12 Jun 1958
Commissioned 22 Apr 1959
Conversion completed 7 Nov 1983

KONSTANZ (M 1081)
Builder Burmester, Bremen, Germany
Launched 30 Sep 1958
Commissioned 23 Jul 1959
Conversion completed 24 May 1982

WOLFSBURG (M 1082)
Builder Burmester, Bremen, Germany
Launched 10 Dec 1958
Commissioned 8 Oct 1959
Conversion completed 4 Mar 1982

ULM (M 1083)
Builder Burmester, Bremen, Germany
Launched 10 Feb 1959
Commissioned 7 Nov 1959
Conversion completed 11 Nov 1981

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

PAP Mk 5 ROV

Klasse 331B minehunters only. The German minehunters carry two PAP Mk 5 (PAP = *poisson autopropulsé*) ROVs, which have the capability simultaneously to hunt and destroy ground mines and tethered mines either by placing and remotely detonating a charge or by cutting the mooring rope of tethered mines. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via either a tether, which can be either a 2,000 m (6,560 ft) fibre optic cable or a 1,000 m (3,280 ft) coaxial cable. It is horizontally propelled by means of two side thrusters.

In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide-rope'. The winch in the PAP is instructed to deploy a selected length of rope and the operator then uses return signals from the vehicle to maintain the vehicle at the desired selected height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP Mk 5 is able to carry the 126 kg (278 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution nearfield sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

Specifications

(PAP Mk 5)
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.2 ft)
Performance:
Max vehicle velocity
mid-water transit: 6 kts (3 m/s)
bottom-following mode: 5.5 kts (2.75 m/s)
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s
Ascent velocity (charge released): 1.5 m/s
Payload:
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Horizontal range:
with fibre optic cable: 2,000 m (6,560 ft)
with coaxial cable: 1,000 m (3,280 ft)
Max continuous endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bars

Manufacturer/Contractor

Société ECA, 92707 Colombes, France.

Type HL 351 'Troika' minesweeping drones

The 'Troika' system consists of a Type 351 control ship and three self-propelled minesweeping drones, designated HFG-F1. The 'Troika' drones, known as *Seehunde* are 24 m (79 ft) long and have a steel, blast-resistant hull, encased in a wooden outer hull. The overall design of the minesweepers is characterised by extremely high shock resistance, with a diesel engine driving a combined rudder/propeller via a hydraulic transmission system.

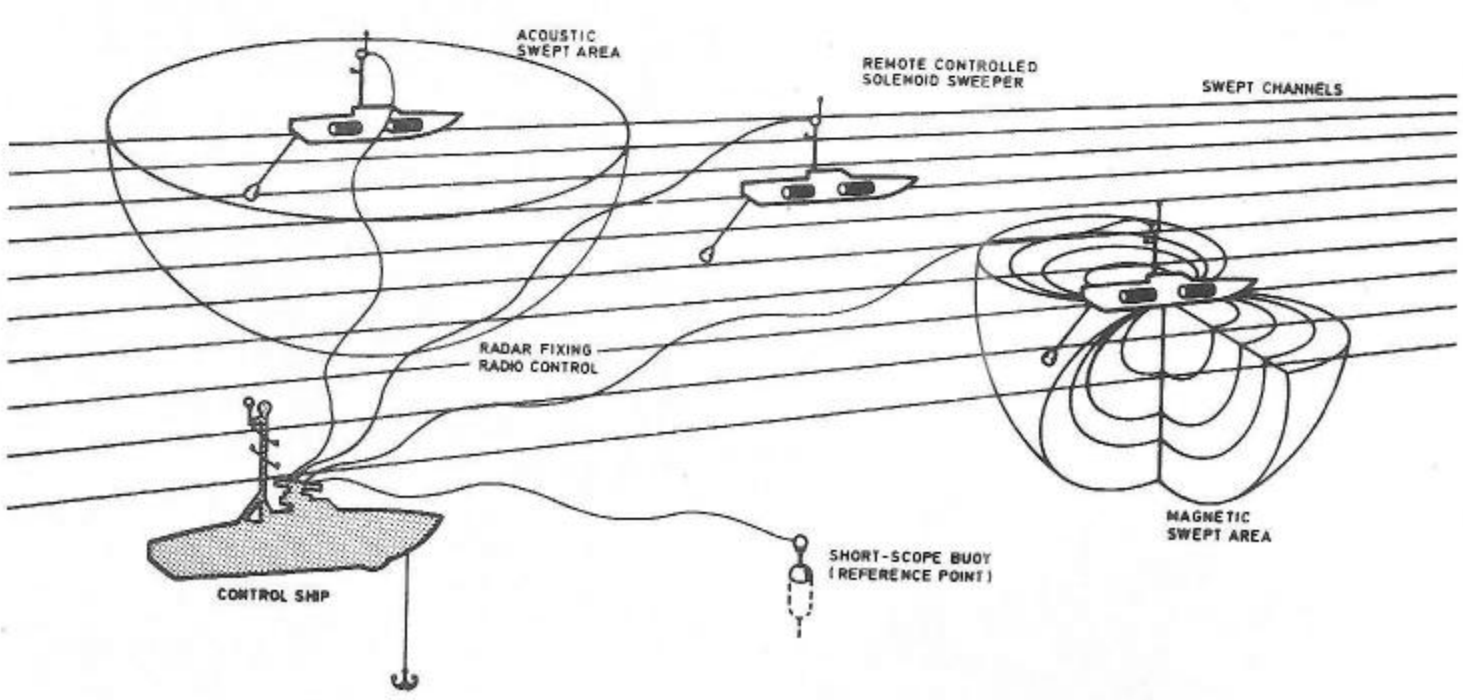
For sweeping magnetic mines, the drone contains two coils, one mounted forward, the other aft, while for acoustic minesweeping two medium-frequency acoustic hammers and one towed low-frequency acoustic displacer are provided.

The Troika system uses a converted 'Lindau' class coastal minesweeper as the minesweeping operations centre. The remote-control equipment comprises a horizon-stabilised X/C-band precision navigation radar, a digital target extractor, a master console and three control displays. Each of the latter is associated with one unmanned minesweeper on the one hand, and with a remote action system operator console on the other. The control displays allow the radar image of the swept channel to be greatly magnified so that a high degree of precision is achieved in guiding the unmanned minesweepers along the specified tracks electronically inserted into the radar image.

Control commands are sent to the minesweepers over a line of sight UHF radio link, using multiplexed data messages. Their responses and functions are monitored automatically by an integrated monitoring system. There is also a reference buoy which provides a geographically stabilised radar image.

Manufacturer/Contractor

Lürssen Werft, Vegesack, Bremen, Germany.



The Troika system with a Klasse 351 vessel acting as the control ship for three Seehunde

MINEHUNTING SONAR

STN Atlas DSQS-11M

The DSQS-11M minehunting sonar is a high-definition, dual-frequency sonar which forms an integral part of the Atlas MWS 80-5 minehunting weapons system. In the 'Rushcutter' class installation the sonar transducer is housed in a self-contained module located in the forward part of the port hull. The sonar performs:

Detection and classification of all types of ground, short tethered and moored mines
High-clearance performance by simultaneous detection and classification within a 90° sector
Simultaneous 3D precision target localisation
Computer-aided detection (CAD) and classification (CAC)
Automatic tracking of stationary and moving targets
Integrated sonar performance prediction function
Integrated route survey mode (side scan function)
Video and data recording and playback
Comprehensive BITE to ensure system availability

The system comprises an operator console, an electronics cabinet, the hoisting unit (with transducer arrays, signal processing units and stabilisation unit) and the hydraulics unit.

The DSQS-11 M console includes two high-resolution raster scan displays and keypads for direct system operation. Additionally the operation is supported by easily accessible menu guidance on both graphic displays.

The DSQS-11M sonar operates on three frequencies (40, 100 and 200 kHz).

Manufacturer/Contractor

STN Atlas Elektronik, Bremen, Germany.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/70

The SAK 40L/70-315 is a manually laid mounting in which the gun platform is on a pedestal. The total height to the centre of the barrel from the deck when the gun is horizontal is 1.36 m (4.5 ft). The mounting weighs 2.87 t unloaded, is 1.83 m (6.0 ft) long and has a training radius of 3.31 m (10.8 ft). The mounting has a protective shield and includes ammunition racks for 96 rounds.

Specifications
Traverse: 360° (nominal) at 30°/s
Elevation: −3 to +85° at 24°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Manufacturer/Contractor
Bofors Weapon Systems, Sweden.

COMMAND AND CONTROL SYSTEMS

RADAR

Raytheon AN/SPS-64(V)9

The ships were fitted with either Kelvin Hughes 14/9 or STN Atlas Elektronik TRS N; both are I-band navigation radars. These are in the process of being replaced by the Raytheon AN/SPS-64(V)9.

Specifications
AN/SPS-64(V)9
Role: Navigation
Frequency: I-band
Beam: 1.9 × 22°
Peak power: 20 kW
Gain: 28 dB
Pulsewidth: 0.06/0.5/1.0 µs
PRF: 3,600/1,800/900 pps
Scan rate: 33 rpm

Manufacturer/Contractor
Raytheon, USA.

PROPULSION

Specifications
System: Diesel
Main machinery:
Minehunters: 2 MTU MD diesels; 2.94 MW (4,000 hp(m))
Troika: 2 MTU MD 16V 538 TB90 diesels, 3.68 MW (5,000 hp(m))
Shafts: 2

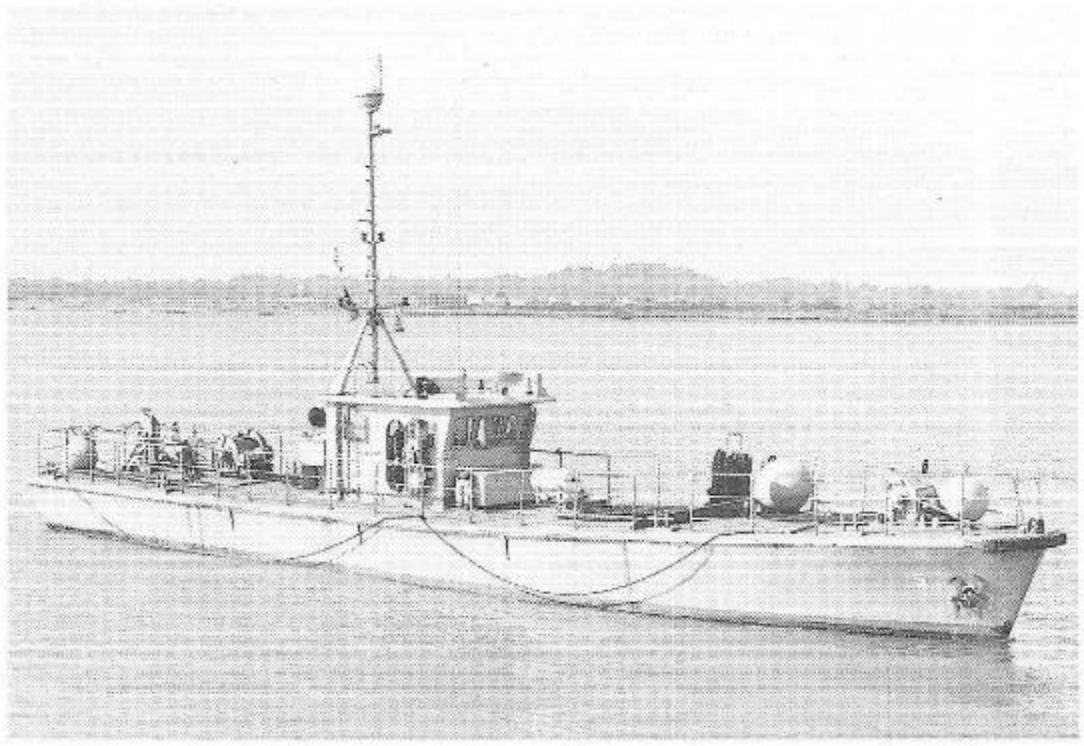
FURTHER INFORMATION

DESIGN

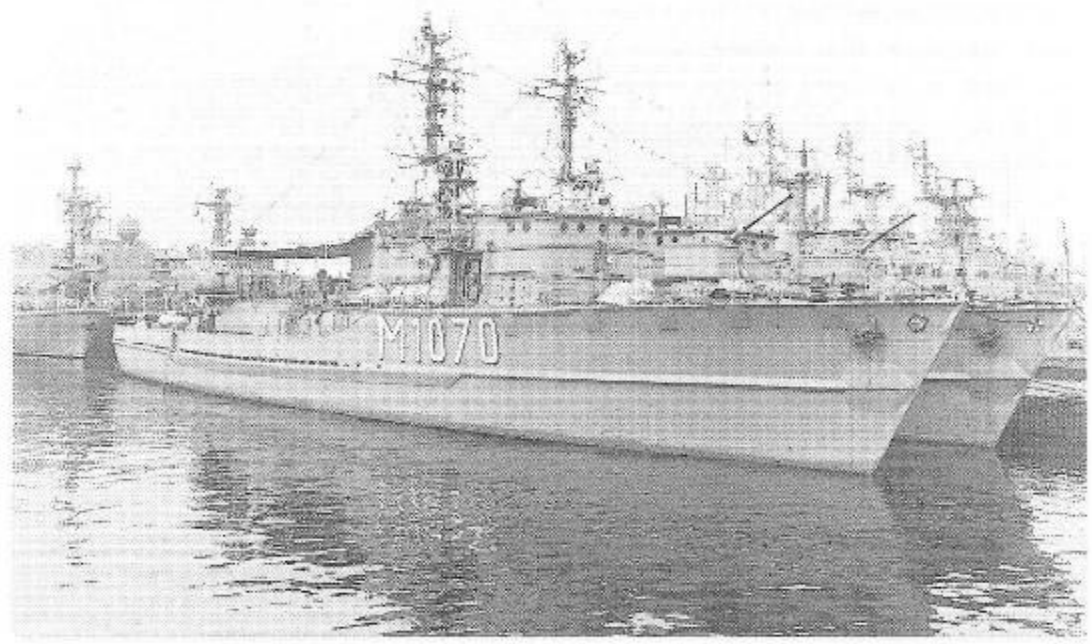
As originally built, the ships belonged to Klasse 320, which was essentially a German version of the NATO standard coastal minesweeper, great numbers of which were produced in the 1950s. The hull is of wooden construction and the components, such as the engines, are made of non-magnetic materials. There were some early problems with the design. The bridge was found to be too high, making the ships unstable, and had to be lowered by one deck level, while there was insufficient working space on the afterdeck, which had to be enlarged. An early refit was required to resolve these problems.

Twelve ships were converted to minehunters. Two (*Fulda* and *Flensburg*) were converted under the original programme, designated Klasse 331A, and have now been retired. The remaining ten were slightly different and were designated Klasse 331B.

The remaining six ships were converted to Klasse 351 as Troika control ships, in which they control up to three Seehunde.

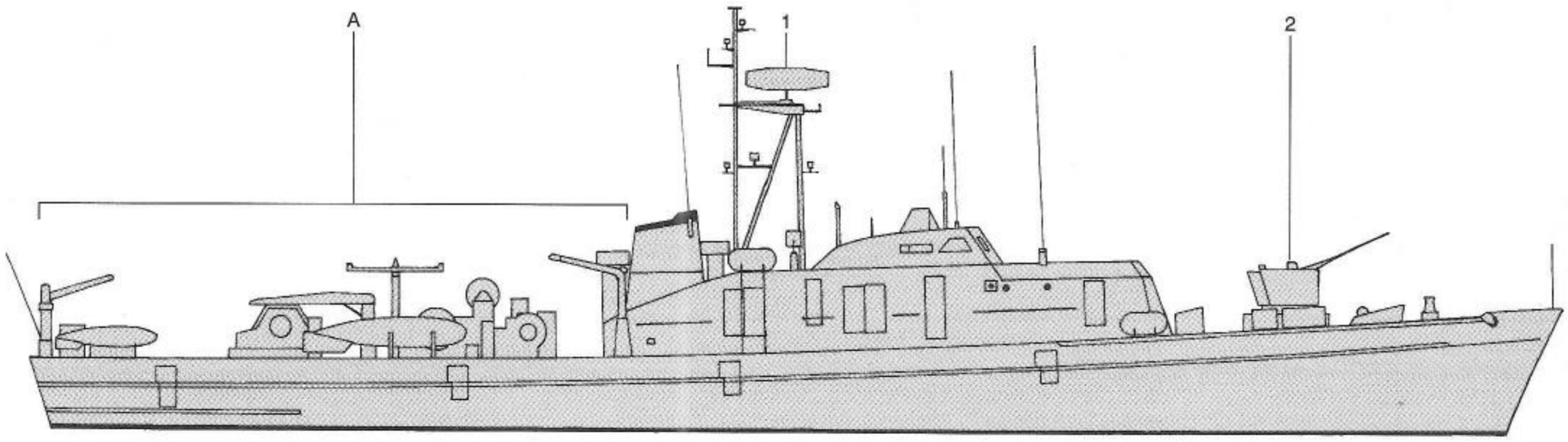


Seehund 5, *one of the unmanned craft for the Troika system* (H & L van Ginderen Collection)



Göttingen *(M 1070) a Klasse 331B minehunter. Note the PAP Mk 5 with sonar head on chocks aft* (H M Steele)

ÁRATU (KLASSE 341a)



'Áratu' class (Brazil — 'Schütze' class)
MCM A *Sweep deck*

General 1 *Signaal ZW-06 surface search/navigation radar* **2** *Bofors 40 mm/70*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Brazil
Type: Klasse 341a (fast coastal minesweepers)

Class: ÁRATU

Purchased: 6
Active: 6

Displacement:
standard: 230 t
full load: 280 t

Dimensions
Length: 47.2 m (154.9 ft)
Beam: 7.2 m (23.6 ft)
Draught: 2.1 m (6.9 ft)

Speed: 24 kts
Range: 710 n miles at 20 kts

Complement: 39 (4 officers)

SHIPS

ÁRATU (M 15)
Builder Abeking & Rasmussen, Lemwerder, Germany
Commissioned 5 May 1971

ANHATOMIRIM (M 16)
Builder Abeking & Rasmussen, Lemwerder, Germany
Commissioned 30 Nov 1971

ATALAIA (M 17)
Builder Abeking & Rasmussen, Lemwerder, Germany
Commissioned 13 Dec 1972

ARACATUBA (M 18)
Builder Abeking & Rasmussen, Lemwerder, Germany
Commissioned 13 Dec 1972

ABROLHOS (M 19)
Builder Abeking & Rasmussen, Lemwerder, Germany
Commissioned 25 Feb 1976

ALBARDAO (M 20)
Builder Abeking & Rasmussen, Lemwerder, Germany
Commissioned 25 Feb 1976

MINE COUNTERMEASURES SYSTEMS

These ships are equipped for mechanical, acoustic and magnetic minesweeping. They do not appear to have a minehunting sonar.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/70
One Bofors 40 mm/70 is mounted on the foredeck.

Specifications
Traverse: 360° (nominal) at 30°/s
Elevation: −3 to +85° at 24°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Manufacturer/Contractor
Bofors Weapon Systems, Sweden.

Áratu *(M 15). These six minesweepers, purchased by Brazil, were virtually identical to the Bundesmarine's 'Schütze' class* (Abeking & Rasmussen)

COMMAND AND CONTROL SYSTEMS

RADAR

Signaal ZW-06
I-band surface search radar.

Specifications
(ZW-06)
Role: Navigation/surface search
Frequency: I-band
Beam: 0.9 × 19°
Peak power: 60 kW
Gain: 32 dB
Pulsewidth: 0.06/0.6 µs
PRF: 4,000/2,000 pps
Scan rate: 24 rpm
Typical range: 14 n miles (26 km)

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, The Netherlands.

PROPULSION

Specifications
System: Diesel
Main machinery: 4 MTU-Maybach diesels; 3.3 MW (4,500 hp(m))
Shafts: 2
Propellers: 2 Escher-Weiss cp

FURTHER INFORMATION

PROGRAMME

The 'Schütze' class minesweepers were built for the (then) West German Navy *(Bundesmarine)* by Abeking & Rasmussen between 1957 and 1959. 25 were built and by 1992 all had been deleted, most of them being disarmed and sold to private owners; none was sold to overseas navies.

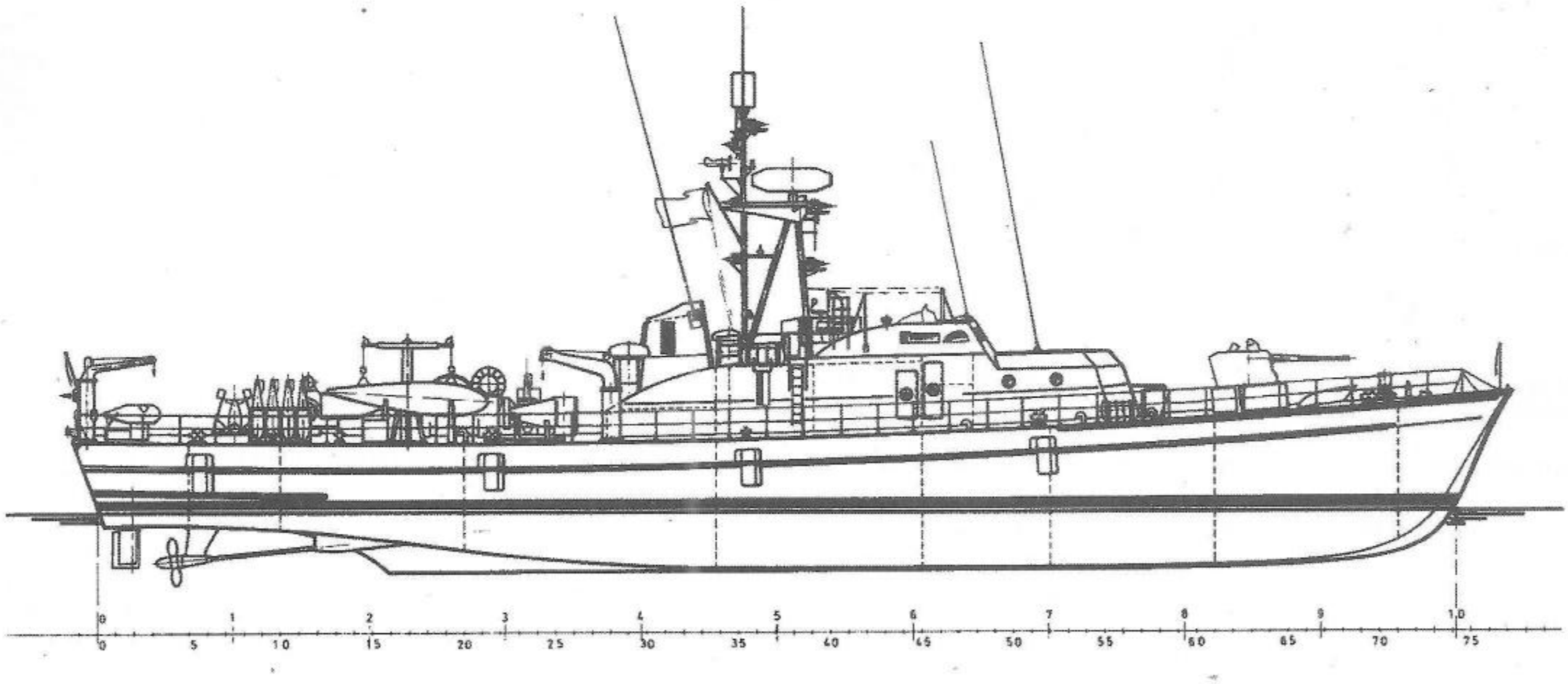
The Brazilian Navy, however, purchased six new boats to the same design as those built for the *Bundesmarine*. The first four were ordered in April 1969 and last two in November 1973. All six remain in service.

DESIGN

The Schütze design was based on that of the last of the R-class boats built for the *Kriegsmarine* during the Second World War. The boats are constructed of wood and non-magnetic materials, and carry mechanical, acoustic and magnetic sweeping gear.

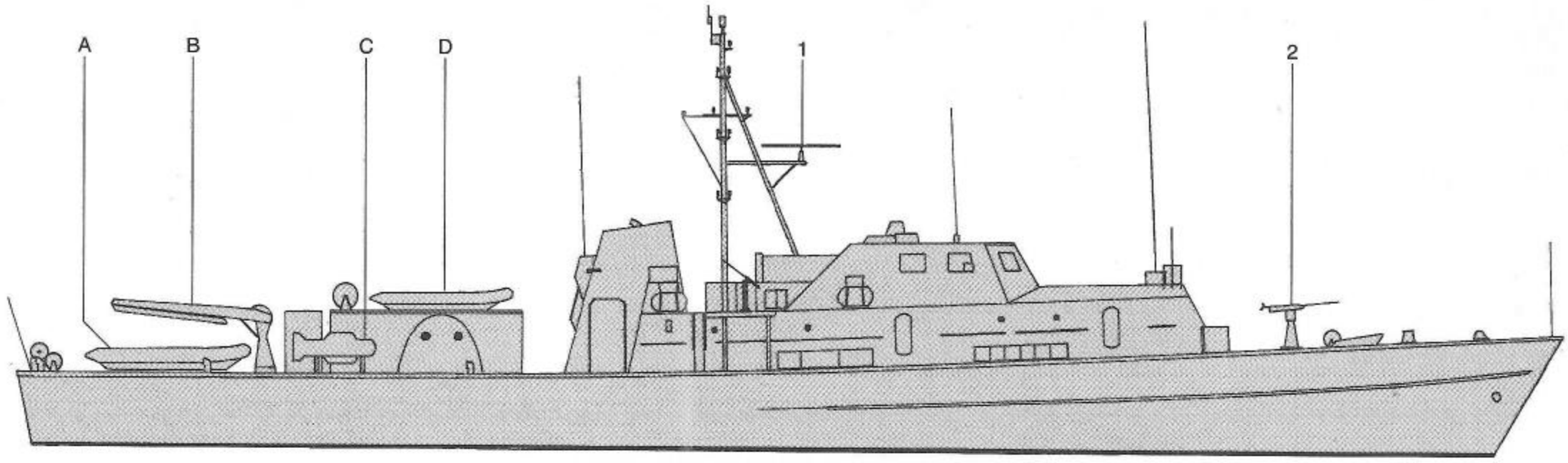
MODERNISATION

It is expected that all six boats will be modernised in the late 1990s.



Brazilian Navy 'Aratu' class (Klasse 341a) (Abeking & Rasmussen)

RIVER (MODIFIED SCHÜTZE)



'River' class (South Africa) Mod. 'Schütze' class
MCM A *RHIB for combat divers* **B** *Davit* **C** *PAP Mk 4* **D** *RHIB*

General 1 *Racal-Decca TM1226 navigation radar* **2** *Oerlikon 20 mm*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: South Africa
Type: Coastal minesweepers/minehunters

Class: RIVER (MODIFIED SCHÜTZE)

Purchased: 4
Active: 4

Displacement:
full load: 380 t

Dimensions
Length: 48.0 m (157.5 ft)
Beam: 8.5 m (27. 9 ft)
Draught: 2.5 m (8.2 ft)

Speed: 16 kts
Range: 2,000 n miles at 13 kts

Complement: 40 (7 officers)

SHIPS

UMKOMAAS (M 1499)
Builders Abeking & Rasmussen, Lemwerder, Germany/ Sandock Austral, South Africa
Commissioned 13 Jan 1981

UMGENI (M 1213)
Builders Abeking & Rasmussen, Lemwerder, Germany/ Sandock Austral, South Africa
Commissioned 1 Mar 1981

UMZIMKULU (M 1142)
Builder Sandock Austral, South Africa
Commissioned 13 Oct 1981

UMHLOTI (M 1212)
Builder Sandock Austral, South Africa
Commissioned 15 Dec 1981

MINE COUNTERMEASURES SYSTEMS

These ships are equipped for mechanical, acoustic and magnetic minesweeping, and are also equipped with a minehunting sonar.

COMBAT DIVERS

There are six combat divers and a decompression chamber is mounted on the sweep deck.

MINESWEEPING

PAP-104 Mk 4 ROV

The South African MCMVs carry two PAP Mk 4 (PAP — *poisson auto-propulsé*) ROVs, which have the capability simultaneously to hunt and destroy ground mines and tethered mines either by placing and remotely detonating a charge or by cutting the mooring rope of tethered mines. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via either a tether or a coaxial cable. It is horizontally propelled by means of two side thrusters.

In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide rope'. The winch in the PAP is instructed to deploy a selected length of rope and the operator then uses return signals from the vehicle to maintain the vehicle at the desired selected height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP Mk 4 is able to carry the 126 kg (278 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution nearfield sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

Specifications
PAP Mk 4
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.2 ft)
Performance
Max vehicle velocity:
mid-water transit: 5 kts
bottom-following mode: 5 kts
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s (2.3 ft/s)
Ascent velocity (charge released): 1.5 m/s (4.9 ft/s)
Payload
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Max continuous endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bars

Manufacturer/Contractor
Société ECA, 92702 Colombes, France.

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm GAM-BO1

There is one Oerlikon cannon on a GAM-BO1 mounting on the foredeck.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)

Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,773 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca 1226

Specifications
Role: Navigation
Frequency: I-band
Range: 48 n miles (81 km)
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: Two MTU 12V-652-TB81 diesels; 3.32 MW (4,515 hp(m))

Shafts: 2
Propellers: Two Voith-Schneider

FURTHER INFORMATION

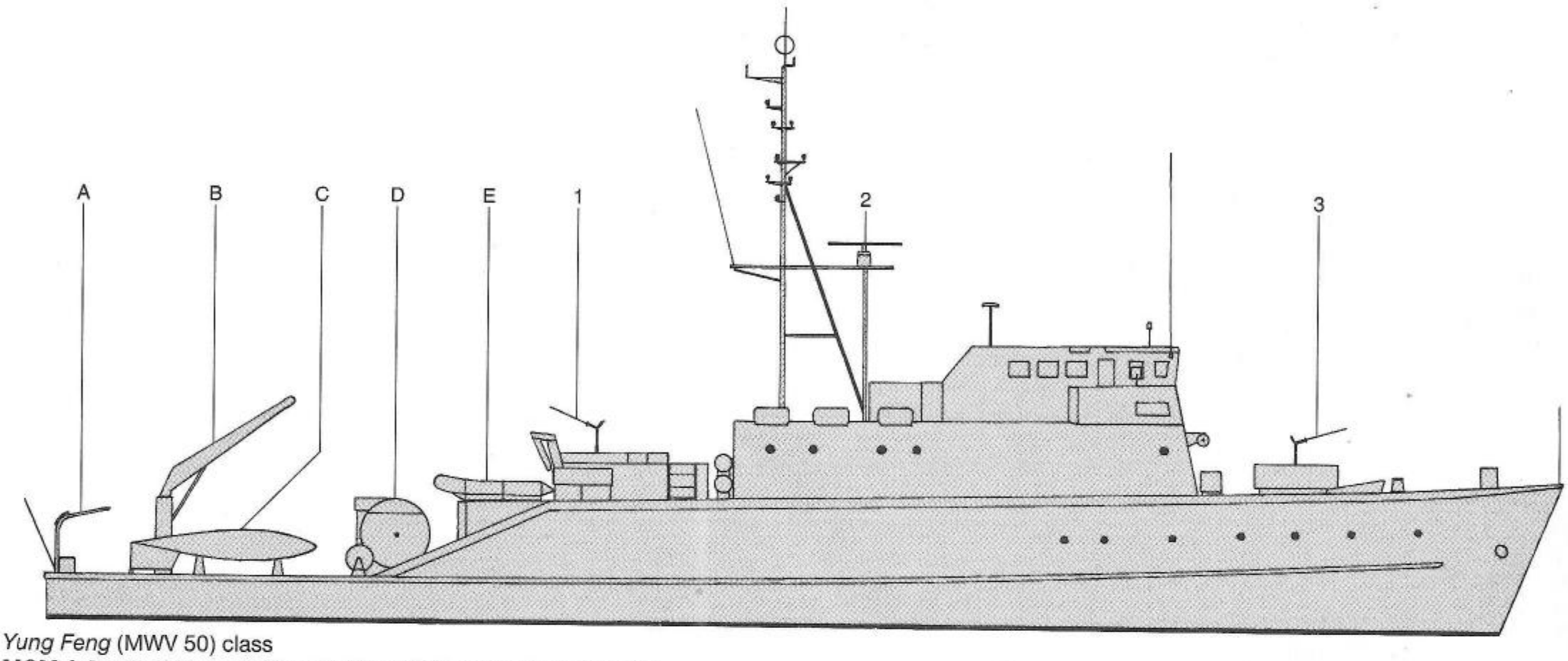
PROGRAMME

Abeking & Rasmussen built a series of 25 'Schütze' class minesweepers for the (then) West German Navy between 1957 and 1959. In the 1970s, the South African Navy (SAN) was faced with an international arms embargo. The first two of these vessels were purchased for 'hydrological and geophysical research' and the hulls were constructed by Abeking & Rasmussen in Germany, following which they were shipped to Cape Town where they were completed and fitted out.

On completion the hulls were painted blue and white upperworks and, having been named *RV Navors I* and *Navors II*, respectively, they were then operated by the navy 'on behalf of' the Department of Transport, flying the national flag (and not the naval ensign). They were finally commissioned into the navy, painted grey and given pennant numbers on 3 February 1988.

It is intended to give them a second-generation mine-hunting system as soon as funds become available, but there are many other calls on the limited funds available.

YUNG FENG (MWV 50)



Yung Feng (MWV 50) class
MCM A *Davits* **B** *Crane* **C** *Float* **D** *Winch* **E** *Combat divers' dinghy*

General 1 *12.7 mm machine gun* **2** *Navigation radar* **3** *12.7 mm machine gun (may be exchanged for Bofors 40 mm)*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Republic of China, Taiwan
Type: MWV 50 (Coastal minehunter)

Class: YUNG FENG

Purchased: 4
Active: 4
Proposed: 2 (?)

Displacement:
full load: 500 t

Dimensions
Length: 49.90 m (163.70 ft)
Beam: 9.40 m (30.84 ft)
Draught: 2.50 m (8.20 ft)

Speed: 15 kts
Range: 2,500 n miles at 12 kts
Endurance: 14 days

Complement: 50 (7 officers)

SHIPS

YUNG FENG (1301)
Builder Abeking & Rasmussen, Lemwerder, Germany
Delivered 1991

YUNG CHIA (1302)
Builder Abeking & Rasmussen, Lemwerder, Germany
Delivered 1991

YUNG NIENG (1303)
Builder Abeking & Rasmussen, Lemwerder, Germany
Delivered 1991

YUNG SHOEN (1305)
Builder Abeking & Rasmussen, Lemwerder, Germany
Delivered 1991

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Pinguin B3 ROV

Two per ship. The Pinguin B3 is a remotely controlled, unmanned underwater vehicle for minehunting operations. With the input of target information derived from minehunting sonars, the ROV is capable of identifying a mine and, if necessary, placing a 125 kg (275 lb) mine disposal charge to destroy it. A second charge enables the ROV to continue the mission and approach a second target.

The Pinguin B3 is equipped with a 1,000 m (3,281 ft) fibre optic cable for data transmission. In low-velocity currents, its operating distance is up to 900 m (2,953 ft) at 200 m (656 ft) depth. In currents of 3 knots the vehicle has a range of about 500 m (1,640 ft) at 200 m (656 ft) depth.

The propulsion system consists of two horizontal propeller thrusters, mounted laterally to the stern section of the vehicle.

Specifications
Length: 3.5 m (11.5 ft)
Hull diameter: 70 cm (27.5 in)
Width: 1.5 m (5.0 ft)
Height: 1.2 m (3.9 ft) including MDCs 1.5 m (4.9 ft)
Mass: 1,350 kg (2,976 lb)
Propulsion: 2 variable speed thrusters, 1 automatic controlled

Vertical thruster
Power supply: Internal battery systems
Max diving depth: 200 m (656 ft)
Speed: 6 kts (continuous), 8 kts (max)
Endurance: 60/120 min
Payload: 255 kg (562 lb) (2 mine disposal charges and other payloads)
Sensors: TV camera, different sonar options

Manufacturer/Contractor
STN Atlas Elektronik, Bremen, Germany.

IBIS V

IBIS V is a lightweight minehunting action information system, elements of the system including the Thomson-CSF TSM-2022 single array sonar and the TSM-2026 NAVIPLOT.

Manufacturer/Contractor
Thomson-CSF, France.

MINEHUNTING SONAR

Thomson-CSF TSM-2022

TSM-2022 is a hull-mounted minehunting sonar, based on experience gained with the DUBM 21B in the field of high-resolution beam-forming techniques. One of the main features of the TSM 2022 is its small-size retractable single array assembly, used for both detection and classification, which enables easy installation and maintenance.

The main functions of the sonar are: detection and classification of moored and bottom mines, detection at distances up to 600 m (1,968 ft) and classification of targets by analysis of the shape of their echo or shadow at distances up to 250 m (820 ft). In the classification mode, horizontal beamwidth is 7°; in detection mode either 14° or 28° beamwidth can be selected. In both modes the vertical beamwidth is 15°.

The main assemblies are:
The hoisting and stabilisation system together with the retractable array which is installed in the sonar trunk (0.75 m (2.5 ft) diameter). The total weight is 900 kg (1,984 lb)

Electronics cabinet
Operator's console, which provides display of sonar images in the various modes, memory and display of former sonar contacts, and includes interfaces with current mine disposal and navigation equipments.

Manufacturer/Contractor
Thomson-CSF, France.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60
There is one 40 mm Bofors in a manually operated mount on the foredeck. The 40 mm Bofors L/60 is an automatic cannon for air defence roles which may also be used to engage surface targets.

Specifications
Gun
Calibre: 40 mm
Length of barrel: 60 calibres
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Rate of fire: 300 rds/min
Traverse: Nominal 360° at 12°/s
Elevation: −5 to +90° at 25°/s
Crew: 3
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)

M2HB 12.7 mm machine gun
Two M2HB 12.7 mm (0.50 in) machine guns are carried in each ship. The M2HB is a selective short recoil automatic operation weapon using 110-round belts.

Specifications
(M2HB)
Calibre: 12.7 mm
Length of barrel: 90 calibres
Gun weight: 38.1 kg (84.0 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

RADAR

Navigation
There is one I-band navigation radar; type not known.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 12V 396 TC80 diesels; 1.874 MW (2,553 hp(m)) sustained
Shafts: 2
Propellers: Two Voith-Schneider five-bladed propellers

FURTHER INFORMATION

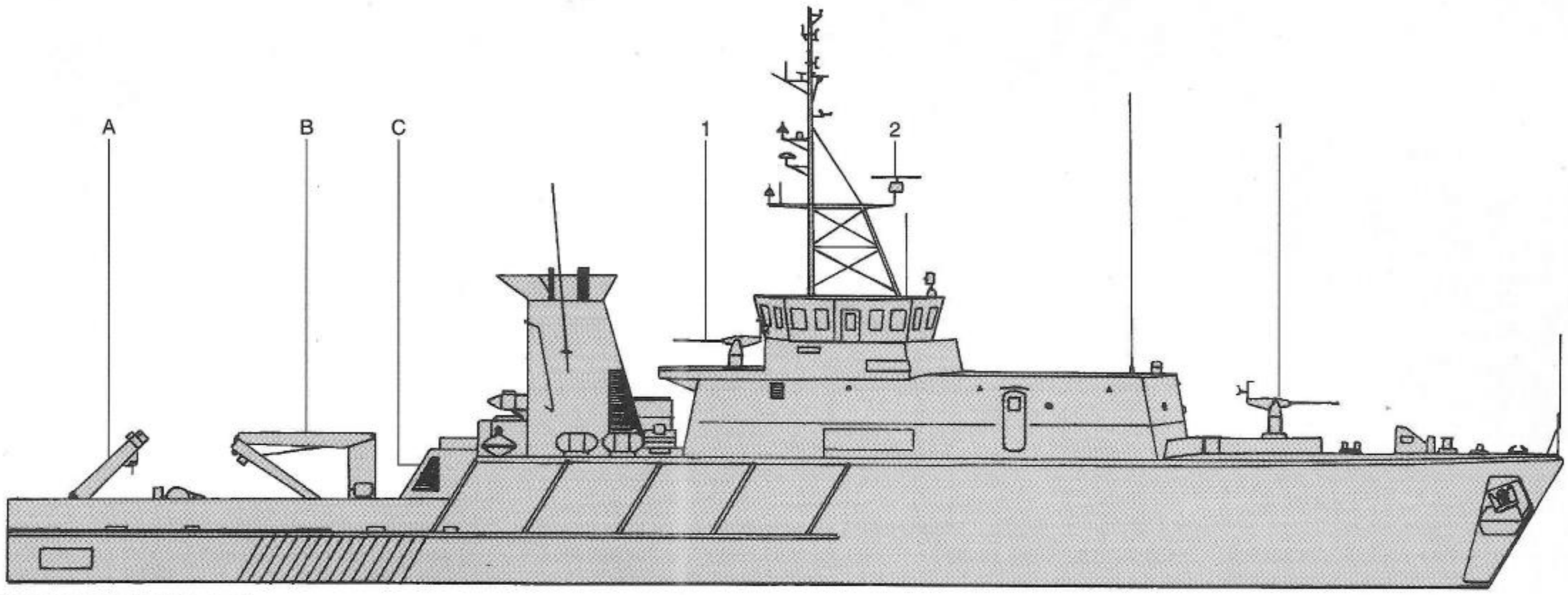
PROGRAMME

These four ships were built for the civilian, Taiwan-based, Chinese Petroleum Corporation by Abeking & Rasmussen, Lemwerder, Germany as offshore oil rig support ships. On arrival in Taiwan, however, they converted for minehunting and even appeared in their new role, but with a 'civilian' paint scheme, which included the CPC logo on the side, which contrasted with the Bofors gun and the minesweeping gear on the quarterdeck.

Some reports suggest that up to eight more of the class may be built. Also, two were reported to be under construction in 1993 in Taiwan but this has never been confirmed and no new ships have been seen. In any case, the first four ships seem to spend little time at sea.

Yung Feng *(1301). Four of these vessels were delivered to Taiwan as 'oil-rig support ships' but are now employed as MCMVs*
(H & L van Ginderen Collection)

BANGRACHAN



Bangrachan (Ian Sturton)
MCM A *Swinging gantry* **B** *Crane* **C** *ROV hangar*

General 1 *Oerlikon 20 mm GAM-BO1 mount (total 3)* **2** *STN Atlas 8600 ARPA radar*

GENERAL SPECIFICATIONS

Country of origin: Germany
Operator: Thailand
Type: Minehunter/sweeper

Class: BANGRACHAN

Purchased: 2
Active: 2

Displacement:
light: 414 t
full load: 451 t

Dimensions
Length: 48.0 m (157.5 ft)
Beam: 9.3 m (30.5 ft)
Draught: 2.75 m (9.02 ft)

Speed: 17 kts (diesel); 7 kts (diesel-electric)
Range: 3,100 n miles at 12 kts

Complement: 40 (7 officers)

SHIPS

BANGRACHAN (631)
Builder Lürssen, Vegesack, Germany
Commissioned 29 Apr 1987

NONGSARAI (632)
Builder Lürssen, Vegesack, Germany
Commissioned 17 Nov 1987

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

STN Atlas MWS 80

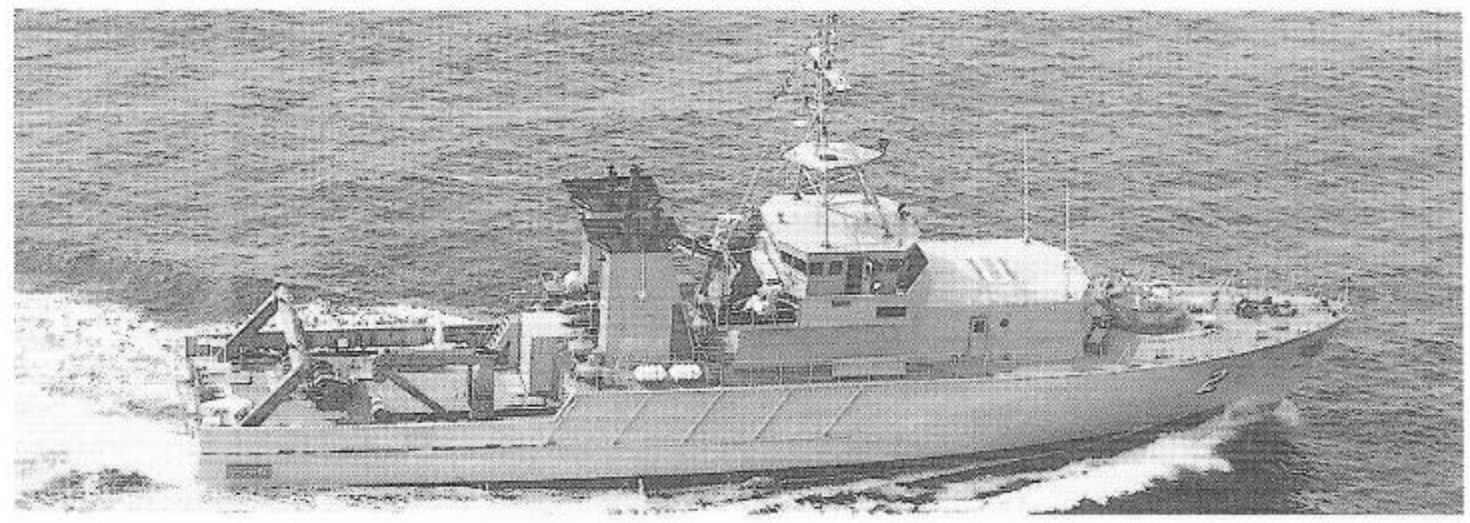
The MWS 80 minehunting action information system is an integrated multirole MCM system. It performs the following functions: search, detection, classification, identification and neutralisation of ground and moored mines, precision navigation and vessel control, and full control and co-ordination of all MCM operations. It also maintains an accurate record of all areas searched and targets located, with geographic positions and details of classification results.

MWS 80 integrates the DSQS-11M minehunting sonar, the NBD (navigation and vessel control equipment), the TCD tactical command system for co-ordinating and documenting MCM operations and the mine disposal system and the AIS 11 active identification sonar installed on the ROV.

The TCD assists the operator to control all phases of an MCM operation by providing means for display, plotting, storage and retrieval of tactical data. The equipment employs a comprehensive database which is continuously updated during operation.

The navigation sensors such as GPS, Radio Location Systems, Gyro or Inertial Platform and so on, and the integrated Doppler Log (DLO 3-2) enable the NBD to compute with a very high degree of accuracy the various navigational parameters such as ship's geographical position, groundspeed, speed through water, course, heading and drift.

All data handled are recorded on hard disk, tape and printer to enable missions to be stopped and started at will, provide recall of data for comparison and evaluation, maintenance of a permanent record of the seabed for MCM survey and for training purposes ashore.



Bangrachan *(631) (here wearing earlier pennant number). These two Thai ships have frames and superstructure made of austenitic steel, and frames and decks made of wood. Note the gantry at the stern used to swing sweeps clear of the transom* (Fr Lürssen)

Manufacturer/Contractor
STN Atlas Elektronik, Bremen, Germany.

Gaymarine Pluto ROV

Two per ship. Pluto is available in three configurations: battery-powered with a 6 mm, 500 m (1,640 ft) long umbilical cable; battery-powered with a 3 mm, 2,000 m (6,561 ft) long fibre optic umbilical cable; or remote-powered of unlimited endurance with 8 mm, 500 m (1,640 ft) long umbilical cable. The vehicle is powered by five thrusters: two horizontal for forward/reverse, two vertical for vertical and lateral shift, and a transversal thruster. The thrusters are controlled by two joysticks.

The vehicle can maintain automatic depth control within ±10 cm (4 in). Forward maximum speed is 4 knots and vertical speed 1 knot. Sensors are mounted in the forward tiltable section of the vehicle and can include black and white LLTV, colour TV or still camera, search or scanning sonar, acoustic pinger, strobe flash, measuring instruments, manipulators and so on. There are ten free channels for remote control and two four-digit telemetry channels for measurements. The console incorporates a 9 in TV monitor for displaying information showing TV image, depth, compass, head tilt angle, elapsed time and sonar diagram. All displayed data can be video recorded.

Specifications
Length: 1,680 mm (66 in)
Width: 600 mm (24 in)
Height: 630 mm (25 in)
Weight: 160 kg (353 lb)
Service depth: 400 m (1,312 ft)
Payload: 15 kg (33 lb)

Manufacturer/Contractor
Gaymarine, Italy.

MINEHUNTING SONAR

STN Atlas DSQS-11M

The DSQS-11M minehunting sonar is a high-definition, dual-frequency sonar which forms an integral part of the Atlas MWS 80-5 minehunting weapons system. In the 'Rushcutter' class installation the sonar transducer is housed in a self-contained module located in the forward part of the port hull. The sonar performs:

- Detection and classification of all types of ground, short tethered and moored mines
- High-clearance performance by simultaneous detection and classification within a 90° sector
- Simultaneous 3D precision target localisation
- Computer-aided detection (CAD) and classification (CAC)
- Automatic tracking of stationary and moving targets
- Integrated sonar performance prediction function
- Integrated route survey mode (side scan function)
- Video and data recording and playback
- Comprehensive BITE to ensure system availability.

The system comprises an operator console, an electronics cabinet, the hoisting unit (with transducer arrays, signal processing units and stabilisation unit) and the hydraulics unit.

The DSQS-11 M console includes two high resolution raster scan displays and keypads for direct system operation. Additionally the operation is supported by easily accessible menu guidance on both graphic displays.

The DSQS-11M sonar operates on three frequencies (40, 100 and 200 kHz).

Manufacturer/Contractor
STN Atlas Elektronik, Bremen, Germany.

Other MCM equipment

- Motorola Miniranger MRS III precise navigation system.
- Draeger decompression chamber for mine-disposal divers.
- Unspecified acoustic and magnetic gear
- SDG-31 mechanical sweeps.

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm om GAM-BO1 mountings

Three Oerlikon 20 mm on GAM-BO1 mountings: one on forecastle, one either side of after end of the bridge-house. This is an unpowered, light, compact swivel fork-type mount with the sidewalls having the trunnion bearings. These mountings usually have the RC35 optical ring sight, but they can be fitted with the SLC 001 lightweight lead-computing sight. The 200-round ammunition box is attached to the front of the mounting and the belt is fed from the right side of the gun, with spent cartridge cases ejected between the sidewalls of the cradle into a separate compartment while the links are collected in a bag on the other side of the mounting. The GAM-BO1 has the KAA gun.

Specifications
KAA Gun
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,150 m/s (3,445-3,773 ft/s)

Range
anti-surface: 1.7 km
anti-air: 1,700 m (5,577 ft)
Rate of fire: 900 rds/min
Round weight: 320-345 g
Projectile: 110-125 g

GAM-BO1 Mounting
Elevation: −15 to +60°
Weight: 500 kg (1,102 lb) (loaded)

COMMAND AND CONTROL SYSTEMS

RADAR

STN Atlas Elektronik 8600 ARPA

Two STN Atlas Elektronik 8600 ARPA I-band navigation radars are fitted.

Specifications
Frequency: I-Band (9,375 MHz)
Pulse peak power: 25 kW
Horizontal beamwidth: 1.5/0.95°
Vertical beamwidth: >20°
Antenna rotation: 23 rpm

Polarisation: Horizontal
Antenna: 5/8 ft slotted array
Antenna weight: 61 kg (134 lb)

Manufacturer/Contractor
STN Atlas Elektronik.

PROPULSION

Specifications
System: Diesel/diesel-electric
Main Machinery: 2 MTU 12V 396 TB83 diesels; 2.3 MW (3,120 hp(m)) sustained

Shafts: 2
Propellers: KaMeWa cp
Electric propulsion and ship's services: Two 275 kVA generator sets; two 150 kVA generator sets.

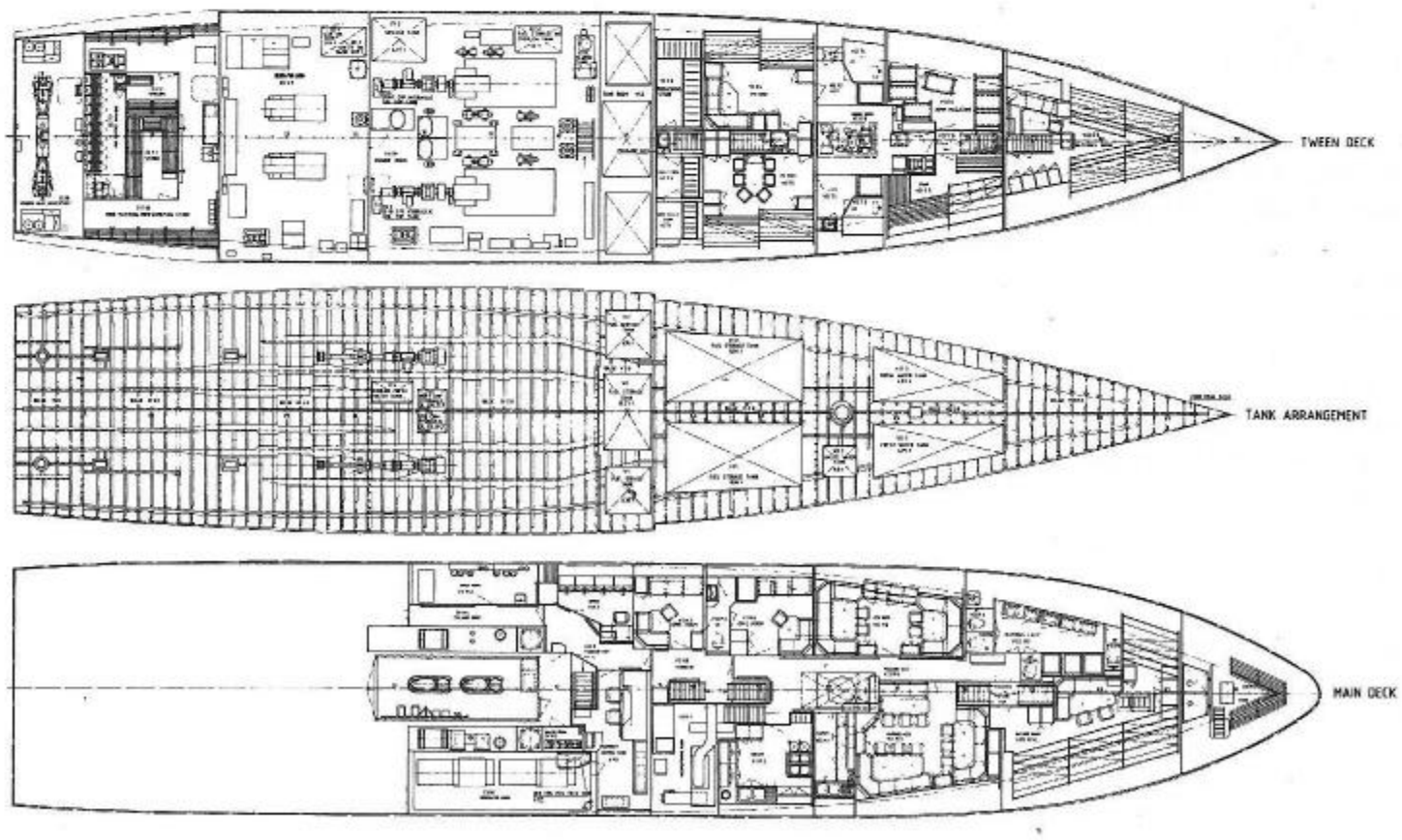
FURTHER INFORMATION

PROGRAMME

These are the first modern MCMVs in the Royal Thai Navy. The first was ordered from Lürssen in late 1984 and arrived in Bangkok on 22 October 1987. The second was ordered on 5 August 1985 and arrived in Bangkok May 1988.

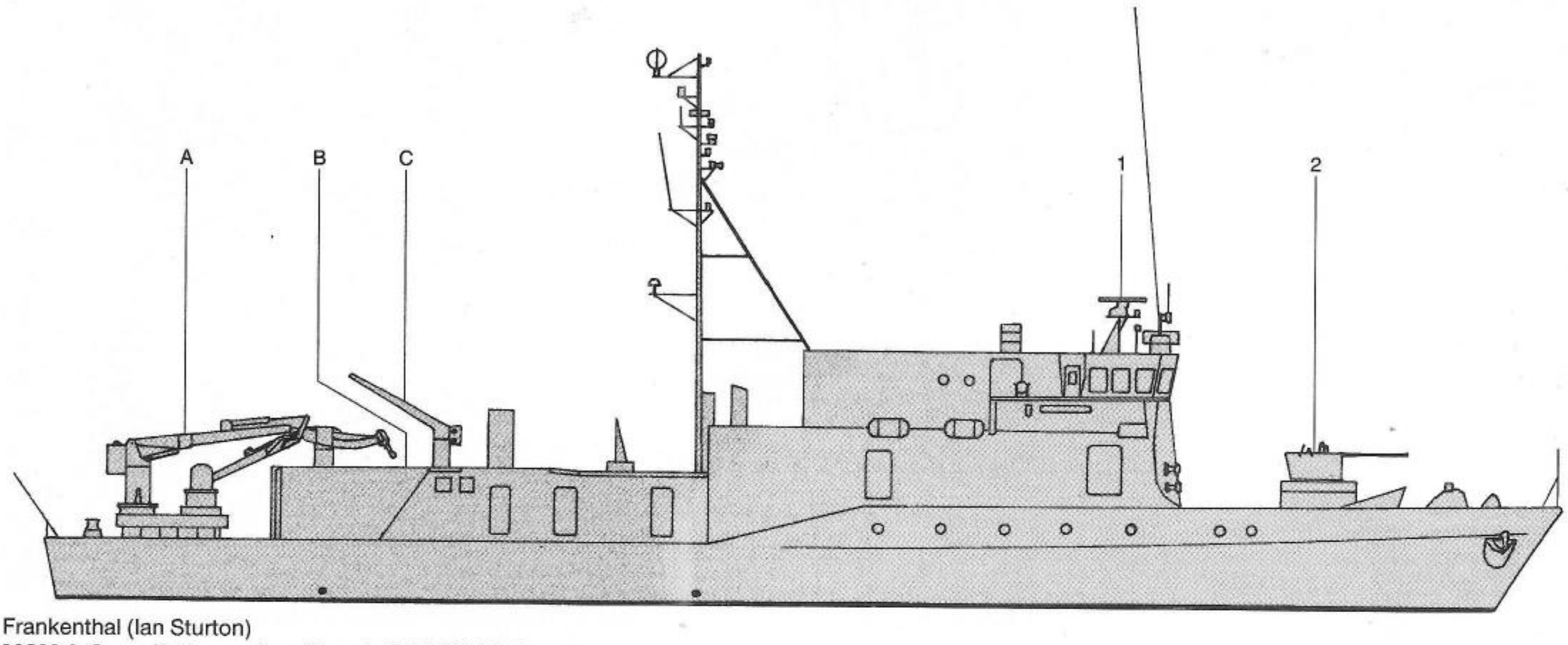
DESIGN

These ships are constructed with amagnetic (austenitic) steel frames and deckhouses, with a wooden hull.



Nongsarai *(632)* (Royal Thai Navy)

FRANKENTHAL (KLASSE 332)



Frankenthal (Ian Sturton)
MCM A *Crane* **B** *Hangar (two Pinguin B3 ROVs)* **C** *Crane*

General 1 *Raytheon AN-SPS-64(V)9* **2** *Bofors 40 mm/70*

GENERAL SPECIFICATIONS

Operator: Germany
Type: Klasse 332 (Coastal minehunter)

Class: FRANKENTHAL

Active: 10
Building: 2

Displacement:
full load: 660 t

Dimensions
Length: 54.4 m (178.5 ft)
Beam: 9.2 m (30.2 ft)
Draught: 2.5 m (8.2 ft)

Speed: 18 kts

Complement: 37 (5 officers)

SHIPS

FRANKENTHAL (M 1066)
Builder Lürssenwerft, Vegesack, Germany
Launched 6 Feb 1992
Commissioned 16 Dec 1992

WEIDEN (M 1060)
Builder Abeking & Rasmussen, Lemwerder, Germany
Launched 14 May 1992
Commissioned 30 Mar 1993

ROTTWEIL (M 1061)
Builder Krogerwerft, Rendsburg, Germany
Launched 12 Mar 1992
Commissioned 7 Jul 1993

BAD BEVENSEN (M 1063)
Builder Lürssenwerft, Vegesack, Germany
Launched 21 Jan 1993
Commissioned 9 Dec 1993

BAD RAPPENAU (M 1067)
Builder Abeking & Rasmussen, Lemwerder, Germany
Launched 3 Jun 1993
Commissioned 19 Apr 1994

GROMITZ (M 1064)
Builder Krogerwerft, Rendsburg, Germany
Launched 29 Apr 1993
Commissioned 23 Aug 1994

DATTELN (M 1068)
Builder Lürssenwerft, Vegesack, Germany
Launched 27 Jan 1994
Commissioned 8 Dec 1994

DILLINGEN (M 1065)
Builder Abeking & Rasmussen, Lemwerder, Germany

Frankenthal *(M 1066)* (Fr Lürssen Werft)

Launched 26 May 1994
Commissioned 25 Apr 1995

HOMBURG (M 1069)
Builder Krogerwerft, Rendsburg, Germany
Launched 21 Apr 1994
Commissioned 26 Sep 1995

SULZBACH-ROSENBERG (M 1062)
Builder Lürssenwerft, Vegesack, Germany
Launched 27 Apr 1995
Commissioned 23 Jan 1996

FULDA (M1058)
Builder Abeking & Rasmussen, Lemwerder, Germany
Launched Feb 1998
Commissioned Jun 1998

WEILHEIM (M 1059)
Builder Lürssenwerft, Vegesack, Germany
Launched Apr 1998
Commissioned Nov 1998

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

STN Atlas MWS 80-4

Minehunting action information system. The MWS 80-4 is an integrated multirole MCM system which performs search, detection, classification, identification and neutralisation of ground and moored mines, precision navigation and vessel control, and full control and co-ordination of all MCM operations. It also maintains an accurate record of all areas searched, targets located, their geographic position and details of classification results.

MWS 80-4 integrates the DSQS-11M minehunting sonar, the NBD (navigation and vessel control equipment), the TCD tactical command system for co-ordinating and documenting MCM operations and the mine disposal system and the AIS 11 active identification sonar installed on the ROV.

The TCD assists the operator to control all phases of an MCM operation by providing means for display, plotting, storage and retrieval of tactical data. The equipment employs a comprehensive database which is continuously updated during operation.

The navigation sensors such as GPS, Radio Location Systems, Gyro or Inertial Platform and so on, and the integrated Doppler Log DLO 3-2 enable the NBD to compute with a very high degree of accuracy the various navigational parameters such as ship's geographical position, groundspeed, speed through water, course, heading and drift.

All data handled are recorded on hard disk, tape and printer to enable missions to be stopped and started at will, provide recall of data for comparison and evaluation, maintenance of a permanent record of the seabed for MCM survey and for training purposes ashore.

Manufacturer/Contractor
STN Atlas Elektronik, Bremen, Germany.

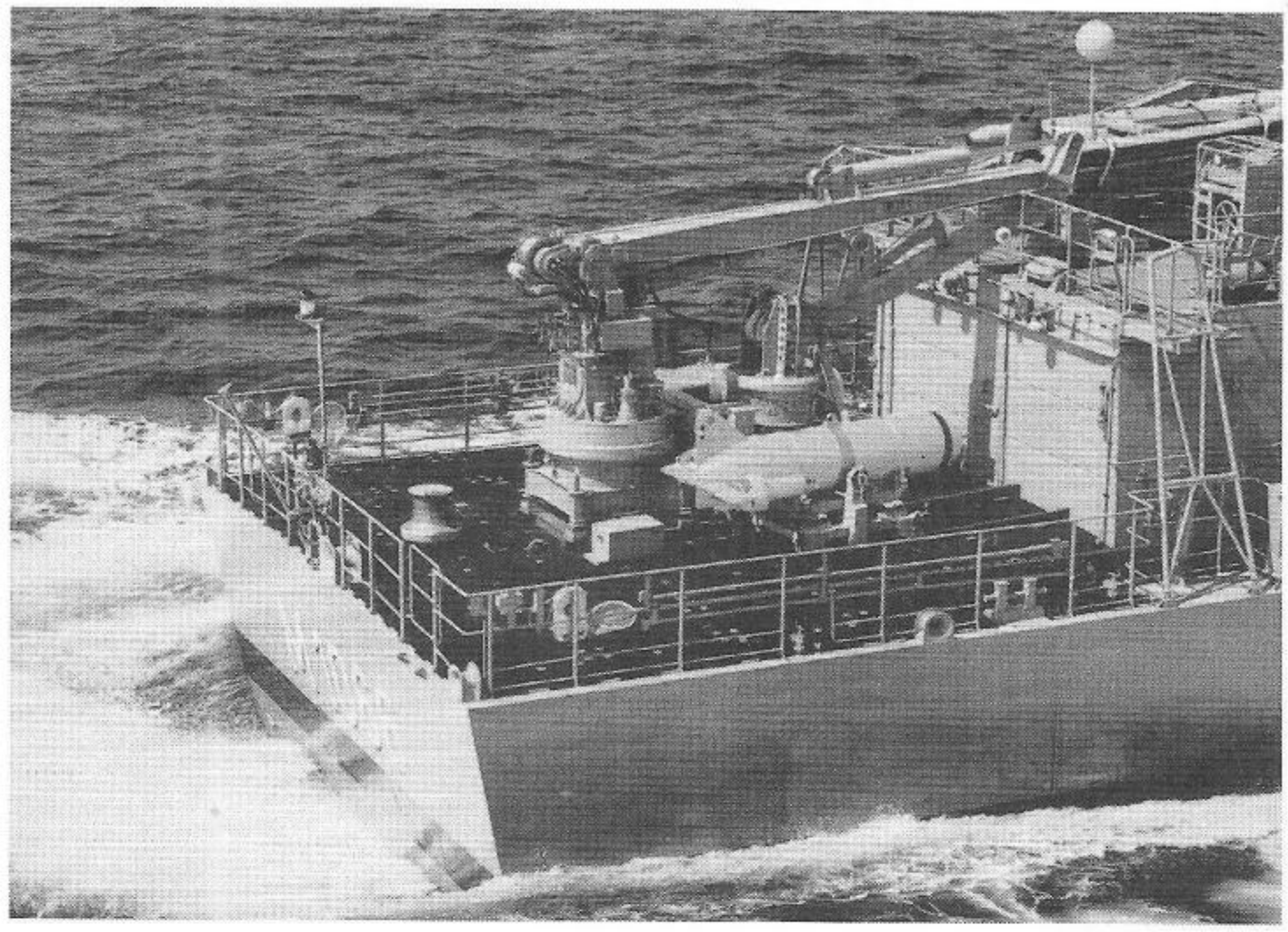
STN Atlas Pinguin B3 ROV

The Pinguin B3 is a remotely controlled, unmanned underwater vehicle for minehunting operations. With the input of target information derived from minehunting sonars, the ROV is capable of identifying a mine and, if necessary, dropping a mine disposal charge to destroy it. A second charge enables the ROV to continue the mission and approach a second target.

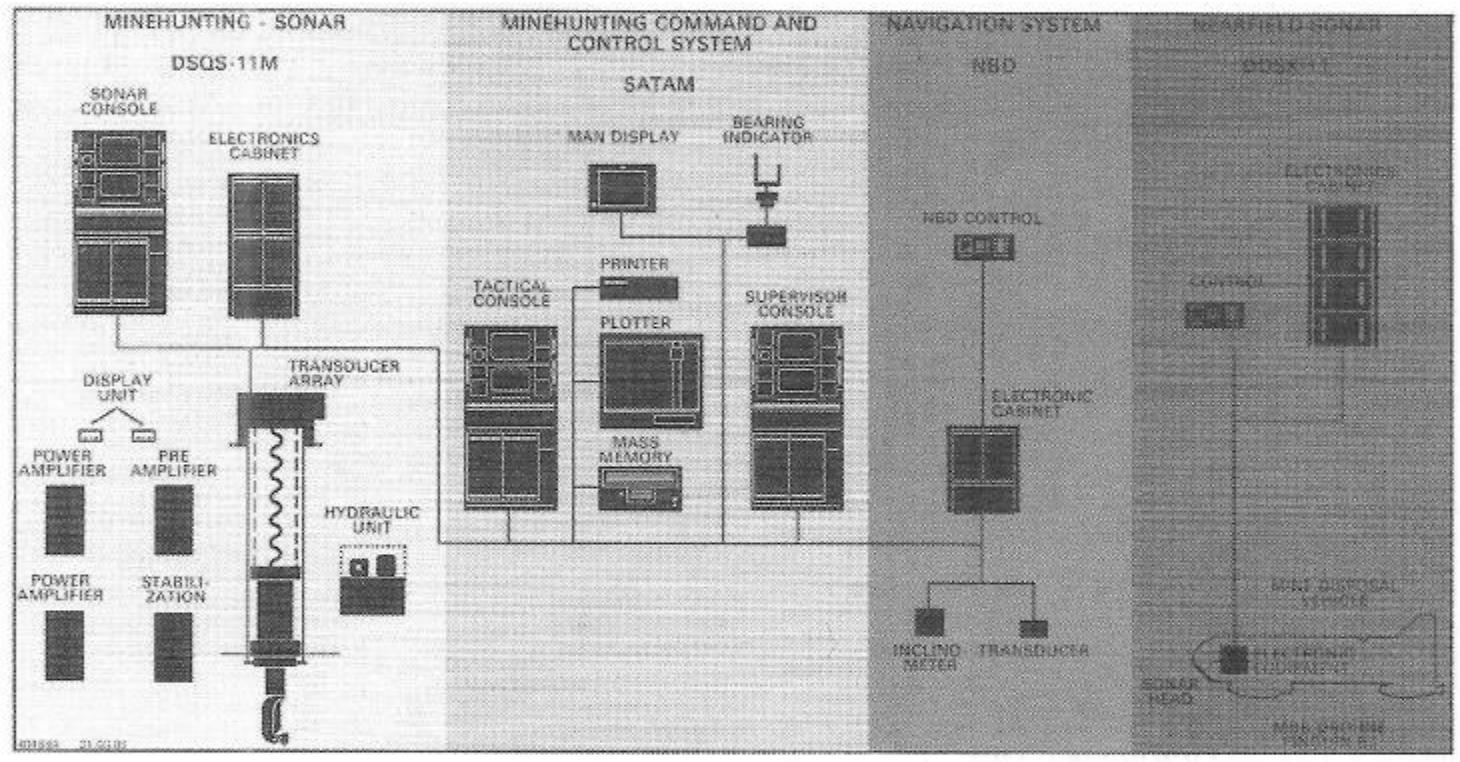
The Pinguin B3 is equipped with a 1,000 m (3,281 ft) fibre optic cable for data transmission. In low-velocity currents, its operating distance is up to 900 m (2,953 ft) at 200 m (656 ft) depth. In currents of 3 knots the vehicle has a range of about 500 m (1,640 ft) at 200 m (656 ft) depth.

The propulsion system consists of two horizontal propeller thrusters, mounted laterally to the stern section of the vehicle. The Pinguin B3 carries two charges of up to 125 kg (275 lb) each.

Specifications
Length: 3.5 m (11.5 ft)
Hull diameter: 70 cm (27.5 in)
Width: 1.5 m (4.9 ft)
Height: 1.2 m (3.9 ft) including MDCs 1.5 m (4.9 ft)
Mass: 1,350 kg (2,976 lb)
Propulsion: 2 variable speed thrusters, 1 automatic controlled vertical thruster
Power supply: Internal battery systems
Max diving depth: 200 m (656 ft)
Speed: 6 kts (continuous), 8 kts (max)
Endurance: 60/120 min
Payload: 255 kg (562 lb) (2 mine disposal charges and other payloads)
Sensors: TV camera, different sonar options



The stern of a Klasse 332 minehunter with a Pinguin B3 ROV on deck. The hangar holds two Pinguins and they are lifted in and out of the water by the crane



The STN Atlas MWS 80-4 integrated MCM system

Manufacturer/Contractor
STN Atlas Elektronik, Bremen, Germany.

MINEHUNTING SONARS

STN Atlas DSQS-11M

The DSQS-11M minehunting sonar is a high-definition, dual-frequency sonar which forms an integral part of the Atlas MWS 80-5 minehunting weapons system. The sonar performs:

- Detection and classification of all types of ground, short tethered and moored mines
- High-clearance performance by simultaneous detection and classification within a 90° sector
- Simultaneous 3D precision target localisation
- Computer-aided detection (CAD) and classification (CAC)
- Automatic tracking of stationary and moving targets
- Integrated sonar performance prediction function
- Integrated route survey mode (side scan function)
- Video and data recording and playback
- Comprehensive BITE to ensure system availability.

The system comprises an operator console, an electronics cabinet, the hoisting unit (with transducer arrays, signal processing units and stabilisation unit) and the hydraulics unit.

The DSQS-11 M console includes two high-resolution raster scan displays and keypads for direct system operation. Additionally the operation is supported by easily accessible menu guidance on both graphic displays.

The DSQS-11M sonar operates on three frequencies (40, 100 and 200 kHz).

Manufacturer/Contractor
STN Atlas Elektronik, Bremen, Germany.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES

Fliegerfaust-2 (Stinger)

The 'Frankenthal' class is equipped with two quad launchers for Stinger surface-to-air missiles which are designated *Fliegerfaust-2* in the *Bundesmarine*. The basic version of Stinger is an IR-guided missile for use against aircraft. In the German Navy, *Fliegerfaust-2* launchers are being installed in several classes of mine countermeasures vessels (MCMV), including 'Frankenthal' (Type 332) class; 'Hameln' class (Type 343); and 'Elbe' (Type 404) class tenders, which support MCMV units.

Specifications
Length: 1.52 m (5.0 ft)
Diameter: 70 cm (27.5 in)
Weight: 8.2 kg (18.0 lb)
Speed: Mach 2.2
Range: 8,000 m (26,246 ft)
Altitude: 3,500-3,800 m (11,483-12,467 ft)
Guidance: Passive homing (FIM-92A)
IR/UV: Passive homing (FIM-92B/C)

Manufacturer/Contractor
Hughes Missile Systems, US.

GUNS

Bofors 40 mm/70

The SAK 40L/70-315 is a manually laid mounting in which the gun platform is on a pedestal. The total height to the centre of the barrel from the deck when the gun is horizontal is 1.36 m (4.5 ft). The mounting weighs 2.87 t unloaded, is 1.83 m (6.0 ft) long and has a training radius of 3.31 m (10.8 ft). The mounting has a protective shield and includes ammunition racks for 96 rounds.

Specifications
Traverse: 360° (nominal) at 30°/s
Elevation: −3 to +85° at 24°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Manufacturer/Contractor
Bofors Weapon Systems, Sweden.

COMMAND AND CONTROL SYSTEMS

RADAR

Specifications
Raytheon AN/SPS-64(V)9
Role: Navigation
Frequency: I-band
Beam: 1.9 × 22°
Peak power: 20 kW
Gain: 28 dB
Pulsewidth: 0.06/0.5/1.0 µs
PRF: 3,600/1,800/900 pps
Scan rate: 33 rpm

Manufacturer/Contractor
Raytheon, USA.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 16V 396 TB84 diesels; 4.08 MW (5,550 hp(m)) sustained.
Shafts: 2
Propellers: 2 Voith-Schneider cycloidal propellers

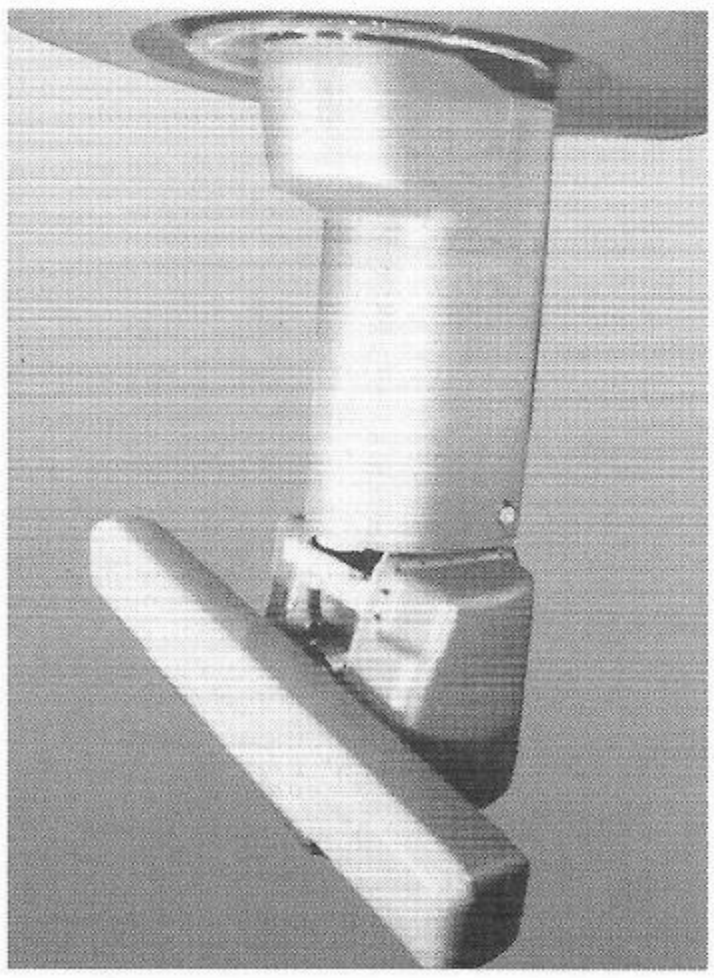
FURTHER INFORMATION

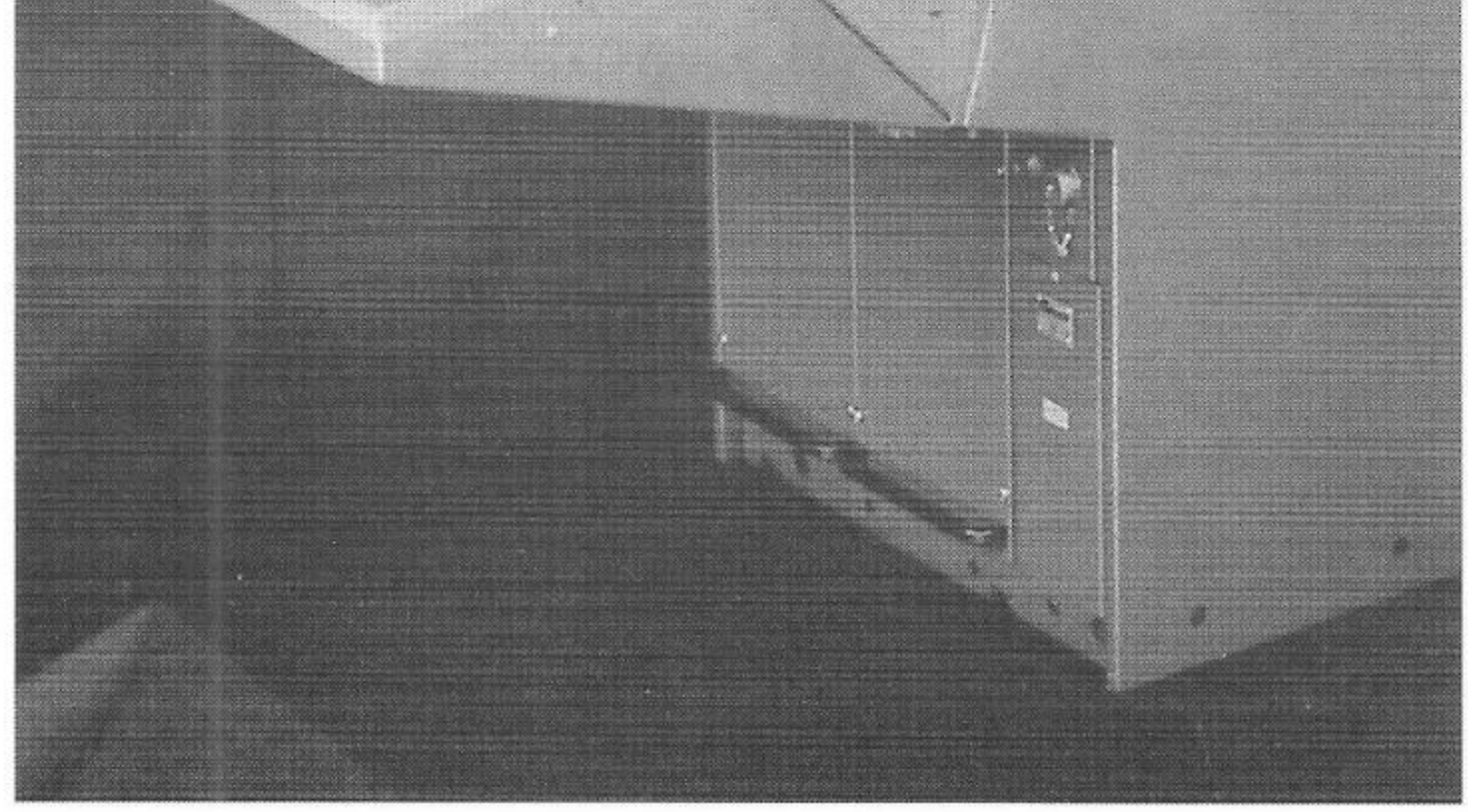
PROGRAMME

The first ten were ordered in September 1988 with STN Systemtechnik Nord (now STN Atlas Elektronik) as main contractor. M 1066 was laid down at Lürssen on 6 December 1989. The last two were ordered on 16 October 1995.

DESIGN

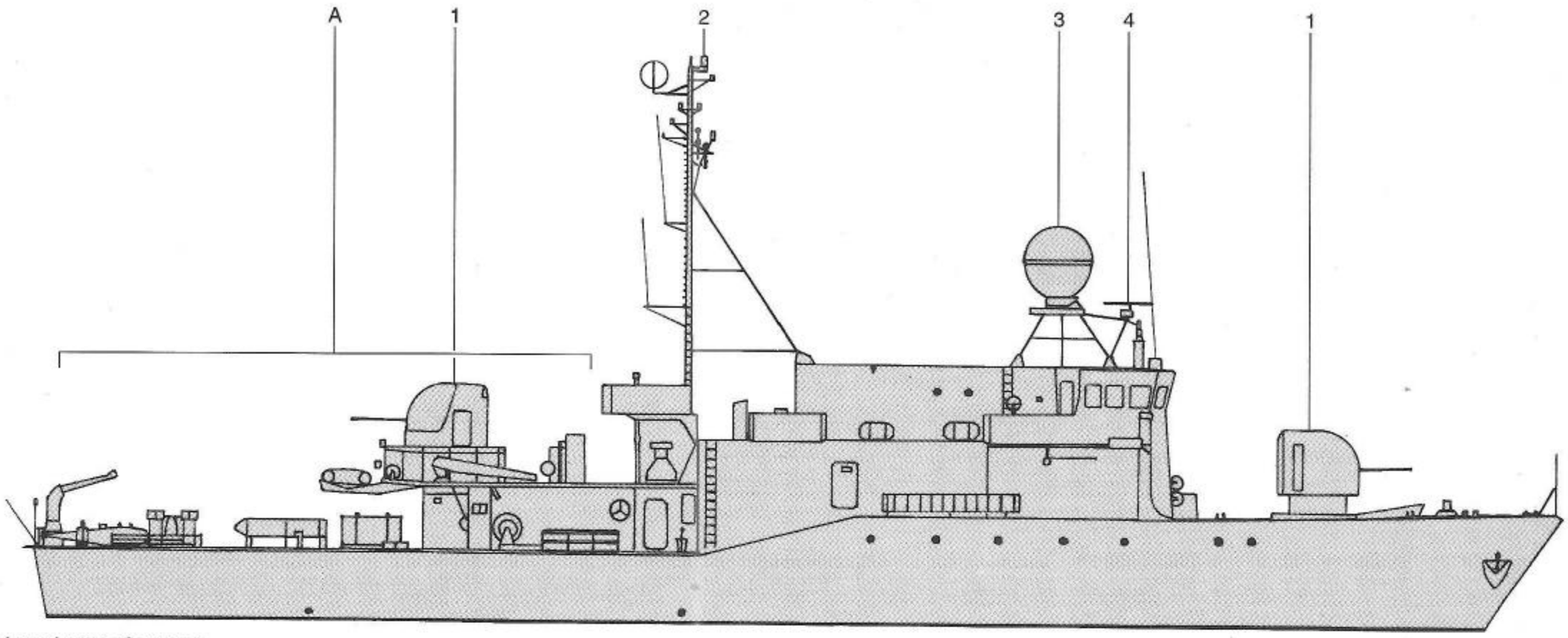
This is a minehunter version of the Type 343, but with a hull form, propulsion system, and equipment adapted for the different mission. Like the Type 343, the Type 332 is built of amagnetic steel, which is an effective solution to the MCMV's magnetic problem, but one that has found no export customers to date.





The STN Atlas DSQS-11M minehunting sonar is an integral part of the MWS 80-4 system. The sonar has a 90° detection sector, trainable over the total azimuth to give gapless coverage of the search path. Modes include: LF long-range detection, LF long-range classification, HF high-resolution detection and classification, and depth classification (STN Atlas)

HAMELN (TYPE 343)



Hameln (Ian Sturton)
MCM A *Sweep deck, including mine rails for 60 mines*

General 1 *Bofors 40 mm/70-315* **2** *Thomson-CSF DR 2000 ESM* **3** *Signaal WM20/2 fire-control radar* **4** *Raytheon AN/SPS-64(V)9 navigation radar*

GENERAL SPECIFICATIONS

Operator: Germany
Type: Coastal minesweeper
National designation: *Schnelles Minensuchboot* (fast minehunter)

Class: HAMELN

Built: 10
Active: 10

Displacement:
full load: 645 t

Dimensions
Length: 54.4 m (178.5 ft)

Beam: 9.2 m (30.2 ft)
Draught: 2.5 m (8.2 ft)

Speed: 18 kts

Complement: 37 (4 officers)

SHIPS

PEGNITZ (M 1090)
Builder Lürssenwerft, Vegesack, Germany
Launched 13 Mar 1989
Commissioned 9 Mar 1990

KULMBACH (M 1091)
Builder Abeking & Rasmussen, Lemwerder, Germany
Launched 15 Jun 1989
Commissioned 24 Apr 1990

HAMELN (M 1092)
Builder Lürssenwerft, Vegesack, Germany
Launched 15 Mar 1988
Commissioned 29 Jun 1989

AUERBACH (M 1093)
Builder Lürssenwerft, Vegesack, Germany
Launched 18 Jun 1990
Commissioned 7 May 1991

ENSDORF (M 1094)
Builder Lürssenwerft, Vegesack, Germany
Launched 8 Dec 1989
Commissioned 25 Sep 1990

ÜBERHERRN (M 1095)
Builder Abeking & Rasmussen, Lemwerder, Germany
Launched 30 Aug 1988
Commissioned 19 Sep 1989

PASSAU (M 1096)
Builder Abeking & Rasmussen, Lemwerder, Germany
Launched 1 Mar 1990
Commissioned 18 Dec 1990

LABOE (M 1097)
Builder Krogerwerft, Rendsburg, Germany
Launched 13 Sep 1988
Commissioned 7 Dec 1989

SIEGBURG (M 1098)
Builder Krogerwerft, Rendsburg, Germany
Launched 14 Apr 1989
Commissioned 17 Jul 1990

HERTEN (M 1099)
Builder Krogerwerft, Rendsburg, Germany
Launched 22 Dec 1989
Commissioned 26 Feb 1991

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

The German MCMVs carry:
- SDG-31 double Oropesa mechanical sweep for moored mines. Maximum depth is 60 m (197 ft) and for depths greater than this, the sweep is usually employed by two vessels acting as a 'team.'
- HFG-G1 acoustic sweep
- GBT-3 (GBT = *Geräuschboje Turbine*)
- GHA magnetic sweep, a large solenoid

MINEHUNTING SONARS

STN Atlas DSQS-11M

DSQS-11M is a high-definition, dual-frequency, minehunting sonar which forms an integral part of the Atlas MWS 80-4 and MWS 80-5 minehunting weapons systems. The sonar performs:
- Detection and classification of all types of ground, short tethered and moored mines
- High-clearance performance by simultaneous detection and classification within a 90° sector
- Simultaneous 3D precision target localisation
- Computer-aided detection (CAD) and classification (CAC)
- Automatic tracking of stationary and moving targets
- Integrated sonar performance prediction function
- Integrated route survey mode (side scan function)
- Video and data recording and playback
- Comprehensive BITE to ensure system availability.

The system comprises an operator console, an electronics cabinet, the hoisting unit (with transducer arrays, signal processing units and stabilisation unit) and the hydraulics unit. The DSQS-11M console includes two high-resolution raster scan displays and keypads for direct system operation. Additionally the operation is supported by easily accessible menu guidance on both graphic displays.

Manufacturer/Contractor
STN Atlas Elektronik, Bremen, Germany.

Digital Navigation Data Transmitter
The DNDT collates all navigation information relevant to MCM operations, including position, compass bearings, speed, wind strength and direction, currents and time. DNDT is linked to the plotter in the CIC, automatic steering system, operator's console and the AN/UYK-20 computer. The ships are also fitted for GPS.

MINELAYING SYSTEM

The ships are equipped to lay a total of 60 mines. The four sets of mine rails and the laying chutes are permanently installed. The parameters of the required lay are entered into the command system and the remainder of the operation is automatic.

WEAPONS SYSTEMS

SURFACE-TO-SURFACE MISSILES

Hughes Fliegerfaust-2 (FIM-92 Stinger)
The 'Hameln' class is equipped with two quad launchers for Stinger surface-to-air missiles. The basic version of Stinger is an IR-guided missile for use against aircraft. In the German Navy, Stinger launchers are being installed in several classes of mine countermeasures vessels (MCMV), each ship having two quad launchers. (The German Stinger system is known as the Fliegerfaust-2 or FIF-2).

Specifications
Length: 1.52 m (5.0 ft)
Diameter: 70 cm (27.5 in)
Weight: 8.2 kg (18.0 lb)
Speed: Mach 2.2
Range:
anti-surface: 8,000 m (26,246 ft)
anti-air: 3,500-3,800 m (11,483-12,467 ft)
Guidance: Passive homing (FIM-92A)
IR/UV: Passive homing (FIM-92B/C)

Manufacturer/Contractor
Hughes Missile Systems, USA.

GUNS

Bofors SAK 40 mm/70-315
The SAK 40/70-315 is a manually laid mounting in which the gun platform is on a pedestal. The total height to the centre of the barrel from the deck when the gun is horizontal is 1.36 m (4.5 ft). The mounting weighs 2.87 t unloaded, is 1.83 m (6.0 ft) long and has a training radius of 3.31 m (10.9 ft). The mounting has a protective GRP shield and includes ammunition racks for 96 rounds.

Specifications
Traverse: 360° (nominal) at 30°/s
Elevation: −3 to +85° at 24°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Manufacturer/Contractor
Bofors Weapon Systems, Sweden.

Hameln *(M 1092), lead ship of ten minesweepers of the Klasse 343. The Signaal 'egg' houses the fire-control radar for the Bofors 40 mm, but air defence is now augmented by two Fliegerfaust-2 (Stinger) missile launchers* (German Navy)

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES

Thomson-CSF DR 2000 radar threat warner
The Thomson-CSF DR 2000U ESM system detects pulse and continuous wave (CW) signals and, when coupled with the Dalia analyser, is used as a basic ESM suite, under the company designation TMV 434. There are six DF antennas and one omni-antenna on a telescopic mast, and a processing control/display console in the EW centre. It provides a virtual 100 per cent probability of detection over the complete 360° of azimuth and gives instantaneous audio and video alerts.

Manufacturer/Contractor
Thomson-CSF, Elancourt, France.

ELECTRONIC COUNTERMEASURES

BUCK-Wegmann Hot Dog/Silver Dog decoy system
Two 12-tube launchers. The BUCK-Wegmann Hot Dog/Silver Dog equipment is an IR/chaff dispenser decoy system to counter anti-ship missiles equipped with active radar and/or IR seeker heads. The system consists of a reloadable 12- or 24-tube launcher, main and auxiliary control units, emergency release, IR decoy grenades (Hot Dog), and chaff grenades (Silver Dog). Two or four carrier mountings, each with three launcher tubes, are deck-mounted on the port and starboard sides of the ships. The tubes can be loaded with either all IR decoys or all chaff grenades, or a combination of the two, and they can be fired in single shots or in a series of shots. In the latter mode the decoy cloud becomes effective after only two seconds, and is sustained over a considerable period.

Specifications
Type: 76 mm decoy grenade launcher
Tubes: 12 or 24 per system

IR decoy (Hot Dog)
Grenade type: 76 mm
Weight: 0.74 kg (1.6 lb) (approx)
Payload weight: 0.41 kg (0.9 lb) (approx)
Cloud development time: 2 s

Chaff decoy (Silver Dog)
Grenade type: 76 mm
Weight: 0.95 kg (2.1 lb) (approx)
Payload weight: 0.45 kg (1.0 lb) (approx)
Cloud development time: 2 s

Manufacturers/Contractors
Wegmann GmbH, Kassel, Germany (launcher).
BUCK System GmbH, Neuenburg, Germany (grenades).

COMMAND AND CONTROL SYSTEMS

COMMUNICATIONS AND DATALINKS

Link 11

RADARS

Signaal WM20/2

Specifications
Role: Surface search/fire control
Frequency: I/J-band
Range: 25 n miles (46 km)
Beam:
search: 1.5 × 4/7°
track: 2.4°
Peak power: 200 kW
Gain: 33.5 dB
Pulsewidth: 0.22/4.5 µs
PRF: 3,600/1,800 pps
Scan rate: 60 rpm

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, The Netherlands.

Raytheon AN/SPS-64(V)9

Specifications
Role: Navigation
Frequency: I-band
Beam: 1.9 × 22°
Peak power: 20 kW
Gain: 28 dB
Pulsewidth: 0.06/0.5/1.0 µs
PRF: 3,600/1,800/900 pps
Scan rate: 33 rpm

Manufacturer/Contractor
Raytheon, USA.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 16V396 TB84 diesels; 4.5 MW (6,140 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

On 3 January 1985 a consortium headed by STN Systemtechnik Nord (now STN Atlas) was awarded the contract.

DESIGN

The key feature of the Type 343 is that it is constructed of amagnetic (austenitic) steel. This material was chosen after detailed examination of the alternatives and was carefully compared with various types of GRP, including: sandwich; stiffened, solid GRP; and non-stiffened, solid GRP. Amagnetic steel came best out of the tests, but a further factor in the choice was Germany's industrial capabilities and experience with this steel which had been developed for use in the *Bundesmarine's* submarines.

MODERNISATION

The sonar was fitted to all ships from 1991 onwards, although the first three only have a mine-avoidance version. All will have the full DSQS-11M sonar in due course.

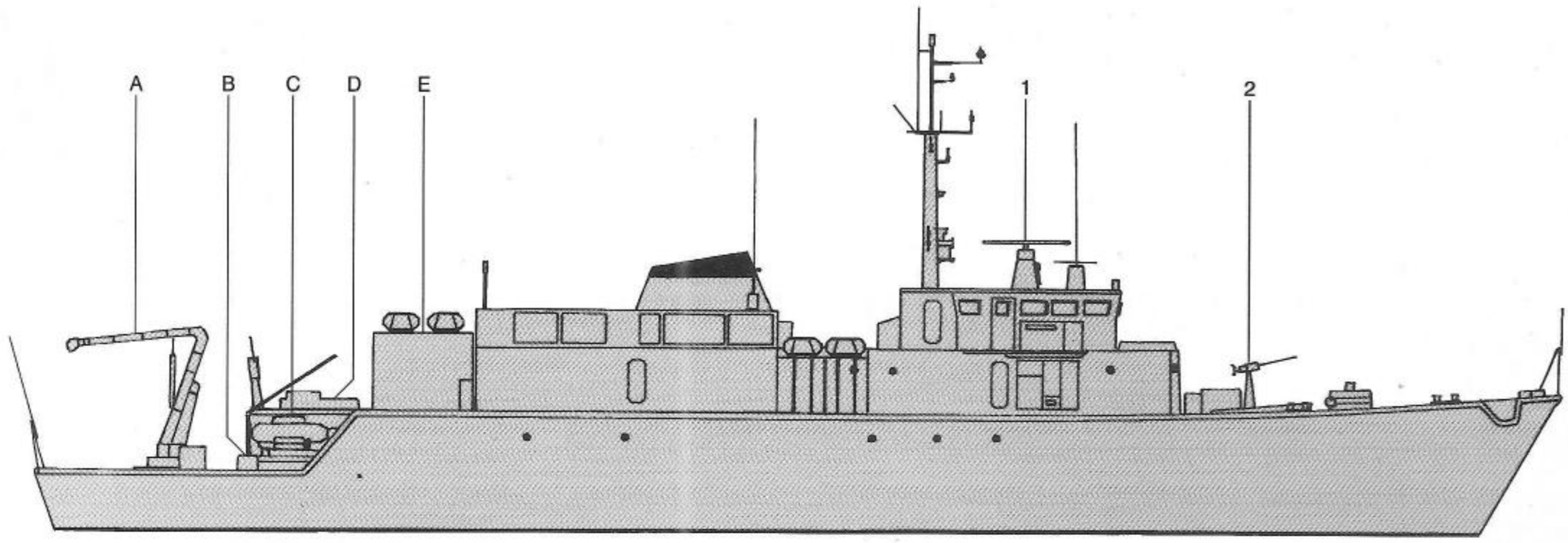
Five of the class are to be modernised to improve SDG-31 mechanical sweeps and to control improved Troika drones. Disposable ROVs (Sea Wolf and Sea Fox) are also being evaluated.

The ships are fitted with Link 11 which enables them to exchange information with NATO AWACS and with other MCMs. Link 11 can also be used to guide other Link 11-equipped ships through minefields with greater safety than ever before.

Ensdorf *(M 1094)* (H & L van Ginderen Collection)

TRIPARTITE MINEHUNTER

OVERVIEW



Minehunter (Ian Sturton)
MCM A *Sweep crane* **B** *Minesweeping winch* **C** *PAP 104 Mk III* **D** *Two-person decompression chamber* **E** *5-tonne container*

General 1 *Racal-Decca 1229 navigation radar* **2** *Giat 20 mm F2*

This is one of the more successful international collaborative projects, in this case between Belgium, France and The Netherlands; hence, its usual name of the 'Tripartite minehunter.' The three nations made initial contact with each other in April 1974 and their needs were so similar that a joint operational requirement was signed by the chiefs of the naval staff of the three countries in December 1974, followed by an intergovernmental agreement in May 1975. The agreement was that each navy would build 15 identical ships in their own shipyards, but from a single set of plans. In addition, the Belgians were made responsible for the electrical systems, including the electrical auxiliary propulsion system, while France was responsible for MCM systems and Netherlands the mechanical-engineering aspects. This ensured that each nation's industry obtained an equal financial share of equipment 'pie,' which amounted, in total, to some 70 per cent of the programme costs, with the remaining 30 per cent being for construction material.

STRUCTURE

The hull, decks and bulkheads all form a single skin, reinforced by trapezoidal formers, glued and pinned to the skin. There are nine watertight bulkheads. The ship is fitted with an active tank stabilisation system and has full NBC protection and air conditioning.

One of the features of the design is the 5-tonne role container mounted at the after end of the superstructure. This can easily be changed and users have developed their own fits to provide special facilities for different missions, such as extra decompression facilities, staff facilities for the HQ ship role, control facilities for drone operations, and so on.

MCM OPERATIONS

The ships are designed as minehunters, but all are capable of carrying and operating a light mechanical sweep. In addition, the Indonesian ships have a magnetic and acoustic minesweeping capability. All ships are capable of being used as patrol ships.

PROPULSION

For normal steaming there is a Stork-Werkspoor RUB 215 × 12 V-12 diesel, which was specially designed for the Tripartite MCMV. More than 60 per cent of the total engine weight consists of non-magnetic materials, with large components (frame, cylinder block, counterweights and flywheel) cast in Ni-Resist D2 austenitic

PRODUCTION

Country	National class name	Number purchased	Builder	Launched	Remarks
Belgium	Aster	10	Beliard, Ostende	1985-1990	
France	Eridan	10	DCN, Lorient	1979-1996	
Netherlands	Alkmaar	15	Van der Giessen, Alblasserdam	1982-1989	
Indonesia	Pulau Rengat	2	Van der Giessen, Alblasserdam	1987	Note 1
Pakistan	Munsif	3	Two — DCN, Lorient One — Karachi	1988, 1995 ?	Note 2
TOTALS		40			

Notes:
1. Both ships for Indonesia were allocated from ships then under construction for RNethN and two more were then built as replacements.
2. Of Pakistan's three ships:

- The most recently completed French Navy ship was allocated and a new ship was then built for the French Navy.
- The second ship was built for Pakistan by DCN, Lorient
- The third ship is to be completed in Karachi with DCN assistance, with the hull being built in France

Willemstad *(M 864) one of 15 Dutch Tripartite minehunters and one of 40 of these versatile ships now in service around the world* (H & L van Ginderen Collection)

steel. Other parts are also fabricated from non-magnetic materials such as austenitic steel, cunifer and bronze.

For minehunting operations, there is a silent, electrical propulsion system consisting of two active rudders, each with its own 100 kW electric motor. There are also twin bow thrusters to give the required degree of manoeuvrability at slow speed.

The power for the active rudders, bow thruster and other electrical equipment is provided by three Turbomeca 250 kW gas-turbine generators providing 440 V/60 Hz AC, which are sited in the superstructure so that power remains available even when much of the hull is flooded. There is also a DAF 180 kW diesel generator in the engine room.

COMPLEMENT

The ship's company varies from 23-45 depending on the assigned task. The maximum that can be accommodated is 45 for the HQ ship role when endurance would be 15 days. For inshore patrols, however, a crew of 22 will suffice and endurance increases to 22 days. Six divers are carried when minehunting.

MODERNISATION

A joint modernisation programme started in 1995, which includes new sonars, navigation systems and PAPs.

SALES

Three of the Belgian ships have been purchased by France to replace the "Circe" class. After refit, they will join the fleet in mid-1997.

ASTER (TRIPARTITE MINEHUNTER)

GENERAL SPECIFICATIONS

Country of origin: International
Operator: Belgium
Type: Tripartite (Coastal minehunter)

Class: ASTER

Built: 10
Active: 7

Displacement:
standard: 562 t
full load: 595 t

Dimensions
Length: 51.5 m (168.96 ft)
Beam: 8.90 m (29.20 ft)
Draught: 2.5 m (8.2 ft)

Speed: 15 kts max; 12 kts cruising; 8 kts minesweeping.
Range: 3,200 n miles at 12 kts
Endurance: 15 days

Complement: 46 (5 officers)

SHIPS

ASTER (M 915)	
Builder	Beliard SY, Ostend and Rupelmonde, Belgium
Laid down	26 Apr 1983
Launched	6 Jun 1985
Commissioned	17 Dec 1985

BELLIS (M 916)	
Builder	Beliard SY, Ostend and Rupelmonde, Belgium
Laid down	9 Feb 1984
Launched	14 Feb 1986
Commissioned	14 Aug 1986

CROCUS (M 917)	
Builder	Beliard SY, Ostend and Rupelmonde, Belgium
Laid down	9 Oct 1984
Launched	6 Aug 1986
Commissioned	5 Feb 1987

LOBELIA (M 921)	
Builder	Beliard SY, Ostend and Rupelmonde, Belgium
Laid down	4 Dec 1986
Launched	6 Jan 1988
Commissioned	9 May 1989

MYOSOTIS (M 922)	
Builder	Beliard SY, Ostend and Rupelmonde, Belgium
Laid down	6 Jul 1987
Launched	4 Aug 1988
Commissioned	14 Dec 1989

NARCIS (M 923)	
Builder	Beliard SY, Ostend and Rupelmonde, Belgium
Laid down	25 Feb 1988
Launched	30 Mar 1990
Commissioned	27 Sep 1990

PRIMULA (M 924)	
Builder	Beliard SY, Ostend and Rupelmonde, Belgium
Laid down	10 Nov 1988
Launched	17 Dec 1990
Commissioned	29 May 1991

MINE COUNTERMEASURES SYSTEMS

COMBAT DIVERS

Normal complement is six mine clearance divers who can operate down to 80 m (263 ft) with an air or breathing mixture supply. A two-person recompression chamber is installed and an additional eight-person chamber can be installed abaft the stack.

MINESWEEPING

The ships normally carry:
Medium depth mechanical sweep; single Oropesa.

PAP Mk 5 ROV

The 'Tripartite' class carries two PAP Mk 5 (PAP = *poisson auto-propulsé*) ROVs, which have the capability simultaneously to hunt and destroy ground mines and tethered mines either by placing and remotely detonating a charge or by cutting the mooring rope of tethered mines. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via either a tether, which can be either a 2,000 m (6,562 ft) fibre optic cable or a 1,000 m (3,281 ft) coaxial cable. It is horizontally propelled by means of two side thrusters.

In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide rope'. The winch in the PAP is instructed to deploy a selected length of rope and the operator then uses return signals from the vehicle to maintain the vehicle at the desired selected height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP Mk 5 is able to carry the 126 kg (277 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution nearfield sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

Specifications

(PAP Mk 5)
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.2 ft)
Performance
Max vehicle velocity
mid-water transit: 6 kts (3 m/s)
bottom-following mode: 5.5 kts (2.75 m/s)
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s (2.3 ft/s)
Ascent velocity (charge released): 1.5 m/s (4.9 ft/s)
Payload
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Horizontal range:
with fibre optic cable: 2,000 m (6,562 ft)
with coaxial cable: 1,000 m (3,281 ft)
Max continuous endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bars

Manufacturer/Contractor

Société ECA, 92707 Colombes, France.

MINEHUNTING SONARS

TSM 2021B (DUBM 21B)

Hull-mounted minehunting sonar. TSM 2021B is intended for use in conjunction with precision navigation equipment, and a mine countermeasure (destruction) system such as the PAP 104. The functions of TSM 2021 are to detect mines at distances up to 600 m (1,968 ft), and to classify them by studying the shape of their echo and acoustic shadow, at distances up to 250 m (820 ft).

Each detection and classification sonar chain consists of an acoustic transmitter/receiver transducer, the associated transmission and reception electronics, and

a display console. A subassembly performs the stabilisation, steering, and retraction of the detector and classifier arrays. The electroacoustic subassembly (EAA) includes:

- The classification sonar transmitter/receiver chain cabinet
- A display console which controls the transmission and reception functions and has CRT presentation of mine detection and location by the detector sonar chain
- A display console with CRT displays for presentation of mine locations within the classification chain
- Bridge repeater display, showing range and bearing of designated targets.

Specifications

Coverage:
detector chain: ±175° in sectors of 30, 60 and 90°
classification chain: sectors of 3, 5 or 10°
Elevation: Variable, between −5 and −40°
Stabilisation: ±15° (roll); ±5° (pitch)

Detection sonar
Frequency: 100 kHz (modulated ±10 kHz)
Pulse duration: 0.2 or 0.5 ms
Range scales: 400, 600 or 900 m
Max sound level: 120 dB
Channels: 20
Beam aperture: 1.5°
Display: PPI

Classification sonar
Range scales: 200 or 300 m (656 or 984 ft)
Max sound level: 122 dB
Channels: 80
Beam aperture: 0.17°
Display: CRT and storage magnifier tube

Manufacturer/Contractor

Thomson Sintra ASM, France.

WEAPONS SYSTEMS

GUNS

20 mm/90 (F2)

One mount per ship on the foredeck. The F2 Type A mounting is of the swivel fork type revolving on a fixed ferrule. The mounting, which is unpowered, is largely made up of light alloys and stainless steel to reduce weight. The DCN 20 mm mounting is based upon the Giat 811 which has a dual feed. It is electrically initiated and capable of firing single rounds, short (three-round), long (eight-round) or continuous bursts. It has adjustable rates of fire of 125 and 400 rds/min as well as 125 and 650 rds/min. The DCN mounting weighs 500 kg (1,102 lb) and occupies 2.75 m (9.0 ft) of deck space. An unusual feature is a display showing the number of rounds remaining in the two magazines on either side of the mounting.

Specifications

(20 mm/90 (F2))
Calibre: 20 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,101 ft/s)
Traverse: 325°
Elevation: −15 to +80°
Mounting weight (loaded): 470 kg (1,036 lb)
Crew: 2
Range: 3.5-5.5 n miles (6.75-10 km)

Manufacturers/Contractors

Giat/DCN, France.

12.7 mm machine gun

One 12.7 mm machine gun is carried; type unknown.

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca 1229

The navigation radar is the Racal-Decca Type 1229, with an output of 20 kW. It is equipped with a 2.7 m (8.9 ft) antenna and operates in the I/J band.

Specifications

Role: Navigation
Frequency: I/J-band
Beam: 1.3 × 30°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
PRF: 1,300/650 pps
Scan rate: 25 rpm

Manufacturer/Contractor

Racal-Decca, UK.

PROPULSION

Specifications

System: Diesel
Main machinery: 1 Stork-Werkspoor A-RUB 215 V12 diesel 1.37 MW (1,900 hp(m)) sustained
Shaft: 1
Propeller: 1 LIPS, five-bladed, controllable pitch propeller
Active rudders: 2 ACEC electric motors; 176 kW (240 hp(m))
Bow thrusters: 2 Schottel, 2 × 90 kW
Shaft: 1
Ship's services: Three Turbomeca gas-turbine alternators (3 × 250 kW)
Emergency power: One diesel-generator set (180 kW)

FURTHER INFORMATION

PROGRAMME

These ships were the Belgian element of the Tripartite minehunter programme with France and the Netherlands. The Belgians built a special 'ship factory' for the fabrication of the hulls at Ostend and the hulls were then towed to Rupelmonde for fitting out.

MODERNISATION

Three of the class are being fitted with improved sonar and ROVs.

MODIFICATIONS

Myosotis (M 922) has been modified as an ammunition transport.

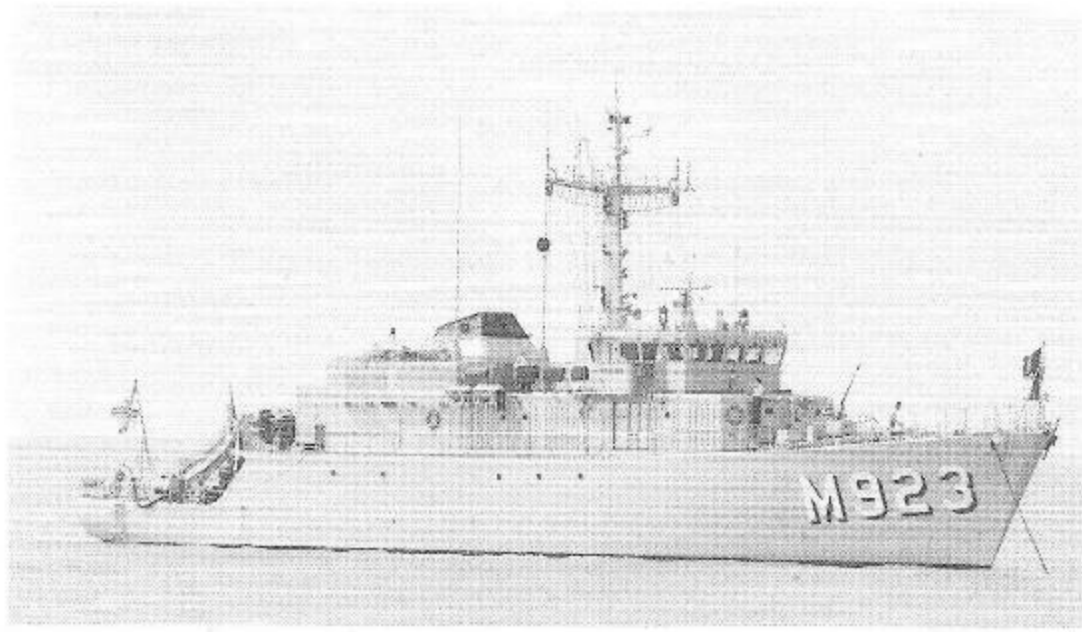
DEPLOYMENT

All of the class are based at Zeebrugge.

SALES

Three of the class paid off in July 1993. It was announced in January 1997 that these have been purchased by the French Navy.

Myosotis *(M 922)* (H & L van Ginderen Collection)



Narcis *(M 923)* (H & L van Ginderen Collection)

ERIDAN (TRIPARTITE MINEHUNTER)

GENERAL SPECIFICATIONS

Country of origin: International
Operator: France
Type: Tripartite (Coastal minehunter)
National designation: *Chasseurs de Mines Tripartites* (CMT)

Class: ERIDAN

Built: 10

Purchased from Belgium: 3
Active: 13

Displacement:
standard: 562 t
full load: 595 t

Dimensions
Length: 51.5 m (168.9 ft)
Beam: 8.9 m (29.2 ft)
Draught: 2.5 m (8.2 ft)

Speed: 15 kts max; 12 kts cruising; 8 kts minesweeping.
Range: 3,000 n miles at 12 kts

Complement: 46 (5 officers)

SHIPS

ERIDAN (M 641)

Builder	DCN, Lorient, France
Laid down	20 Dec 1977
Launched	2 Feb 1979
Commissioned	16 Apr 1984

CASSIOPEE (M 642)

Builder	DCN, Lorient, France
Laid down	26 Mar 1979
Launched	26 Sep 1981
Commissioned	5 May 1984

ANDROMEDE (M 643)

Builder	DCN, Lorient, France
Laid down	6 Mar 1980
Launched	22 May 1982
Commissioned	18 Oct 1984

PEGASE (M 644)

Builder	DCN, Lorient, France
Laid down	22 Dec 1980
Launched	23 Apr 1983
Commissioned	30 May 1985

ORION (M 645)

Builder	DCN, Lorient, France
Laid down	17 Aug 1981
Launched	6 Feb 1985
Commissioned	14 Jan 1986

CROIX DU SUD (M 646)

Builder	DCN, Lorient, France
Laid down	22 Apr 1982
Launched	6 Feb 1985
Commissioned	14 Nov 1986

AIGLE (M 647)

Builder	DCN, Lorient, France
Laid down	2 Dec 1982
Launched	8 Mar 1986
Commissioned	1 Jul 1987

LYRE (M 648)

Builder	DCN, Lorient, France
Laid down	13 Oct 1983
Launched	14 Nov 1986
Commissioned	16 Dec 1987

PERSEE (M 649)

Builder	DCN, Lorient, France
Laid down	30 Oct 1984
Launched	19 Apr 1988
Commissioned	4 Nov 1988

SAGITTAIRE (M 650)*

Builder	DCN, Lorient, France
Laid down	31 Jul 1993
Launched	14 Jan 1995
Commissioned	Mar 1996

Notes:
* This was the second 'Eridan' class MCMV of this name and pennant number to be built for the French Navy. The first, which was launched on 9 Nov 1988, was sold to Pakistan in 1992 and was replaced by the ship listed here.

Three were purchased from Belgium in January 1997. French names/numbers are not yet known.

MINE COUNTERMEASURES SYSTEMS

COMBAT DIVERS

Normal complement is five mine clearance divers who can operate down to 80 m (263 ft) with an air or breathing mixture supply. A two-person recompression chamber is installed and an additional eight-person chamber can be installed forward of the stack.

MINESWEEPING

The ships normally carry:

- OD-3 mechanical sweep. This is a lightweight sweep developed for the 'Eridan' class to give it a mechanical sweeping capability. It uses a single Oropesa sweep.
- AP-4 acoustic sweep. This may sometimes be carried by the Eridan for specific missions. It uses an electrodynamic noise generation technique and is housed in a large towed body.

MINEHUNTING SYSTEMS

PAP Mk 5 ROV

The 'Tripartite' class carries two PAP Mk 5 (PAP = *poisson auto-propulsé*) ROVs, which have the capability simultaneously to hunt and destroy ground mines and tethered mines either by placing and remotely detonating a charge or by cutting the mooring rope of tethered mines. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via either a tether, which can be a 2,000 m (6,562 ft) fibre optic cable or a 1,000 m (3,281 ft) coaxial cable. It is horizontally propelled by means of two side thrusters.

In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide rope'. The winch in the PAP is instructed to deploy a selected length of rope and the operator then uses return signals from the vehicle to maintain the vehicle at the desired selected height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP Mk 5 is able to carry the 126 kg (277 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution nearfield sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

Specifications
(PAP Mk 5)
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.2 ft)
Performance
Max vehicle velocity
mid-water transit: 6 kts (3 m/s)
bottom-following mode: 5.5 kts (2.75 m/s)
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s (2.3 ft/s)
Ascent velocity (charge released): 1.5 m/s (4.9 ft/s)
Payload
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Horizontal range:
with fibre optic cable: 2,000 m (6,562 ft)
with coaxial cable: 1,000 m (3,281 ft)
Max continuous endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bars

Manufacturer/Contractor
Société ECA, 92707 Colombes, France.

MINEHUNTING SONARS

TSM 2021B (DUBM 21B)

All except *Sagittaire* (M 650). Hull-mounted minehunting sonar. TSM 2021B is intended for use in conjunction with precision navigation equipment, and a mine countermeasure (destruction) system such as the PAP 104. The functions of TSM 2021 are to detect mines at distances up to 600 m (1,968 ft), and to classify them by studying the shape of their echo and acoustic shadow, at distances up to 250 m (820 ft).

Each detection and classification sonar chain consists of an acoustic transmitter/receiver transducer, the associated transmission and reception electronics, and a display console. A subassembly performs the stabilisation, steering and retraction of the detector and classifier arrays. The electroacoustic subassembly (EAA) includes:

The classification sonar transmitter/receiver chain cabinet
A display console which controls the transmission and reception functions and has CRT presentation of mine detection and location by the detector sonar chain
A display console with CRT displays for presentation of mine locations within the classification chain
Bridge repeater display, showing range and bearing of designated targets.

Specifications
Coverage:
detector chain: ±175° in sectors of 30, 60 and 90°
classification chain: sectors of 3, 5 or 10°
Elevation: Variable, between −5 and −40°
Stabilisation: ±15° (roll); ±5° (pitch)

Detection sonar
Frequency: 100 kHz (modulated ±10 kHz)
Pulse duration: 0.2 or 0.5 ms
Range scales: 400, 600 or 900 m

Max sound level: 120 dB
Channels: 20
Beam aperture: 1.5°
Display: PPI

Classification sonar
Range scales: 200 or 300 m (656 or 984 ft)

Max sound level: 122 dB
Channels: 80
Beam aperture: 0.17°
Display: CRT and storage magnifier tube

Manufacturer/Contractor
Thomson Sintra ASM, France.

TSM 2021D (DUBM 21D)
***Sagittaire* (M 650) only.** *Sagittaire* (M 650) was built nine years after the last Eridan as a replacement for the ship sold to Pakistan. It was, therefore, given a more modern version of the sonar.

WEAPONS SYSTEMS

GUNS

20 mm/90 (F2)
One mount per ship on the foredeck. The F2 Type A mounting is of the swivel fork-type revolving on a fixed ferrule. The mounting, which is unpowered, is largely made up of light alloys and stainless steel to reduce weight. The DCN 20 mm mounting is based upon the Giat 811 which has a dual feed. It is electrically initiated and capable of firing single rounds, short (three-round), long (eight-round) or continuous bursts. It has adjustable rates of fire of 125 and 400 rds/min as well as 125 and 650 rds/min. The DCN mounting weighs 500 kg (1,102 lb) and occupies 2.75 m (9.0 ft) of deck space. An unusual feature is a display showing the number of rounds remaining in the two magazines on either side of the mounting.

Specifications
(20 mm/90 (F2))
Calibre: 20 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,101 ft/s)
Traverse: 325°
Elevation: −15 to +80°
Mounting weight (loaded): 470 kg (1,036 lb)
Crew: 2
Range: 3.5-5.5 n miles (6.75-10 km)

Manufacturers/Contractors
Giat/DCN, France.

12.7 mm machine gun
One 12.7 mm machine gun is carried; type unknown.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

EVEC 20
EVEC 20 *(Ensemble de Visualisation et d'Enregistrement de la Chasse aux Mines)* is a data handling system which was developed specifically for the French Tripartite minehunter. EVEC 20 samples and processes data from the sonar, radio navigation systems, navigation radar, gyrocompass and Doppler log to present the operator with a continuously updated display of the minehunting area showing the positions of own ship and located targets, as well as radar contacts, tracks and lines representing specified zones. All or part of the displayed images can be recorded on cassette for subsequent recall, updating and maintaining an up-to-date permanent record of operations relating to a specified zone. A repeater on the bridge displays point co-ordinates from the minehunting sonar derived by the EVEC 20 and transmitted to the repeater.

The computer in the EVEC 20 also assists the automatic pilot, providing command inputs and error generation, and helps to control the automatic radar navigation systems providing location computations, error corrections and location of tracking windows.

The automatic pilot is used to keep the ship on a predetermined track during minehunting operations, receiving necessary data from the gyrocompass and Doppler log.

The navigation radar and automatic tracking system integrate with the EVEC 20 to provide a buoy location system.

The horizontal plotting table uses an 80 cm² screen on which up to 200 sonar contacts can be displayed. The table receives data from the central processing unit which has a 20 kbyte random access memory.

Manufacturer/Contractor
Thomson-CSF, France.

RADAR

Racal-Decca 1229
The navigation radar is the Racal-Decca Type 1229, with an output of 20 kW. It is equipped with a 2.7 m (8.9 ft) antenna and operates in the I/J band

Specifications
Role: Navigation
Frequency: I/J-band
Beam: 1.3 × 30°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
PRF: 1,300/650 pps
Scan rate: 25 rpm

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 1 Stork-Werkspoor A-RUB 215V-12 diesel; 1.37 MW (1,860 hp(m)) sustained

Propeller: 1 LIPS, five-bladed, controllable pitch propeller
Auxiliary propulsion: 2 ACEC electric motors; 179 kW (240 hp(m)), two active rudders

Thrusters: 2 Schottel bow thrusters, 2 × 90 kW
Shaft: 1

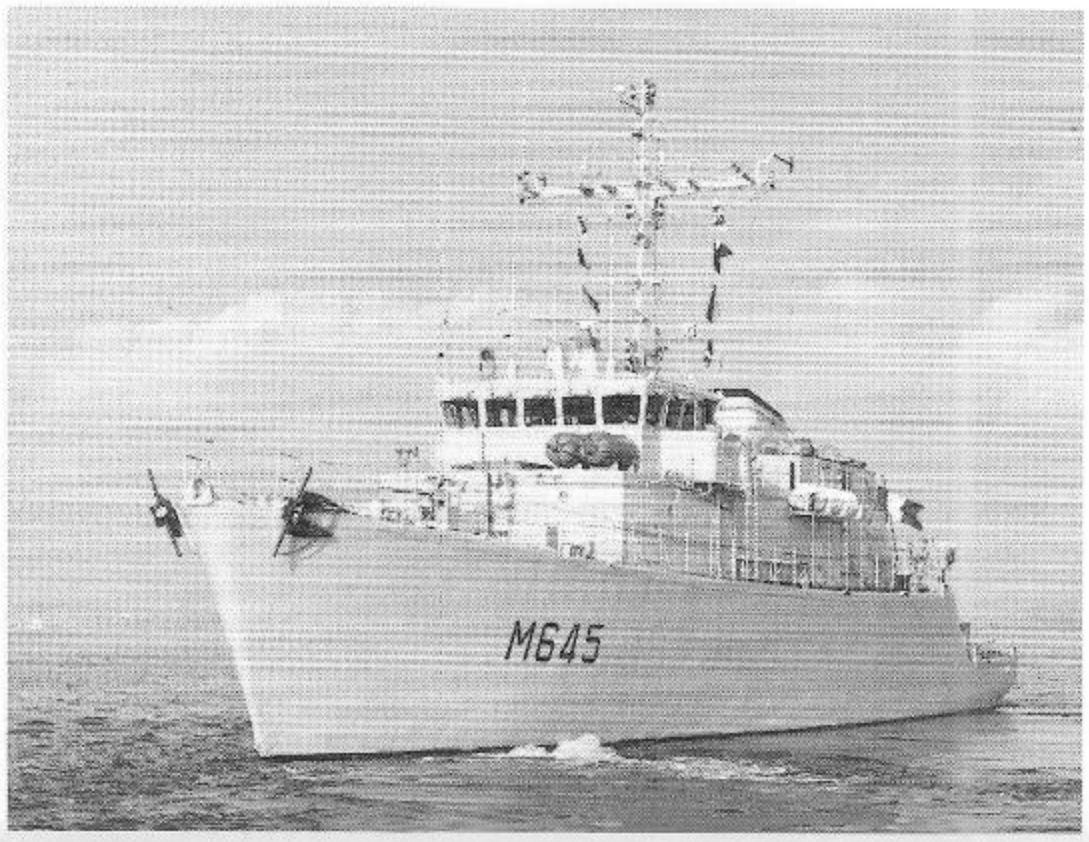
FURTHER INFORMATION

PROGRAMME

The original French Navy requirement was for 15, but this was later reduced to 10, all of which were built at Lorient. The original tenth ship of the class, completed in 1989, was subsequently transferred to Pakistan on 24 September 1992 as the first in an order for three, and a new tenth ship for the French Navy was ordered in January 1992. It bears the same name and pennant number as the ship it replaces. The French Navy has bought three ships from Belgium, bringing its total to 13.

DEPLOYMENT

M 641-646 plus the ex-Belgian ships are based at Brest, the remainder at Toulon.



Perseé *(M 649)* (H & L van Ginderen Collection)

Orion *(M 645) turning under the power of its Schottel bow thrusters* (DCN/Jean Biaugeaud)

ALKMAAR (TRIPARTITE MINEHUNTER)

GENERAL SPECIFICATIONS

Country of origin: International
Operator: Netherlands
Type: Tripartite (Coastal minehunter)

Class: ALKMAAR

Built: 15
Active: 15

Displacement:
standard: 562 t
full load: 595 t

Dimensions
Length: 51.5 m (168.9 ft)
Beam: 8.9 m (29.2 ft)
Draught: 2.5 m (8.2 ft)

Speed: 15 kts max; 12 kts cruising; 8 kts minesweeping.
Range: 3,000 n miles at 12 kts

Complement: 29-42 depending on task

SHIPS

ALKMAAR (M 850)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	30 Jan 1979
Launched	18 May 1982
Commissioned	28 May 1983

DELFZYL (M 851)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	29 May 1980
Launched	29 Oct 1982
Commissioned	7 Aug 1983

DORDRECHT (M 852)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	5 Jan 1981
Launched	26 Feb 1983
Commissioned	16 Nov 1983

HAARLEM (M 853)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	16 Jun 1981
Launched	6 May 1983
Commissioned	12 Jan 1984

HARLINGEN (M 854)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	30 Nov 1981
Launched	9 Jul 1983
Commissioned	12 Apr 1984

SCHEVENINGEN (M 855)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	24 May 1982
Launched	2 Dec 1983
Commissioned	18 Jul 1984

MAASSLUIS (M 856)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	7 Nov 1982
Launched	5 May 1984
Commissioned	12 Dec 1984

MAKKUM (M 857)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	25 Feb 1983
Launched	27 Sep 1984
Commissioned	13 May 1985

MIDDELBURG (M 858)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	11 Jul 1983
Launched	23 Feb 1985
Commissioned	10 Dec 1986

HELLEVOETSLUIS (M 859)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	12 Dec 1983
Launched	18 Jul 1985
Commissioned	20 Feb 1987

SCHIEDAM (M 860)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	6 May 1984
Launched	20 Dec 1985
Commissioned	9 Jul 1986

URK (M 861)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	1 Oct 1984
Launched	2 May 1986
Commissioned	10 Dec 1986

ZIERIKZEE (M 862)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	25 Feb 1985
Launched	4 Oct 1986
Commissioned	7 May 1987

VLAARDINGEN (M 863)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	6 May 1986
Launched	4 Aug 1988
Commissioned	15 Mar 1989

WILLEMSTAD (M 864)

Builder	Van der Giessen de Noord, Alblasserdam, Netherlands
Laid down	3 Oct 1986
Launched	27 Jan 1989
Commissioned	20 Sep 1989

MINE COUNTERMEASURES SYSTEMS

COMBAT DIVERS

Normal complement is five mine clearance divers who can operate down to 80 m (263 ft) with an air or breathing mixture supply. A two-person recompression chamber is installed and an additional eight-person chamber can be installed forward of the stack.

MINESWEEPING

The ships normally carry:

OD-3 mechanical sweep. This is a lightweight sweep developed for the 'Eridan' class to give them a mechanical sweeping capability. It uses a single Oropesa sweep.

PAP Mk 5 ROV

The 'Tripartite' class carries two PAP Mk 5 (PAP = poisson auto-propulsé) ROVs, which have the capability simultaneously to hunt and destroy ground mines and tethered mines either by placing and remotely detonating a charge or by cutting the mooring rope of tethered mines. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via either a tether, which can be a 2,000 m (6,562 ft) fibre optic cable or a 1,000 m (3,281 ft) coaxial cable. It is horizontally propelled by means of two side thrusters.

In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide-rope'. The winch in the PAP is instructed to deploy a selected length of rope and the operator then uses return signals from the vehicle to maintain the vehicle at the desired selected height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP Mk 5 is able to carry the 126 kg (277 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution nearfield sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

Specifications

(PAP Mk 5)
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.2 ft)
Performance
Max vehicle velocity
mid-water transit: 6 kts (3 m/s)
bottom-following mode: 5.5 kts (2.75 m/s)
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s (2.3 ft/s)
Ascent velocity (charge released): 1.5 m/s (4.9 ft/s)
Payload
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Horizontal range:
with fibre optic cable: 2,000 m (6,562 ft)
with coaxial cable: 1,000 m (3,281 ft)
Max continuous endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bars

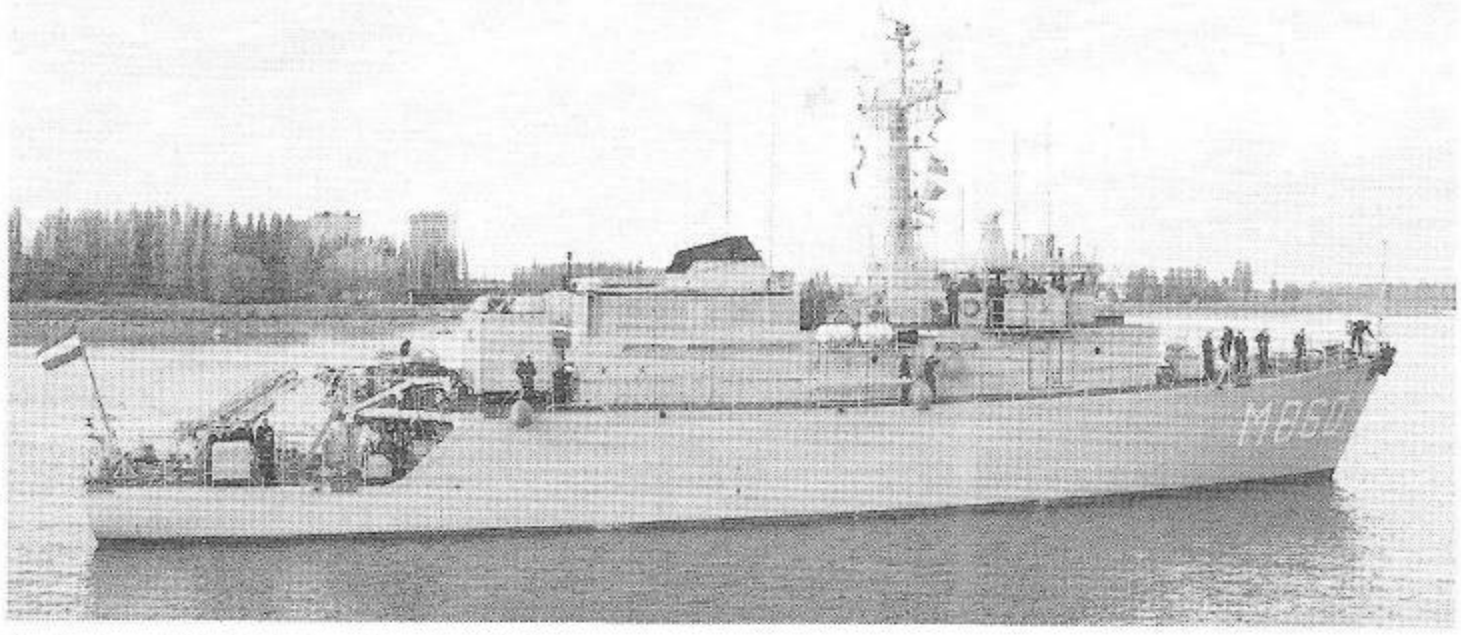
Manufacturer/Contractor

Société ECA, 92707 Colombes, France.

MINEHUNTING SONARS

TSM 2021A

Hull-mounted minehunting sonar. Unlike the Belgian and French ships which have TSM-2021B, the Dutch ships have TSM 2021A, which differs only in minor ways, such as the displays. TSM 2021A is intended for use in conjunction with precision navigation equipment, and a mine countermeasure (destruction) system such as the PAP 104. The functions of TSM 2021 are to detect mines at distances up to 600 m (1,968 ft), and to classify them by studying the shape of their echo and acoustic shadow, at distances up to 250 m (820 ft).



Schiedam *(M 860), showing detail of the sweep deck. Note also the 5-tonne container (above fender) which can be exchanged with other units, roled according to the user's operational requirements* (H & L van Ginderen Collection)

Each detection and classification sonar chain consists of an acoustic transmitter/receiver transducer, the associated transmission and reception electronics, and a display console. A subassembly performs the stabilisation, steering, and retraction of the detector and classifier arrays. The electroacoustic subassembly (EAA) includes:

The classification sonar transmitter/receiver chain cabinet

A display console which controls the transmission and reception functions and has CRT presentation of mine detection and location by the detector sonar chain

A display console with CRT displays for presentation of mine locations within the classification chain

Bridge repeater display, showing range and bearing of designated targets.

Specifications

Coverage:

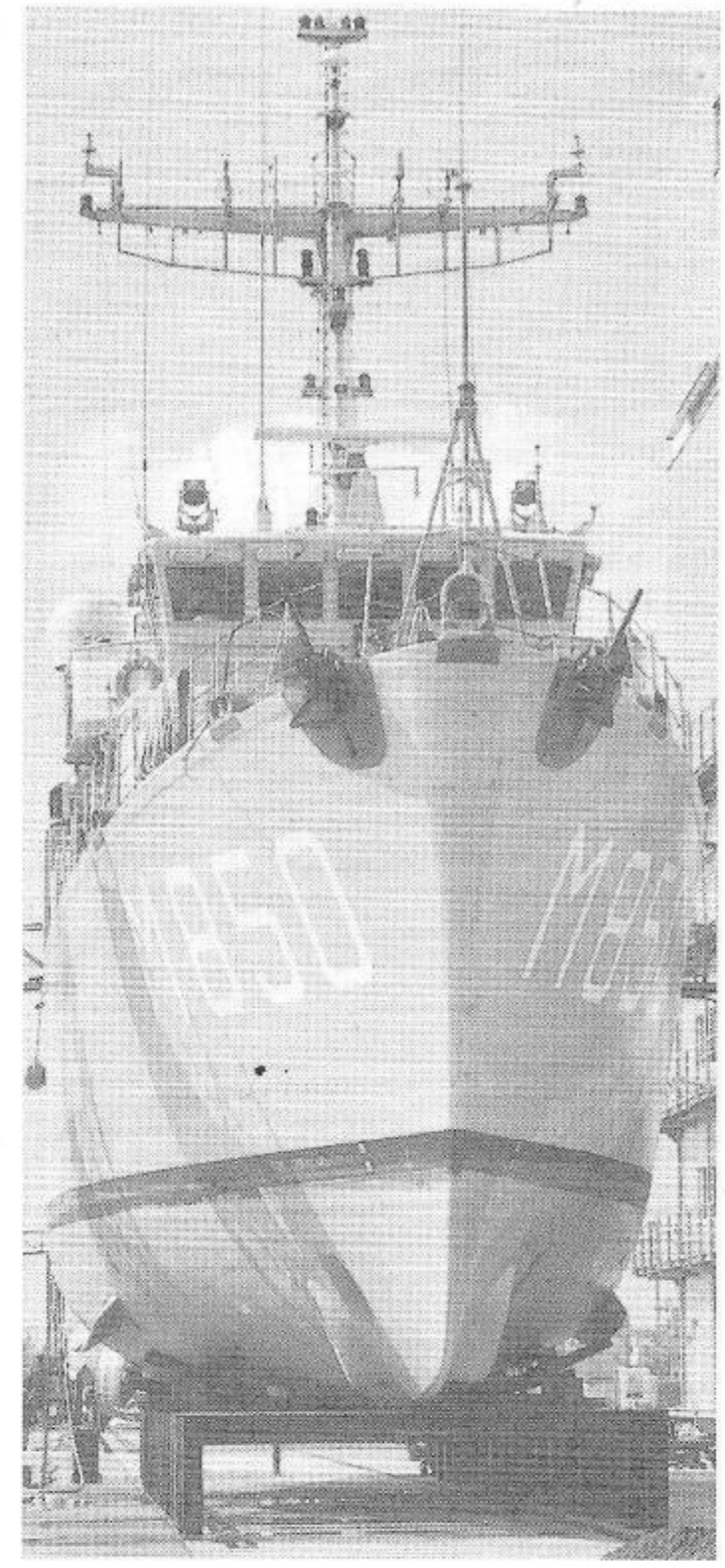
detector chain: ±175° in sectors of 30, 60 and 90°
classification chain: sectors of 3, 5 or 10°
Elevation: Variable, between −5 and −40°
Stabilisation: ±15° (roll); ±5° (pitch)

Detection sonar
Frequency: 100 kHz (modulated ±10 kHz)
Pulse duration: 0.2 or 0.5 ms
Range scales: 400, 600 or 900 m
Max sound level: 120 dB
Channels: 20
Beam aperture: 1.5°
Display: PPI

Classification sonar
Range scales: 200 or 300 m (656 or 984 ft)
Max sound level: 122 dB
Channels: 80
Beam aperture: 0.17°
Display: CRT and storage magnifier tube

Manufacturer/Contractor

Thomson Sintra ASM, France.



Alkmaar *(M 850) showing its hull profile. Note the bow thrusters and bilge keels* (MoD Netherlands)

WEAPONS SYSTEMS

GUNS

20 mm/90 (F2)

One mount per ship on the foredeck. The F2 Type A mounting is of the swivel fork-type revolving on a fixed ferrule. The mounting, which is unpowered, is largely made up of light alloys and stainless steel to reduce weight. The DCN 20 mm mounting is based upon the Giat 811 which has a dual feed. It is electrically initiated and capable of firing single rounds, short (three-round), long (eight-round) or continuous bursts. It has adjustable rates of fire of 125 and 400 rds/min as well as 125 and 650 rds/min. The DCN mounting weighs 500 kg (1,102 lb) and occupies 2.75 m (9.0 ft) of deck space. An unusual feature is a display showing the number of rounds remaining in the two magazines on either side of the mounting.

Specifications

(20 mm/90 (F2))
Calibre: 20 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,101 ft/s)
Traverse: 325°
Elevation: −15 to +80°
Mounting weight (loaded): 470 kg (1,036 lb)
Crew: 2
Range: 3.5-5.5 n miles (6.75-10 km)

Manufacturers/Contractors

Giat/DCN, France.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

EVEC 20

EVEC 20 *(Ensemble de Visualisation et d'Enregistrement de la Chasse aux Mines)* is a data handling system which was developed specifically for the French Tripartite minehunter. EVEC 20 samples and processes data from the sonar, radio navigation systems, navigation radar, gyrocompass and Doppler log to present the operator with a continuously updated display of the minehunting area showing the positions of own ship and located targets, as well as radar contacts, tracks and lines representing specified zones. All or part of the displayed images can be recorded on cassette for subsequent recall, updating and maintaining an up-to-date permanent record of operations relating to a specified zone. A repeater on the bridge displays point coordinates from the minehunting sonar derived by the EVEC 20 and transmitted to the repeater.

The computer in the EVEC 20 also assists the automatic pilot, providing command inputs and error generation, and helps to control the automatic radar navigation systems providing location computations, error corrections and location of tracking windows.

The automatic pilot is used to keep the ship on a predetermined track during minehunting operations, receiving necessary data from the gyrocompass and Doppler log.

The navigation radar and automatic tracking system integrate with the EVEC 20 to provide a buoy location system. The horizontal plotting table uses an 80 cm² screen on which up to 200 sonar contacts can be displayed. The table receives data from the central processing unit which has a 20 kbyte random access memory.

Manufacturer/Contractor

Thomson-CSF, France.

Signaal SEWACO IX

The Dutch MCMVs are fitted with the Signaal SEWACO IX minehunting action information system. This is a cut-down version of the SEWACO combat data systems originally developed for frigate-size vessels.

Manufacturer/Contractor

Hollandse Signaalapparaten BV, Hengelo, Netherlands.

Satcom

MARISAT

RADAR

Racal-Decca TM 1229C

The navigation radar is the Racal-Decca Type TM 1229C, with an output of 20 kW. It is equipped with a 2.7 m (8.9 ft) antenna and operates in the I/J band.

Specifications

Role: Navigation
Frequency: I/J-band
Beam: 1.3 × 30°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
PRF: 1,300/650 pps
Scan rate: 25 rpm

Manufacturer/Contractor

Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 1 Stork-Werkspoor A-RUB 215V-12 diesel; 1.37 MW (1,860 hp(m)) sustained

Propeller: 1 LIPS, five-bladed, controllable pitch propeller
Auxiliary propulsion: 2 ACEC electric motors; 179 kW (240 hp(m)), 2 active rudders

Thrusters: 2 Schottel bow thrusters, 2 × 90 kW
Shaft: 1

FURTHER INFORMATION

PROGRAMME

These ships are the Dutch element of the Tripartite Minehunter programme and it should be noted that, in the event, the RNethN was the only one of the three partners to take their originally agreed full share of 15 ships. The Dutch ships were all built by van der Giessen de Noord, which launched them virtually ready for sea-going trials.

The Dutch programme was slightly interrupted when the Indonesian Navy placed an order for two. Two unfinished ships in the Dutch production order were diverted to meet the Indonesian requirement and two further hulls were then laid down to complete the Dutch order for 15.

There was also a plan to transfer two ships to Egypt, but the deal was never finalised.

MODERNISATION

Conversions started in 1996 for three of the class to become Troika control ships operating four drones each. The drones are being developed by Signaal and will be based on the German type. The first one is planned to be in service in 1998 and it is planned to produce 14, in order that 12 will always be available.

The remaining twelve ships are to have minehunting capability upgrades including a new mine disposal system. Four of the class will also be fitted with propelled variable depth sonars (PVDS) to enable them to be employed as deep-water minehunters.

At least some of the ships may carry shoulder-launched air defence missiles (probably Stinger) when employed on patrol duties.

DEPLOYMENT

One of the class is to be converted for use as a survey vessel but will be capable of restoration to a minehunter at three months' notice.

PULAU RENGAT (TRIPARTITE MINEHUNTER)

GENERAL SPECIFICATIONS

Country of origin: International
Operator: Indonesia
Type: Tripartite (Coastal minesweeper/hunter)

Class: PULAU RENGAT

Purchased: 2
Active: 2

Displacement:
standard: 562 t
full load: 595 t

Dimensions
Length: 51.5 m (168.9 ft)
Beam: 8.9 m (29.2 ft)
Draught: 2.5 m (8.2 ft)

Speed: 15 kts max; 12 kts cruising; 8 kts minesweeping.
Range: 3,000 n miles at 12 kts

Complement: 46 plus 4 spare berths

SHIPS

PULAU RENGAT (711)		**Commissioned**	26 Mar 1988	**Laid down (RNethN)**	22 Jul 1985 (*Vlaardingen* (M 863))
Builder	Van der Giessen de Noord, Alblasserdam, Netherlands	**PULAU RUPAT** (712)		**Ordered (Indonesia)**	30 Aug 1985
Ordered (Indonesia)	29 Mar 1985	**Builder**	Van der Giessen de Noord, Alblasserdam, Netherlands	**Launched**	27 Aug 1987
Laid down	29 Mar 1985			**Commissioned**	26 Mar 1988
Launched	23 Jul 1987				

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

These two ships are outfitted and employed as minesweepers as well as minehunters. Their minesweeping equipment includes:

OD-3 mechanical sweep
This is a French lightweight sweep, which was developed for the 'Eridan' class to give them a mechanical sweeping capability. It uses a single Oropesa float.

F-82 magnetic sweep
The two Indonesian ships have the F-82 magnetic sweep, which is more usually combined with a Fiskars acoustic sweep and an integration package to form the FIMS (Fiksars Integrated Mine System), three electrode magnetic sweep cables, with current capacities of 400 A DC, 100 A repetitive peak. The 346 mm (13.6 in) diameter, buoyant sweep cables have a low-tow resistance enabling them to be used at speeds up to 10 knots. The magnetic sweep current generator is normally powered from the ship's supply, but can be supplied with its own diesel generator.

Manufacturer/Contractor
Fiskars-Elesco Oy, Espoo, Finland.

AS 203 acoustic sweep gear
AS 203 is a Swedish-manufactured acoustic sweep.

Manufacturer/Contractor
S A Marine, Sweden.

Cranes
There are two sweep-gear cranes on the afterdeck to handle these sweeps.

MINEHUNTING SYSTEMS

PAP-104 Mk 4 ROV
The Indonesian 'Tripartite' class carries two PAP Mk 4 (PAP = *poisson auto-propulsé*) ROVs, which have the capability simultaneously to hunt and destroy ground mines and tethered mines either by placing and remotely detonating a charge or by cutting the mooring rope of tethered mines. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via either a tether or a coaxial cable. It is horizontally propelled by means of two side thrusters.

In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide-rope'. The winch in the PAP is instructed to deploy a selected length of rope and the operator then uses return signals from the vehicle to maintain the vehicle at the desired selected height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP Mk 4 is able to carry the 126 kg (277 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution nearfield sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

Specifications
(PAP Mk 4)
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.2 ft)
Performance
Max vehicle velocity
mid-water transit: 5 kts
bottom-following mode: 5 kts
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s (2.3 ft/s)
Ascent velocity (charge released): 1.5 m/s (4.9 ft/s)
Payload
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Max continuos endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bars

Manufacturer/Contractor
Société ECA, 92707 Colombes, France.

ACTION INFORMATION

Ibis V minehunting action information system
IBIS V is a lightweight system comprising:

- Thomson-CSF TSM 2022 single array sonar system
- Thomson-CSF TSM 2026 NAVIPLOT
- Thomson-CSF TSM 2060 four-colour tactical display
- Thomson-CSF TSM 5721 Doppler bottom log

The sonar array has a span of about 1.5 m (4.9 ft) but pivots to retract vertically into the sonar well, which is only 75 cm (30 in) in diameter.

Manufacturer/Contractor
Thomson-CSF, France.

MINEHUNTING SONAR

Thomson-CSF TSM 2022
TSM 2022 is a hull-mounted high-frequency minehunting sonar, which can also be used for mine avoidance on minesweepers. It is based largely on experience gained with the French DUBM 21B in the field of high-resolution beam-forming techniques. It is a hull-mounted equipment intended also for use in conjunction with precision display and navigation equipment and a mine countermeasures system.

The main feature of the TSM 2022 is its small-size retractable single array assembly, used for both detection and classification, which enables easy installation and maintenance. The high-resolution features of the DUBM 21 are maintained and improvements are mainly in the field of digital processing technology. The main functions of the sonar are: detection and classification of moored and bottom mines, detection at distances up to 600 m (1,968 ft), and classification of targets by analysis of the shape of their echo or shadow at distances up to 250 m (820 ft). In the classification mode, horizontal beamwidth is 7°; in detection mode either 14° or 28° beamwidth can be selected. In both modes the vertical beamwidth is 15°. In the Mk II configuration the TSM 2022 is equipped with a 19 in high-resolution colour console and specific sonar processing such as computer-aided detection (CAD), computer-aided classification (CAC) and performance indicator (PI).

Manufacturers/Contractors
Thoray, USA.
Thomson Sintra ASM, France.

WEAPONS SYSTEMS

GUNS

Rheinmetall Rh-202 20 mm/85 multipurpose cannon
Two Rheinmetall Rh-202 20 mm/85 are carried. The 85 calibre Rh 202 is 2.61 m (8.56 ft) long, weighs 81.5 kg (180 lb) and is capable of single shot or automatic fire. Naval versions use either a conventional single belt feed in which rounds enter from the right and spent cartridges are ejected to the left, or the Type 2 two-way belt-feed mechanism. The Rheinmetall powered twin mounting installed in the 'Jason' class is 4.05 m (13.3 ft) long, 1.67 m (5.5 ft) high and 2.3 m (7.5 ft) across, and weighs 1.64 t. The twin guns, their ammunition boxes and the operator's seat are on a platform that can rotate through 360°. It has a three- or four-man crew.

Specifications
(Rh 202)
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,101 ft/s)
Rate of fire: 800-1,000 rds/min

Manufacturer/Contractor
Rheinmetall, Germany.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

SEWACO-RI
SEWACO-RI (RI = *Republik Indonesia*) is an action data automation system developed specifically for these Indonesian MCMs. It is derived from the more sophisticated SEWACO combat data systems for larger surface combatants.

Manufacturer/Contractor
Hollandse Signaalapparaten BV, Hengelo, Netherlands.

RADAR

Racal-Decca AC 1229C
The navigation radar is the Racal-Decca Type AC 1229C, with an output of 25 kW. It is equipped with a 2.7 m (8.9 ft) antenna and operates in the I/J band.

Specifications
Role: Navigation
Frequency: I/J-band
Beam: 1.3 × 30°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
PRF: 1,300/650 pps
Scan rate: 25 rpm

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU 12V 396 TC82 diesels; 1.92 MW (2,610 hp(m)) sustained
Shafts: 2
Propulsors: 2 ACEC retractable electric motors, 1.76 MW (2,400 hp(m))
Thrusters: 2 Schottel bow thrusters; 110 kW (150 hp(m))
Ship's services: 3 Turbomeca gas-turbine generators (3 × 250 kW) plus diesel-generator set in engine room (180 kW)

FURTHER INFORMATION

PROGRAMME

The original Indonesian programme was for a class of twelve Tripartite minehunters, of which two would be built in the Netherlands and the balance in Indonesia. The two Dutch ships were duly ordered. First ordered on 29 March 1985, laid down 22 July 1985 and both were delivered in 1988. The plan to build a further ten has, however, been cancelled due to a lack of funds.

DESIGN

These ships were required from the start to serve as minehunters, minesweepers and patrol ships, and as a result there are differences from the standard European Tripartites. The Indonesian ships have MTU engines, their deckhouses and general layout are different, and they have Rheinmetall instead of Giat guns.

MODERNISATION

Consideration is being given to an additional short-range missile system or a third 20 mm gun.

MUNSIF (TRIPARTITE)

GENERAL SPECIFICATIONS

Country of origin: International
Operator: Pakistan
Type: Tripartite (Coastal minehunter)

Class: MUNSIF (ERIDAN)

Built: 2
Active: 2
Building: 1

Displacement:
standard: 562 t
full load: 595 t

Dimensions
Length: 51.5 m (168.9 ft)
Beam: 8.9 m (29.2 ft)
Draught: 2.5 m (8.2 ft)

Speed: 15 kts max; 12 kts cruising; 8 kts minesweeping.
Range: 3,000 n miles at 12 kts

Complement: 46 plus 4 spare berths

SHIPS

MUNSIF (M 166)		**Transferred (Pakistan Navy)**	Sep 1992	**MAHMOOD** (M 168)	
Builder	DCN, Lorient, France			**Builder**	DCN, Lorient, France/Karachi
Laid down	13 Nov 1985	**MUHAFIZ** (M 167)		**Launched**	Jun 1996
Launched	9 Nov 1988	**Builder**	DCN, Lorient, France	**Commissioned**	Feb 1997
Commissioned (French Navy)	27 Jul 1989 (*Sagittaire* (M 650))	**Launched**	8 Jul 1995		
		Commissioned	Apr 1996		

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

OD-3 mechanical sweep.

This is the French lightweight sweep developed for the 'Eridan' class to give them a mechanical sweeping capability. It uses a single Oropesa sweep.

MRK 400 acoustic sweep

The MRK 400 is an acoustic sweep developed by Fiskars.

Manufacturer/Contractor
Fiskars Elesco, Finland.

MRK 960 magnetic sweep

Manufacturer/Contractor
Fiskars Elesco, Finland.

COMBAT DIVERS

Normal complement is five mine clearance divers, who can operate down to 80 m (263 ft) with an air or breathing mixture supply. A two-person recompression chamber is installed and an additional eight-person chamber can be installed forward of the stack.

MINEHUNTING SYSTEMS

PAP Mk 5 ROV

The 'Tripartite' class carries two PAP Mk 5 (PAP = *poisson auto-propulsé*) ROVs, which have the capability simultaneously to hunt and destroy ground mines and tethered mines either by placing and remotely detonating a charge or by cutting the mooring rope of tethered mines. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via either a tether, which can be a 2,000 m (6,562 ft) fibre optic cable or a 1,000 m (3,281 ft) coaxial cable. It is horizontally propelled by means of two side thrusters.

In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide rope'. The winch in the PAP is instructed to deploy a selected length of rope and the operator then uses return signals from the vehicle to maintain the vehicle at the desired selected height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP Mk 5 is able to carry the 126 kg (277 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution nearfield sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

Specifications
(PAP Mk 5)
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.2 ft)
Performance
Max vehicle velocity
mid-water transit: 6 kts (3 m/s)
bottom-following mode: 5.5 kts (2.75 m/s)
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s (2.3 ft/s)
Ascent velocity (charge released): 1.5 m/s (4.9 ft/s)
Payload
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Horizontal range:
with fibreoptic cable: 2,000 m (6,562 ft)
with coaxial cable: 1,000 m (3,281 ft)
Max continuous endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bars

Manufacturer/Contractor
Société ECA, 92707 Colombes, France.

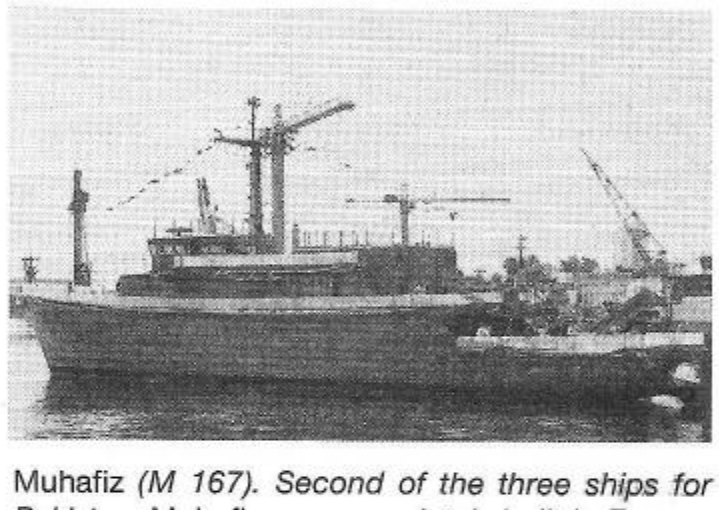
MINEHUNTING SONARS

TSM 2021B (DUBM 21B)

***Munsif* (M 166) and *Muhafiz* (M 168) only.** Hull-mounted minehunting sonar. TSM 2021B is intended for use in conjunction with precision navigation equipment, and a mine countermeasure (destruction) system such as the PAP 104. The functions of TSM 2021 are to detect mines at distances up to 600 m (1,968 ft), and to classify them by studying the shape of their echo and acoustic shadow, at distances up to 250 m (820 ft).

Each detection and classification sonar chain consists of an acoustic transmitter/receiver transducer, the associated transmission and reception electronics, and a display console. A subassembly performs the stabilisation, steering, and retraction of the detector and classifier arrays. The electroacoustic subassembly (EAA) includes:

- The classification sonar transmitter/receiver chain cabinet
- A display console which controls the transmission and reception functions and has CRT presentation of mine detection and location by the detector sonar chain
- A display console with CRT displays for presentation of mine locations within the classification chain
- Bridge repeater display, showing range and bearing of designated targets.



Muhafiz *(M 167). Second of the three ships for Pakistan,* Muhafiz *was completely built in France, but while the hull of the third of class has been constructed in France it is being completed and fitted out in Karachi* (Jane's/H M Steele)

Specifications
Coverage:
detector chain: ±175° in sectors of 30, 60 and 90°
classification chain: sectors of 3, 5 or 10°
Elevation: Variable, between −5 and −40°
Stabilisation: ±15° (roll); ±5° (pitch)

Detection sonar
Frequency: 100 kHz (modulated ±10 kHz)
Pulse duration: 0.2 or 0.5 ms
Range scales: 400, 600 or 900 m
Max sound level: 120 dB
Channels: 20
Beam aperture: 1.5°
Display: PPI

Classification sonar
Range scales: 200 or 300 m (656 or 984 ft)
Max sound level: 122 dB
Channels: 80
Beam aperture: 0.17°
Display: CRT and storage magnifier tube

Manufacturer/Contractor
Thomson Sintra ASM, France.

TSM 2021D (DUBM 21D)

***Mahmood* (M 169) only.** *Mahmood* (M 169) which is being fitted out in Pakistan, will have a more modern version of the sonar.

WEAPONS SYSTEMS

GUNS

Giat 20 mm/90 F2

One mount per ship on the foredeck. The F2 Type A mounting is of the swivel fork-type revolving on a fixed ferrule. The mounting, which is unpowered, is largely made up of light alloys and stainless steel to reduce weight. The DCN 20 mm mounting is based upon the Giat 811 which has a dual feed. It is electrically initiated and capable of firing single rounds, short (three-round), long (eight-round) or continuous bursts. It has adjustable rates of fire of 125 and 400 rds/min as well as 125 and 650 rds/min. The DCN mounting weighs 500 kg (1,102 lb) and occupies 2.75 m (9.0 ft) of deck space. An unusual feature is a display showing the number of rounds remaining in the two magazines on either side of the mounting.

Specifications
(20 mm/90 (F2))
Calibre: 20 mm
Length of barrel: 90 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,101 ft/s)
Traverse: 325°
Elevation: −15 to +80°
Mounting weight (loaded): 470 kg (1,036 lb)
Crew: 2
Range: 3.5-5.5 n miles (6.75-10 km)

Manufacturers/Contractors
Giat/DCN, France.

12.7 mm machine gun

One 12.7 mm machine gun is carried; type unknown.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Thomson-CSF TSM 2061 Mk II

***Muhafiz* (M 167) and *Mahmood* (M 168) only.** TSM 2061 Mk II is a minehunting and mine disposal system which includes onboard, real-time analysis.

EVEC 20

EVEC 20 *(Ensemble de Visualisation et d'Enregistrement de la Chasse aux Mines)* is a data handling system, which was developed specifically for the French Tripartite minehunter. EVEC 20 samples and processes data from the sonar, radio navigation systems, navigation radar, gyrocompass and Doppler log to present the operator with a continuously updated display of the minehunting area showing the positions of own ship and located targets, as well as radar contacts, tracks and lines representing specified zones. All or part of the displayed images can be recorded on cassette for subsequent recall, updating and maintaining an up-to-date permanent record of operations relating to a specified zone. A repeater on the bridge displays point co-ordinates from the minehunting sonar derived by the EVEC 20 and transmitted to the repeater.

The computer in the EVEC 20 also assists the automatic pilot, providing command inputs and error generation, and helps to control the automatic radar navigation systems providing location computations, error corrections and location of tracking windows.

The automatic pilot is used to keep the ship on a predetermined track during minehunting operations, receiving necessary data from the gyrocompass and Doppler log.

The navigation radar and automatic tracking system integrate with the EVEC 20 to provide a buoy location system. The horizontal plotting table uses an 80 cm^2 screen on which up to 200 sonar contacts can be displayed. The table receives data from the central processing unit which has a 20 kbyte random access memory.

Manufacturer/Contractor
Thomson-CSF, France

RADAR

Racal-Decca 1229

The navigation radar is the Racal-Decca Type 1229, with an output of 20 kW. It is equipped with a 2.7 m (8.9 ft) antenna and operates in the I/J band

Specifications
Role: Navigation
Frequency: I/J-band
Beam: 1.3 × 30°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
PRF: 1,300/650 pps
Scan rate: 25 rpm

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 1 Stork-Werkspoor A-RUB 215V-12 diesel; 1.37 MW (1,860 hp(m)) sustained
Propeller: 1 LIPS, five-bladed, controllable pitch propeller
Auxiliary propulsion: 2 ACEC electric motors; 179 kW (240 hp(m)), 2 active rudders
Thrusters: 2 Schottel bow thrusters, 2 × 90 kW
Shaft: 1

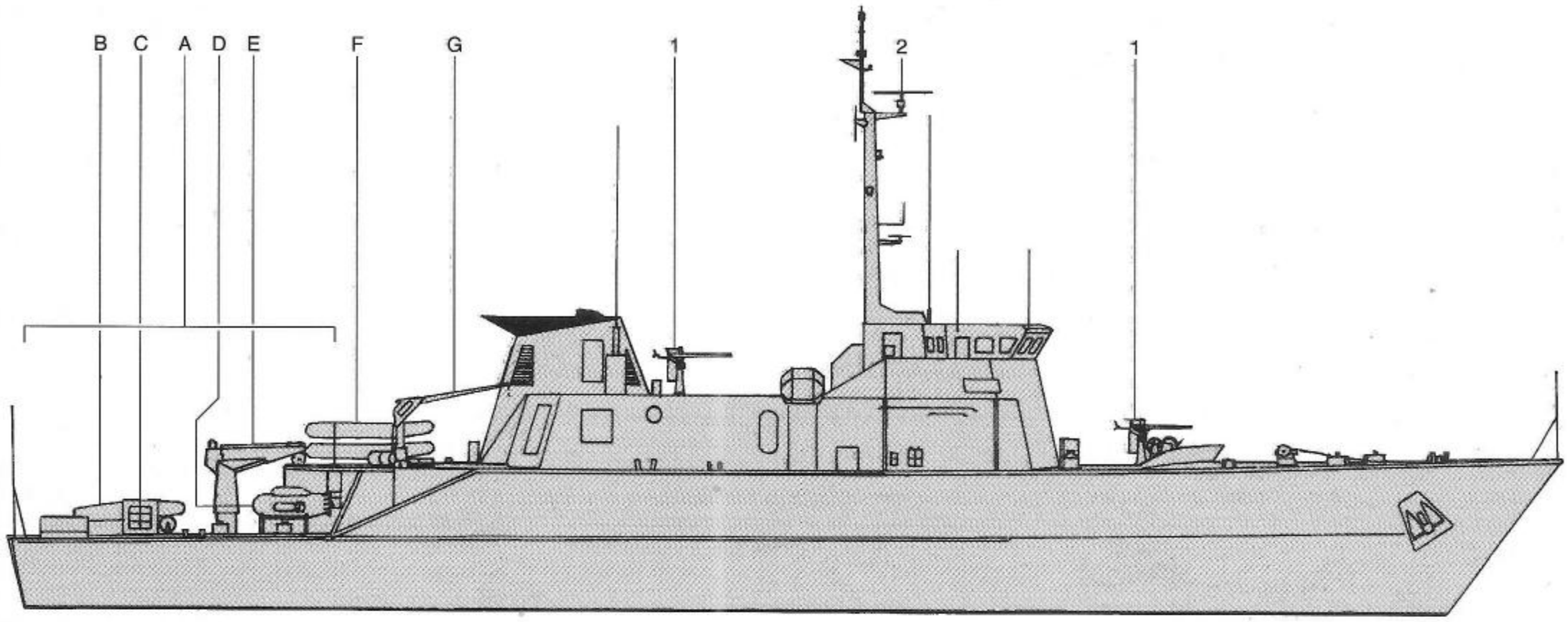
FURTHER INFORMATION

PROGRAMME

The contract for the supply of three MCMVs was signed with France 17 January 1992. In order to provide the purchaser with a working ship as quickly as possible, the French Navy handed over its ship *Sagittaire,* which had already seen service in the Gulf in 1991. It was recommissioned into the Pakistan Navy on 24 September 1992 and sailed for Pakistan in November 1992. The second was built for the Pakistan Navy and started sea trials in February 1996, sailing for Karachi on completion. The third hull was built in France and then shipped out to Karachi in April 1995 by transporter ship; sea trials were scheduled to start in December 1996. It is reported that Thomson Sintra TSM 2054 sonar may be included in the third ship.

LERICI/GAETA

OVERVIEW



'Gaeta' class (Ian Sturton)
MCM A *Sweep deck* **B** *Oropesa float* **C** *Kite* **D** *MIN Mk 2 ROV* **E** *Sweep crane* **F** *RIB* **G** *Crane*

General 1 *Oerlikon 20 mm (not always mounted)* **2** *SMA SPN-728(V)3*

The Italian Lerici/Gaeta MCMV design has achieved a considerable degree of success in a very competitive market, with 38 ships ordered so far, by six navies, with particular successes in the Far East and the USA. Intermarine uses a monocoque structure which has no longitudinal or transverse reinforcements other than the nine bulkheads and the main deck. The design of such a hull — and especially its stress characteristics — is very carefully calculated, with the Intermarine hull varying in hull thickness from 150 mm at the keel to 50 mm at the sides. The bulkheads serve as load-carrying members and are spaced to meet the watertight subdivision requirements. They also carry the GRP cradles for the main engines (which are constructed of amagnetic materials) and major items of equipment. In design terms this provides a very elegant solution.

All ships are capable of carrying and operating mechanical, magnetic and acoustic sweeps. They also carry full facilities for combat divers, including two-man compression chambers, boats and a telescopic launching crane.

The design incorporates a passive roll-damping system, but the tanks can be used for extra fuel for long transits, increasing range to 4,000 n miles at 12 knots.

There are only a small number of MCMV designs currently available and each order over the past 20 years has been keenly contested. As is shown in the table below, however, the Lerici/Gaeta design has been successful in a large number of those competitions, and there will be 38 in service with six navies by 2000.

It was announced in October 1996 that the Royal Thai Navy has ordered two modified 'Gaeta' class MCMVs which will differ from both the Italian 'Gaeta' class and the Australian 'Huon' class. The Thai ships will have STN Atlas DSQS-11M minehunting sonar and the same company's MWS-80 control system; they will also have the Australian ADI Dyad influence sweep. The Thai ships will be built in Italy.

Navy	Type	Class name	Ordered	Built	Entered service
Italy	Lerici Gaeta	Lerici Gaeta	4 — 1978 6 — 1988 2 — 1991	Italy Italy	1985 1992-96
Australia	Gaeta	Huon	6 — 1994	Australia	1998-2002
Malaysia	Lerici	Mahamiru	4 — 1981	Italy	1985
Nigeria	Lerici	Ohue	1 — 1983 1 — 1986	Italy	1987-88
Thailand	Gaeta	(not known)	2 — 1996	Italy	1998/1999
USA	Osprey	Osprey	12 — 1986	USA	1993-98
Total			38		

LERICI

GENERAL SPECIFICATIONS

Operator: Italy
Type: Minehunter/sweeper

Class: LERICI

Built: 4
Active: 4

Displacement:
full load: 620 t

Dimensions
Length: 50 m (164 ft)
Beam: 9.9 m (32.5 ft)
Draught: 2.6 m (8.6 ft)

Speed: 14 kts (6 kts hunting)
Range: 1,500 n miles at 14 kts
Endurance: 12 days

Complement: 47 (4 officers) including 7 divers

SHIPS

LERICI (M 5550)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 3 Sep 1982
Commissioned 22 Mar 1985

SAPRI (M 5551)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 5 Apr 1984
Commissioned 4 Jun 1985

MILAZZO (M 5552)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 4 Jan 1985
Commissioned 6 Aug 1985

VIESTE (M 5553)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 18 Apr 1985
Commissioned 2 Dec 1985

MINE COUNTERMEASURES SYSTEMS

COMBAT DIVERS

Normal complement is seven combat divers.

COMBAT DATA SYSTEMS

Integrated Minehunting Combat System (IMICS)

IMICS was designed and developed specifically for the 'Lerici' class and integrates the various command and data systems aboard, including:

- Datamat SMA SSN-714(V)2 Minehunting Action Information System (MACTIS).
- SPN-728(V)3 navigation radar
- SSN-715 navigation and tracking system
- SSQ-14(IT) sonar
- MRS III/GPS Eagle precision (GPS) navigation system

There are two IMICS displays: one is in the action information centre, the second on the bridge.

MIN 77 ROV

The MIN 77 (MIN = Mine Identification and Neutralisation) remotely operated vehicle (ROV) was developed specifically for the 'Lerici' class MCMVs to provide the capability to identify and neutralise both bottom and moored mines. It is a torpedo-shaped device, propelled by a single, steerable, battery-driven propeller.

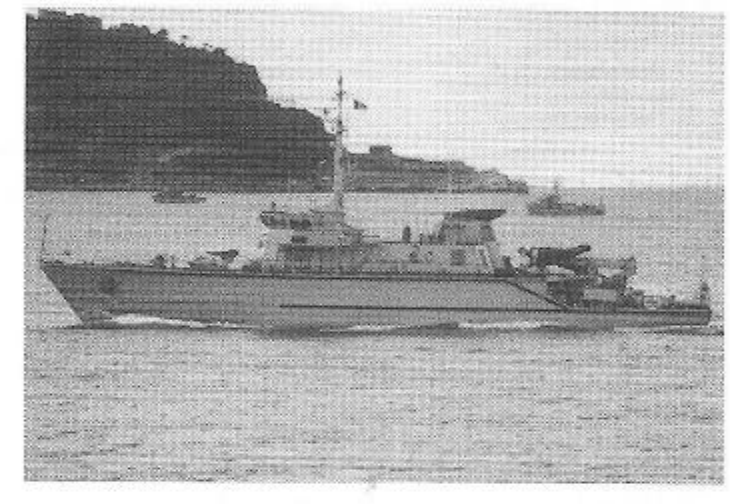
MIN 77 is equipped with a low-light TV camera or a sonar, both of which can be panned through 120° in the vertical plane allowing flexibility of observation during both bottom and moored minehunting. The vehicle's maximum operational depth is 200 m (656 ft). It is battery powered and the batteries can be recharged in approximately 15 minutes. The system can use two types of weapons (bottom charge and explosive cutter) thus enabling the hunting of either bottom or moored mines.

Specifications
Diameter: 105 mm (4.1 in)
Length: 3.5 m (11.5 ft)
Weight: 1,300 kg (2,866 lb)
Max diving depth: 200 m (656 ft)
Max operational range: 400 m (440 yd)
Speed: 6 kts
Endurance: <40 min at 3 kts

Manufacturer/Contractor
Consorzio SMIN, Rome, Italy.

Oropesa 0 Size 4

The wire sweeping system is the Oropesa 0 Size 4, which has 300 fathoms of streamed wire and a swept path of approximately 400 m (1,312 ft). It is operated at a speed of advance of 8 kts.



Milazzo *(M 5552) of the original 'Lerici' class* (H & L van Ginderen Collection)

MINEHUNTING SONAR

SQQ-14(IT)

SQQ-14(IT) is a variable depth sonar system which is lowered from the keel forward of the bridge. The SQQ-14(IT) is a redesigned version of the General Electric AN/SQQ-14 minehunting sonar, with completely new electronics for both the dry and wet ends, and, in fact, only the mechanical elements of the old hoist system remain. New functions such as a real-time performance monitor, speed scan, memory display and remote display have been included, as well as BITE functions which provide self-diagnosis and the location of malfunctions down to the printed circuit cards.

The transmitter unit is now inside the towed body resulting in an increase in operational performance, as well as a redundancy of the principal functions, that is, console interchangeability and the possibility of operating with reduced efficiency in the case of malfunction in one or more of the transmitter sections. The adoption of the latest consoles for search and classification operations has greatly improved the man/machine interface, and simplified the use of the system and the training of operators. Recording and mission playback facilities are available, as well as training and simulation programmes.

Manufacturer/Contractor
FIAR, Italy

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm/70

One Oerlikon 20 mm/70 is on a single mount on the foredeck.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°

COMMAND AND CONTROL SYSTEMS

RADAR

SMA SPN-728(V)3

SPN-728(V)3 is an I-band navigation radar.

PROPULSION

Specifications
System: Diesel
Main machinery:
Passage: 1 Fincantieri GMT BL 230.8 M diesel, 1.46 MW (1,985 hp(m)) sustained

Minehunting: 3 Isotta-Fraschini ID 36 SS 6V diesels 1.1 MW (1,481 hp(m)) sustained
Shafts: 1
Propellers:
Passage: 1 cp

Minehunting: 3 hydraulic, drop-down, 360° rotating thrust propellers; 372 kW (506 hp(m)) (one forward, 2 aft)

FURTHER INFORMATION

PROGRAMME

These four MCMVs were ordered on 7 January 1978 under the Legge Navale. It was originally planned to order six more, but this was first postponed and then revived, but for a modified design designated the 'Gaeta' class.

MAHAMIRU (LERICI)

GENERAL SPECIFICATIONS

Country of origin: Italy
Operator: Malaysia
Type: Minehunter/sweeper

Class: MAHAMIRU

Purchased: 4
Active: 4

Displacement:
full load: 660 t

Dimensions
Length: 51 m (167.3 ft)
Beam: 9.9 m (32.5 ft)
Draught: 2.8 m (9.2 ft)

Speed: 16 kts; 7 kts thruster
Range: 2,000 n miles at 12 kts
Endurance: 14 days.

Complement: 42 (5 officers)

SHIPS

MAHAMIRU (11)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 23 Feb 1984
Commissioned 11 Dec 1985

JERAI (12)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 5 Jan 1984
Commissioned 11 Dec 1985

LEDANG (13)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 14 Jul 1983
Commissioned 11 Dec 1985

KINABALU (14)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 19 Mar 1983
Commissioned 11 Dec 1985

MINE COUNTERMEASURES SYSTEMS

MINEHUNTING

Thomson-CSF Ibis V
IBIS V is a lightweight MCM combat information system, which includes other Thomson-CSF products such as the TSM 2022 single array sonar, TSM 2026 NAVIPLOT, TSM 5721 Doppler bottom log and TSM 2060 four-colour tactical display. IBIS V weighs 1.5 tonnes.

Manufacturer/Contractor
Thomson-CSF, France.

MINEHUNTING SONAR

Thomson-CSF TSM 2022
The TSM 2022 sonar array has a span of about 1.5 m (4.9 ft) and pivots to retract vertically into the sonar well, which is only 75 cm (29.5 in) in diameter. The 2022 performs detection and classification sequentially and requires only a single operator. TSM 2022 can detect moored and bottom mines at ranges of up to 600 m (1,968 ft) and can classify them at 250 m (820 ft).

COMBAT DIVERS

There are five combat divers who are equipped with the Draeger Duocom decompression chamber.

PAP-104 ROV
The Malaysian MCMVs each carry two PAP-104 ROVs. The PAP 104 has the capability simultaneously to hunt and destroy ground mines and tethered mines by either placement and remote detonation of a charge or by cutting the mooring rope of tethered mines. The vehicle is wire-guided and remote-controlled from a control console situated in the operation room. It is horizontally propelled by means of two side thrusters. Using a 'guide rope' deployed from a winch in the underside of the ROV, it can be maintained at a constant altitude within the vicinity of the seabed.

The ROV can carry the 126 kg (278 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution near-field sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera.

Vertical thrusters are used which allow mid-water navigation. A new payload can be fitted in place of the charge, consisting of a manipulator with associated camera and projector.

Specifications
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.3 ft)
Total weight: 850 kg (1,874 lb) (including 100 kg (220 lb) charge)
Operating range: 2,000 m (6,561 ft) max (at depths of 300 m (984 ft))
Speed: 6 kts max

Manufacturer/Contractor
Société ECA, France.

MINESWEEPING

Oropesa 0 Size 4
The wire sweeping system is the Oropesa 0 Size 4, which has 300 fathoms of streamed wire and a swept path of approximately 400 m (1,312 ft). It is operated at a speed of advance of 8 kts.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/70-315
There is one single 40 mm/70-315 per ship, mounted on the forecastle. The SAK 40L/70-315 is a manually laid mounting in which the gun platform is on a pedestal. The total height to the centre of the barrel from the deck when the gun is horizontal is 1.36 m (4.5 ft). The mounting weighs 2.87 t unloaded, is 1.83 m (6.0 ft) long and has a training radius of 3.31 m (10.8 ft). The mounting has a protective shield and includes ammunition racks for 96 rounds.

Specifications
Traverse: Nominal 360° at 30°/s
Elevation: −10 to +90° at 24°/s
Crew: 4
Weight (unloaded): 1.7 t

Manufacturer/Contractor
Bofors Weapon Systems, Sweden.

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca 1226

Specifications
Role: Navigation

Band: I
Range: 48 n miles (81 km)
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB

Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm

Manufacturer/Contractor
Racal-Decca.

PROPULSION

Specifications
System: Diesel
Main machinery:
Passage: 2 MTU 12V 396 TC82 diesels, 1.91 MW (2,605 hp(m)) sustained

Minehunting: 3 Fincantieri Isotta-Fraschini ID 36 SS 6V diesels; 1.09 MW (1,481 hp(m)) sustained
Shaft: 1
Propellers:
Passage: 1 KaMeWa cp

Minehunting: 2 Riva-Calzoni hydraulic thrust jets 372 kW (506 hp(m)) (one forward, one aft)

FURTHER INFORMATION

These four ships were ordered on 20 February 1981 and all arrived in Malaysia on 26 March 1986. They are 1 m (3.3 ft) longer than the Italian 'Lerici' class ships.

There were plans at one stage to purchase another two 'Lerici' class ships, but it has been decided to shelve this proposal and to buy a completely new design in due course. There are, however, plans to upgrade the tactical data system in the existing four ships.

Jerai *(12) of the Royal Malaysian Navy* (H & L van Ginderen Collection)

Kinabalu *(14). The Malaysian ships are 1 m (3.3 ft) longer than the original Italian 'Lerci' class* (H & L van Ginderen Collection)

OHUE (LERICI)

GENERAL SPECIFICATIONS

Country of origin: Italy
Operator: Nigeria
Type: Minehunter/sweeper

Class: LERICI

Active: 2

Displacement:
full load: 660 t

Dimensions
Length: 51 m (167.3 ft)
Beam: 9.9 m (32.5 ft)
Draught: 2.8 m (9.2 ft)

Speed: 15.5 kts
Range: 2,500 n miles at 12 kts

Complement: 50 (5 officers)

SHIPS

OHUE (M 371)

Builder	Intermarine, Sarzana, La Spezia, Italy
Laid down	23 Jul 1984
Launched	22 Nov 1985
Commissioned	28 May 1987

MARABAI (M 372)

Builder	Intermarine, Sarzana, La Spezia, Italy
Laid down	11 Mar 1985
Launched	6 Jun 1986
Commissioned	25 Feb 1988

MINE COUNTERMEASURES SYSTEMS

MINEHUNTING

Thomson-CSF Ibis V
IBIS V is a lightweight MCM combat information system, which includes other Thomson-CSF products such as the TSM 2022 single array sonar, TSM 2026 NAVIPLOT, TSM 5721 Doppler bottom log and TSM 2060 four-colour tactical display. IBIS V weighs 1.5 tonnes.

Manufacturer/Contractor
Thomson-CSF, France.

Thomson-CSF TSM 2022
The TSM 2022 sonar array has a span of about 1.5 m (4.9 ft) and pivots to retract vertically into the sonar well, which is only 75 cm (29.5 in) in diameter. The 2022 performs detection and classification sequentially and requires only a single operator. TSM 2022 can detect moored and bottom mines at ranges of up to 600 m (1,968 ft) and can classify them at 250 m (820 ft).

COMBAT DIVERS

There are six or seven combat divers. The ship carries a Galeazzi two-man decompression chamber.

Gaymarine Pluto ROV

There are two ROVs per vessel. Pluto is available in three configurations: battery-powered with a 6 mm, 500 m (1,640 ft) long umbilical cable; battery-powered with a 3 mm, 2,000 m (6,561 ft) long fibre optic umbilical cable; or remote-powered of unlimited endurance with 8 mm, 500 m (1,640 ft) long umbilical cable. The vehicle is powered by five thrusters: two horizontal for forward/reverse, two vertical for vertical and lateral shift, and a transversal thruster. The thrusters are controlled by two joysticks. The vehicle can maintain automatic depth control within ±10 cm (4.0 in). Forward maximum speed is 4 knots and vertical speed 1 knot. Sensors are mounted in the forward tiltable section of the vehicle.

Specifications

Length: 1,680 mm (66 in)
Width: 600 mm (23.6 in)
Height: 630 mm (24.8 in)
Weight: 160 kg (253 lb)
Service depth: 400 m (1,312 ft)
Payload: 15 kg (33.0 lb)

Manufacturer/Contractor

Gaymarine, Italy.

MINESWEEPING

Oropesa 0 Size 4

The wire sweeping system is the Oropesa 0 Size 4, which has 300 fathoms of streamed wire and a swept path of approximately 400 m (1,312 ft). It is operated at a speed of advance of 8 kts.

WEAPONS SYSTEMS

GUNS

ESCO 30 twin 30 mm mounting

The Emerlec 30 is a twin 30 mm weapon designed for air defence, surface engagement and anti-missile operations, using either local or remote control. Ship's power supplies are used normally but there is an on-mount battery which will provide sufficient power to operate the guns and fire a full complement of ammunition in an emergency. Traditional hand-crank mechanisms provide further back-up. There is an enclosed, environmentally controlled cabin for the operator and an integral below-deck magazine.

The Emerlec 30 employs the Oerlikon KCB positively locked, gas-operated cannon and the gunner sits in a cabin for local control operation using a daylight reflex, or an image-intensifier, sight, together with gyro-assisted line of sight stabilisation. The cabin is located between the barrels and forward of the elevating mass. Behind it, in a sealed compartment are the elevating and training drives together with flexible chutes to channel ammunition to the feeding mechanisms.

Ready ammunition is stored in an integral, below-deck, drum magazine with a capacity of 985 rounds for each barrel in a continuous disintegrating-link belt. These are transferred to the guns through separate chutes by means of electrically operated drives which automatically respond to the individual demand for ammunition supply.

Specifications

Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Traverse: 360° at 80°/s
Elevation: −15 to +80° at 80°/s
Crew: 1
Range: 3.25 n miles (6 km) (anti-surface) (max)
Rate of fire: 600 rds/min/barrel (nominal) or 140 rds/min/barrel (nominal)
Ammunition: 870 g (HEI/HEI-T, SAPHEI, TP/TP-T)

Manufacturer/Contractor

Electronics & Space Corporation (ESCO), St Louis, Missouri, USA.

20mm GAM-BO1

The GAM mounting is an unpowered light, compact design for use in a wide variety of vessels, but especially those involved in patrol operations. It is of the swivel fork type with the sidewalls having the trunnion bearings. The cradle is made of light alloy and the weapon's working parts are enclosed in a protective case whose top opens to ease maintenance and installation. The sight, shoulder rests and back support strap are all attached to the sight bracket which is adjustable for height. Usually these mountings have the RC35 optical ring sight but they can be fitted with the SLC 001 lightweight lead computing sight. The GAM-BO1 mounting is 3.32 m (10.9 ft) long and is adjustable in height from 1.5 to 1.7 m (4.9 to 5.5 ft). The ammunition box with 200 rounds is attached to the front of the mounting and the belt is fed from the right side of the gun. Spent cartridge cases are ejected between the sidewalls of the cradle into a separate compartment while the links are collected in a bag on the other side of the mounting. The GAM-BO1 has the KAA gun.

Specifications

Gun (KAA)
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 650 rds/min
Ammunition: 870 g

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca 1226

Specifications

Role: Navigation
Band: I
Range: 48 n miles (81 km)
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
Scan rate: 28 rpm

Manufacturer/Contractor

Racal-Decca.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 MTU 12V 396 TB83 diesels; 2.3 MW (3,120 hp(m)) sustained
Shafts: 1
Propellers:
Passage: one cp
Minehunting: 2 Turbomeccanica PG-2000 water-jets

FURTHER INFORMATION

Ohue was ordered in April 1983 and *Marabai* in January 1986. They have GRP hulls but, unlike the Italian and Malaysian 'Lerici' class ships, they do not have separate hydraulic minehunting propulsion and are fitted with water-jets, instead.

Like many other ships in the Nigerian Navy, these two MCMVs were both non-operational in 1996 but are assessed to be repairable.

GAETA

GENERAL SPECIFICATIONS

Operator: Italy
Type: Minehunter/sweeper

Class: GAETA

Built: 8
Active: 8

Displacement:
full load: 697 t

Dimensions
Length: 52.5 m (172.1 ft)
Beam: 9.9 m (32.5 ft)
Draught: 2.6 m (8.6 ft)

Speed: 14 kts (6 kts hunting)
Range: 1,500 n miles at 14 kts

Complement: 47 (4 officers) including 7 divers

SHIPS

GAETA (M 5554)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 28 Jul 1990
Commissioned 3 Jul 1992

TERMOLI (M 5555)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 15 Dec 1990
Commissioned 13 Nov 1992

ALGHERO (M 5556)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 11 May 1991
Commissioned 31 Mar 1993

NUMANA (M 5557)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 26 Oct 1991
Commissioned 30 Jul 1993

CROTONE (M 5558)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 11 Apr 1992
Commissioned 19 Jan 1994

VIAREGGIO (M 5559)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 3 Oct 1992
Commissioned 1 Jul 1994

CHIOGGIA (M 5560)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 9 May 1994
Commissioned Apr 1996

RIMINI (M 5561)
Builder Intermarine, Sarzana, La Spezia, Italy
Launched 17 Sep 1994
Commissioned May 1996

MINE COUNTERMEASURES SYSTEMS

Integrated Minehunting Combat System (IMICS)

IMICS was designed and developed specifically for the 'Lerici' class and integrates the various command and data systems aboard, including:

- Datamat SMA SSN-714(V)2 Minehunting Action Information System (MACTIS).
- SPN-728(V)3 navigation radar
- SSN-715 navigation and tracking system
- SSQ-14(IT) sonar
- MRS III/GPS Eagle precision (GPS) navigation system

There are two IMICS displays: one is in the action information centre, the second on the bridge.

MINESWEEPING

Oropesa 0 Size 4

The wire sweeping system is the Oropesa 0 Size 4, which has 300 fathoms of streamed wire and a swept path of approximately 400 m (1,312 ft). It is operated at a speed of advance of 8 kts.

COMBAT DIVERS

There are seven combat divers. The ship carries a Galeazzi two-man decompression chamber.

MIN Mk 2

MIN Mk 2 is carried by the 'Gaeta' class, replacing the MIN 77 in the 'Lerici' class. The MIN (Mine Identification and Neutralisation) system was developed to provide the capability to identify and neutralise both bottom and moored mines, and the latest version, the Mk 2, comprises a wire-guided underwater vehicle, an operations room console, tracking system, auxiliary console, and set of operational accessories. The ROV is equipped with a TV camera and sonar which can be panned through 150° in the vertical plane allowing flexibility of observation during both bottom and moored minehunting. The vehicle's operational depth has been increased to over 300 m (984 ft).

The system can use two types of weapons (bottom charge and explosive cutter) thus enabling the hunting of either bottom or moored mines. The MIN Mk 2 and its control console are integrated into the MCMV combat system via serial datalinks with the command centre, parent vessel's search/classification sonar and parent vessel's gyrocompass.

Specifications
Weight: 1,150 kg (2,535 lb)
Max diving depth: 350 m (1,148 ft)
Speed: 6 kts
Endurance: <1 h

Manufacturer/Contractor
Consorzio SMIN, Rome, Italy.

MINEHUNTING SONAR

SQQ-14(IT)

SQQ-14 (IT) is a variable depth sonar system which is lowered from the keel forward of the bridge. The SQQ-14(IT) is a redesigned version of the General Electric AN/SQQ-14 minehunting sonar, with completely new electronics for both the dry and wet ends, and, in fact, only the mechanical elements of the old hoist system remain. New functions such as a real-time performance monitor, speed scan, memory display and remote display have been included, as well as BITE functions which provide self-diagnosis and the location of malfunctions down to the printed circuit cards.

The transmitter unit is now inside the towed body resulting in an increase in operational performance, as

Gaeta *(M 5554) nameship of the second class of this successful Italian MCMV design* (Italian Navy)

well as a redundancy of the principal functions, that is, console interchangeability and the possibility of operating with reduced efficiency in the case of malfunction in one or more of the transmitter sections. The adoption of the latest consoles for search and classification operations has greatly improved the man/machine interface, and simplified the use of the system and the training of operators. Recording and mission playback facilities are available, as well as training and simulation programmes.

Manufacturer/Contractor
FIAR, Italy

WEAPONS SYSTEMS

Oerlikon 20 mm/70
The 'Gaeta' class mounts one twin Oerlikon 20 mm/70 on the foredeck.

Specifications
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,800 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +55°

COMMAND AND CONTROL SYSTEMS

RADAR

SMA SPN-728(V)3
SPN-728(V)3 is an I-band navigation radar.

PROPULSION

Specifications
System: Diesel
Main machinery:
Passage: 1 Fincantieri GMT BL 230.8 M diesel, 1.46 MW (1,985 hp(m)) sustained
Minehunting: 3 Isotta-Fraschini ID 36 SS 6V diesels 1.1 MW (1,481 hp(m)) sustained
Shafts: 1
Propellers:
Passage: 1 cp
Minehunting: 3 hydraulic 360° rotating thrust props; 372 kW (506 hp(m)) (one forward, 2 aft)

FURTHER INFORMATION

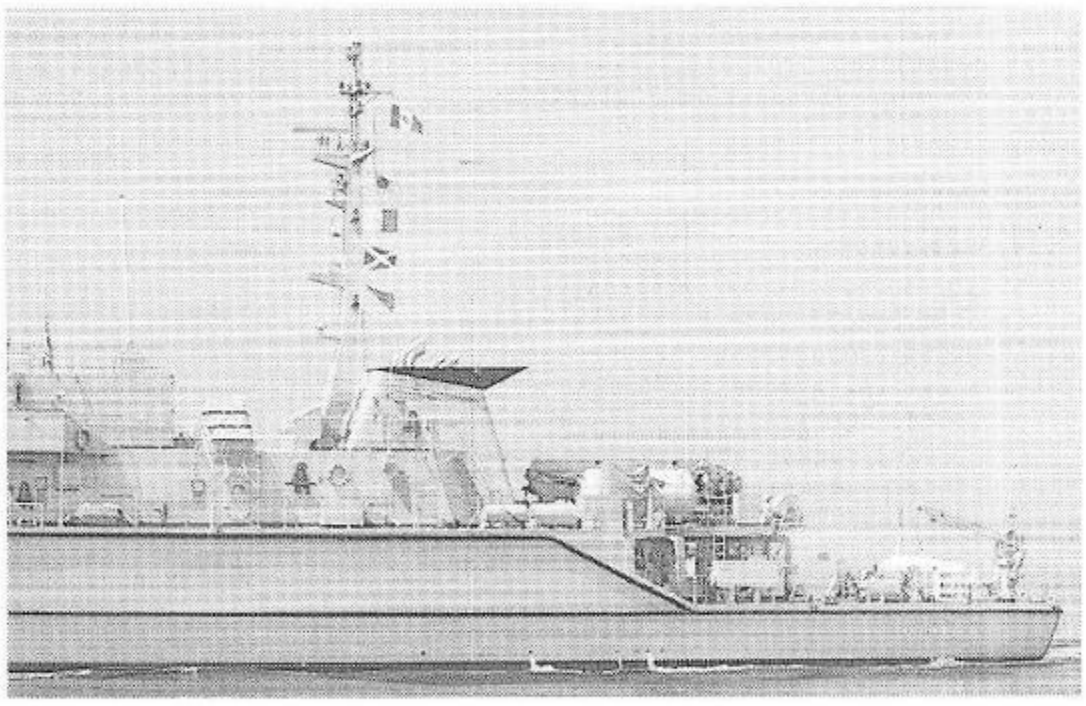
PROGRAMME

The 'Gaeta' class is the follow-on MCMV for the Italian Navy and is 2 m (6.5 ft) longer than its predecessor, with a number of equipment improvements. The first six were ordered from Intermarine on 30 April 1988. This was followed by an order for two more, which was placed in 1991, then cancelled due to budget cuts, but then reordered on 17 September 1992. The Italian Navy is reported to be interested in ordering a further six to an improved design.

DESIGN

Improvements incorporated in the 'Gaeta' class include a better minehunting sonar system (which was backfitted to the 'Lerici' class in 1991), a third hydraulic system, improved electrical generators, an ROV with better endurance and equipment, a new type of recompression chamber, and a reduced magnetic signature.

All machinery is mounted on vibration dampers and the main engines are made of amagnetic material. The ships are fitted with Galeazzi two-man compression chambers and a telescopic crane for launching Callegari frogmen boats.



Alghero *(M 5556) showing the sweep deck in detail. Note the inflatable dinghies and the diver decompression chamber abaft the stack, and the Oropesa float and kite on the sweep deck* (Italian Navy)

Alghero *(M 5556)* (Jane's/H M Steele)

HUON (GAETA)

GENERAL SPECIFICATIONS

Country of origin: Italy
Operator: Australia
Type: Coastal minehunter

Class: HUON

Active: 0
Building: 6

Displacement:
full load: 720 t

Dimensions
Length: 52.5 m (172.2 ft)
Beam: 9.9 m (32.5 ft)
Draught: 3.0 m (9.8 ft)

Speed: 14 kts passage; 6 kts minehunting
Range: 1,600 n miles at 12 kts

Complement: 36 (6 officers) plus 13 spare

SHIPS

HUON (82)
Builder Intermarine, Sarzana, La Spezia, Italy/Australian Defence Industries, Newcastle, New South Wales, Australia
Commissioned 1998

HAWKESBURY (83)
Builder Australian Defence Industries, Newcastle, New South Wales, Australia
Commissioned 1999

NORMAN (84)
Builder Australian Defence Industries, Newcastle, New South Wales, Australia
Commissioned 2000

GASCOYNE (85)
Builder Australian Defence Industries, Newcastle, New South Wales, Australia
Commissioned 2001

DIAMANTINA (86)
Builder Australian Defence Industries, Newcastle, New South Wales, Australia
Commissioned 2001

YARRA (87)
Builder Australian Defence Industries, Newcastle, New South Wales, Australia
Commissioned 2002

MINE COUNTERMEASURES SYSTEMS

MINEHUNTING

Bofors SUTEC Double Eagle Mk 2

Two Double Eagle mine disposal vehicles with DAMDIC charges. Double Eagle is a comparatively low-weight system fitted with high-speed thrusters for use in currents up to at least 3 knots. The vehicle is driven by eight thrusters, which, in various combinations, enable the vehicle to be propelled at 5 knots forward, 3 knots astern, 3 knots laterally and 1 knot vertically. Double Eagle is fitted with a computerised stabilisation control system and is extremely manoeuvrable, exhibiting unlimited movement in six degrees of freedom (pitch ±180°, roll ±180°).

The operations room display comprises two monitors with control keyboard. One monitor displays the picture from a colour TV camera, the other the picture from a monochrome TV camera mounted at the tip of a telescopic arm. Digital data such as heading, depth, pitch and roll angle, cable twist, leakage warnings, real-time clock with date and time and diagnostics are superimposed on the TV monitor. High-quality video is available using fibre optic link in the umbilical cable. The standard umbilical is 600 m (1,968 ft) long, but as an option a 1,000 m (3,281 ft) cable can be attached. The vehicle is fitted with one colour CCD camera as standard, and tilt arrangement with colour and SIT camera is available as an optional extra. Optional sensors include echo-sounder, and electronic scanning or conventional sonar.

The vehicle uses a unique precision charge placement technique using a small mine disposal charge which also features several advantages. The vehicle can also carry a heavy standard NATO mine disposal charge as well as cable cutters.

Specifications
Length: 1.90 m (6.2 ft)
Width: 1.30 m (4.2 ft)
Height: 0.80 m (2.6 ft)
Weight: 400 kg (881 lb)
Payload: 80 kg (176 lb)
Speed: 5 kts
Max operating depth: 500 m (1,640 ft)

Manufacturer/Contractor
Bofors Underwater Systems, Sweden.

MINESWEEPING

Double Oropesa sweep

The double Oropesa sweep has been developed in Australia and incorporates lessons learned from modern fishing technology. It is designed to cut the cables on moored mines, releasing the mines to float to the surface, where they can be located and destroyed. A double Oropesa sweep consists of two sweep wires, which are towed astern of the MCMV, which are kept in the required positions by Oropesa floats, lightweight otters and a new type of kite designed for easy handling. Explosive cutters are attached to the sweep wires at intervals.

Manufacturer/Contractor
ADI, Australia.

ADI Mini-Dyad

The 'Huon' class will tow the mini-Dyad influence sweep, an emulation sweep developed in Australia. This is a modular, distributed dipolar system, based on combinations of positive buoyant permanent magnets (Dyads) and water-driven acoustic generators. The latter produce a ship-like acoustic signature in the low, audible and HF ranges. The mini-Dyads are designed to emulate degaussed and undegaussed ships of various sizes up to approximately 100,000 t dwt.

MINESWEEPING SONAR

GEC-Marconi Type 2093 VDS

Sonar Type 2093 variable depth sonar (VDS) will detect, localise and classify all current and future mine threats. The variable depth, dual-frequency search and dual-frequency classification capability provides a sonar able to operate under all bottom and sea conditions at a range claimed to be twice that of hull-mounted sonar and with an increase of three times detection depth.

The towed body ('fish') is cylindrical with hemispherical ends and contains sonar arrays comprising two 360° rings for LF and VLF operation, hydrophones for HF and VHF reception, and separate HF and VHF projectors. Underneath the 'fish' there is a cylindrical VLF projector and a VLF depth sounder. LF and VLF are used for search, survey and moored mine classification, while HF and VHF are used for classification and survey.

Sonar 2093 employs multiple operating modes which offer the MCM commander the choice of a number of operational configurations to match the prevailing threat and environment. These multiple operating modes comprise VLF and LF search and moored mine classification, VLF and LF search, search and ground mine classification, also search and route survey. Sonar 2093 can combine these modes to enable concurrent operation.

Manufacturer/Contractor
GEC-Marconi, UK.

WEAPONS SYSTEMS

GUNS

Oerlikon 30 mm in DS30B mounting

Single 30 mm mounting fitted forward of bridge. The DS30B uses the Astra/Oerlikon KCB.

Specifications
Gun (KCB)
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 650 rds/min
Ammunition: 870 g
Traverse: 230° at 55°/s
Elevation: −25 to +70° at 55°/s
Crew: 1
Mounting weight (loaded): 1,463 kg (3,225 lb)
Power requirement: 440/415/380 V, 50-60 Hz, three phase (4 kVA)

Manufacturer/Contractor
MSI Defence Systems, UK.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

AWADI Prism ESM receiver

Prism is a radar warning receiver operating in the frequency range 2 to 18 GHz. The four-port monopulse antenna array contains the RF processing, video processing and pulse processing functions and has high receiver sensitivity to allow long-range detection of radar emitters. The processor uses amplitude comparison coupled into a distributed transputer network to provide passive detection, direction-finding and classification of pulsed radar systems. The console unit, normally located on the ship's bridge, houses the emitter processing, display processing, system control functions and operator interface. Automatic emitter classification is by matching with library data and can be programmed to trigger audio and visual threat alarms.

Specifications
Antenna: 4 antenna monopulse DF array
Frequency: 2-18 GHz
System sensitivity: Better than −65 dBm
DF accuracy: Better than 10° RMS
Emitter intercept probability: 70% within 4 emitter scan periods for scanning emitters; 95% within 1 s for constant illuminating emitters
Emitter library: 600 emitter modes
Alarm: Visual and audio automatic alert
Weight: Antenna 14 kg (30.8 lb); console unit 20 kg (44.0 lb)

Manufacturer/Contractor
AWA Defence Industries Pty Limited, Adelaide, South Australia, Australia.

ELECTRONIC COUNTERMEASURES (ECM)

ML Aviation Superbarricade countermeasures system

There will be two Superbarricade launchers. Super-

barricade is an improved version of the widely used Barricade system and provides ships with means of deploying chaff and infra-red (IR) decoys to counter missile attacks, using a layered defence against the various types of anti-ship missile. The system uses a 102 mm rocket and a redesigned launcher with four sets of triple-cell launchers. The system has a similar control unit to Barricade Mk III and the same tactical computer. The ammunition lockers each contain 24 rockets. There are four decoy modes: confusion; distraction; dump; and centroid.

Manufacturer/Contractor
ML Wallop Defence Systems, Andover, Hampshire, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

NAUTIS-M
NAUTIS-M is specifically designed for use in the mine countermeasures (MCM) role, and can be a one, two or three console system. It provides support for operational planning, ship control guidance, underwater and surface picture compilation, command and control for mine disposal, together with a real-time MCM database. The version to be installed in the 'Huon' class is a three-console (minehunting, operations, bridge) monochrome system similar to that purchased for the UK Royal Navy and the Royal Saudi Arabian Navy for use in their 'Sandown' minehunters and by the US Navy for the 'Avenger' class MCM ships.

WEAPONS CONTROL

Radamec 1000N
Radamec System 1000N consists of a lightweight, stabilised director with TV camera and thermal imager. It is controlled from a below-decks console with a display screen, function buttons and switches, a joystick and a touch-sensitive panel.

Manufacturer/Contractor
Radamec, UK.

RADAR

Kelvin Hughes Type 1007
Navigation radar is the Kelvin Hughes Type 1007.

Specifications
Type 1007
Role: Navigation
Frequency: H/I-band (9,410 MHz)
Beam: 1.0 × 18°/0.75 × 18°
Peak power: 25 kW
Pulsewidth: 0.08/0.3/0.8 µs
PRF: 1,600/800/400 pps
Scan rate: 26 rpm

Manufacturer/Contractor
Kelvin Hughes Ltd, Hainault, Essex, UK.

PROPULSION

Specifications
System: Diesel
Main machinery:
Passage: 1 Fincantieri GMT BL 230.8 M diesel, 1.46 MW (1,985 hp(m)) sustained

Minehunting: 3 Isotta Fraschini 1,300 diesels; 1,058 kW (1,440 hp(m))
Shafts: 1
Propellers:
Passage: 1 cp

Minehunting: 3 Riva-Calzoni hydraulic 360° rotating thrust props; 372 kW (506 hp(m)) (1 forward, 2 aft)

FURTHER INFORMATION

PROGRAMME

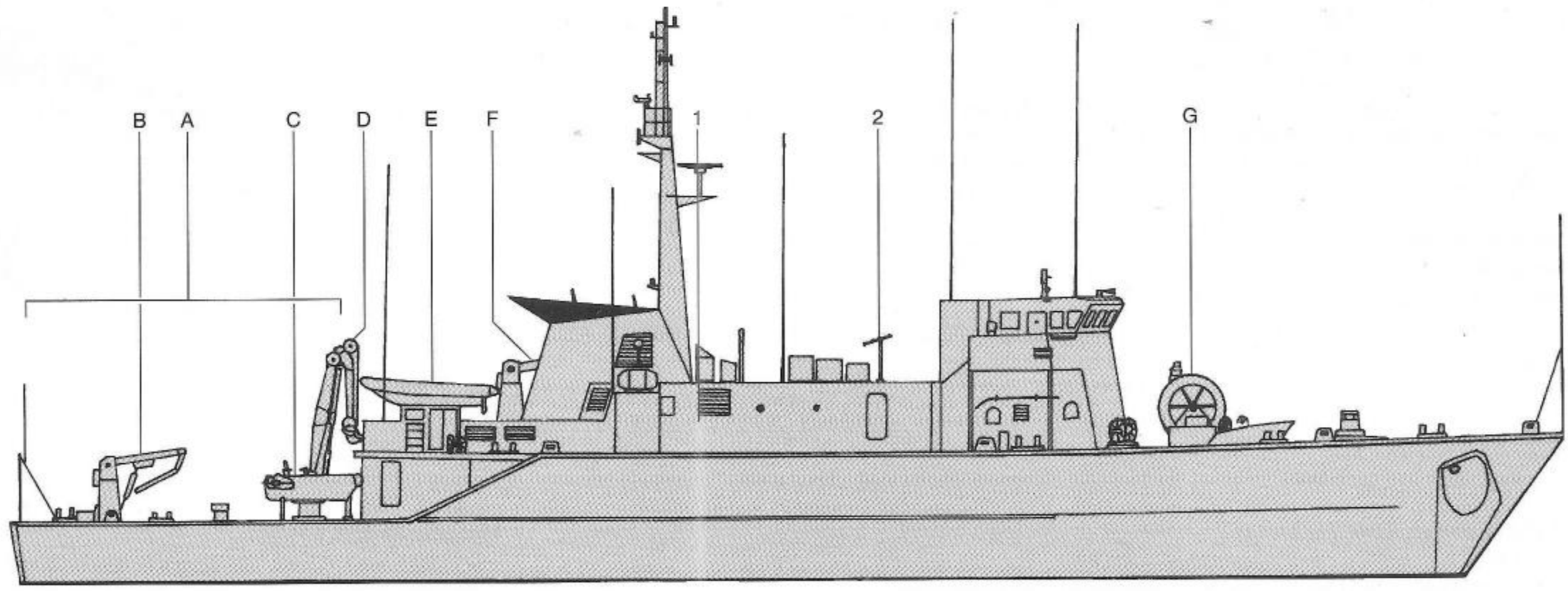
The Australian 'Force Design Review' of May 1991 recommended the acquisition of coastal minehunters of proven design. These ships would be required to operate in deeper and more exposed waters, to achieve lower transit times and remain on station longer than the two inshore minehunters ('Rushcutter' class) currently in service. After receiving bids from all the major MCMV builders, the RAN eventually awarded the contract to Australian Defence Industries (ADI) on 12 August 1994 to build six Intermarine-designed derivatives of their 'Gaeta' class ships.

The hull of the first ship was constructed at Intermarine's shipyard at Sarzana, La Spezia, Italy and arrived in Australia as deck cargo on 31 August 1995 for fitting out in Newcastle, New South Wales, Australia, where the remaining five ships are building at ADI's Throsby Basin. Local content for this project is about 70 per cent.

DEPLOYMENT

This class, which is named after Australian rivers, is to be based at HMAS Waterhen in Sydney. Sea trials for *Huon* are planned to start in April 1998.

OSPREY (MODIFIED GAETA)



Osprey class (Ian Sturton)
MCM A *Sweep deck* **B** *Sweep crane* **C** *AN/SLQ-48(V)2 ROV* **D** *Crane* **E** *RHIB* **F** *Crane* **G** *Winch for AN/SQQ-32 VDS sonar*

General 1 *Raytheon AN/SPS-64(V)9 navigation radar* **2** *12.7 mm machine-gun (two)*

GENERAL SPECIFICATIONS

Country of origin: Italy
Operator: US
Type: Minehunter/sweeper

Class: OSPREY

Active: 9
Building: 3

Displacement:
full load: 918 t

Dimensions
Length: 57.3 m (188 ft)
Beam: 11 m (35.9 ft)
Draught: 2.9 m (9.5 ft)

Speed: 12 kts
Range: 1,500 n miles at 10 kts

Complement: 51 (4 officers)

SHIPS

OSPREY (MHC 51)
Builder Intermarine, Savannah, Georgia, USA
Launched 23 Mar 1991
Commissioned 20 Nov 1993

HERON (MHC 52)
Builder Intermarine, Savannah, Georgia, USA
Launched 21 Mar 1992
Commissioned 6 Aug 1994

PELICAN (MHC 53)
Builder Avondale Industries, Gulfport, Mississippi, USA
Launched 2 Feb 1993
Commissioned 11 Aug 1995

ROBIN (MHC 54)
Builder Avondale Industries, Gulfport, Mississippi, USA
Launched 11 Sep 1993
Commissioned May 1996

ORIOLE (MHC 55)
Builder Intermarine, Savannah, Georgia, USA
Launched 22 May 1993
Commissioned 16 Sep 1995

KINGFISHER (MHC 56)
Builder Avondale Industries, Gulfport, Mississippi, USA
Launched 18 Jun 1994
Commissioned Aug 1996

CORMORANT (MHC 57)
Builder Avondale Industries, Gulfport, Mississippi, USA
Launched 21 Oct 1995
Commissioned Jan 1997

BLACK HAWK (MHC 58)
Builder Intermarine, Savannah, Georgia, USA
Launched 27 Aug 1994
Commissioned 27 Apr 1996

FALCON (MHC 59)
Builder Intermarine, Savannah, Georgia, USA
Launched 3 Jun 1995
Commissioned Oct 1996

CARDINAL (MHC 60)
Builder Intermarine, Savannah, Georgia, USA
Launched 9 Mar 1996
Commissioned Jul 1997

RAVEN (MHC 61)
Builder Intermarine, Savannah, Georgia, USA
Launched Sep 1996
Commissioned Apr 1998

SHRIKE (MHC 62)
Builder Intermarine, Savannah, Georgia, USA
Launched Jun 1997
Commissioned Dec 1998

MINE COUNTERMEASURES SYSTEMS

MINEHUNTING

AN/SLQ-48(V)2 mine neutralisation system (MNS)

The AN/SLQ-48(V)2 Mine Neutralisation System (MNS) is centred on the remotely operated vehicle (ROV). The system is designed to detect, locate, classify and neutralise moored and bottom mines, using high-resolution sonar, low-light level TV, cable cutters and mine destruction charges.

The ROV operates at the end of a 1,066 m (3,000 ft) umbilical, which carries power cables from the ship, together with datalinks for the control systems and sensors. The ROV is powered by two 12 hp motors and two side thrusters, giving it a forward speed of 6 knots. Onboard equipment includes a high-definition sonar, a low-light TV for examining objects, cable cutters and an explosive charge for destroying a mine. There is also a tracking transponder to enable the parent ship to track the ROV.

Initial target detection and vehicle guidance information is provided by the ship's AN/SQQ-32 variable depth minehunting sonar. Initial vehicle navigation is plotted and monitored within the MNS acoustic tracking system, with the ROV's onboard sonar being used during the mid-course search and final homing phases; its high resolution enables operations in poor visibility by sonar guidance alone. Low-light TV is used in conjunction with sonar during the precision guidance phase near the target.

Specifications

AN/SLQ-48(V)2 ROV
Length: 3.8 m (12.47 ft)
Width: 0.9 m (2.95 ft)
Height: 1.2 m (3.94 ft)
Speed: 6 kts
Vehicle weight: 1,247 kg (2,749 lb) (in air)
Propulsion: Hydraulic, twin 15 hp
Thrusters: Horizontal/vertical/lateral
Cable length: 1,066 m (3,000 ft)
Power requirements: 43 kVA

Manufacturer/Contractor

Alliant Techsystems, US.

MINESWEEPING

AN/SLQ-53

AN/SLQ-53 (also known as Single Ship Deep Sweep) is under development for use aboard the 'Osprey' class MCMVs. It will provide mechanical and modular influence sweep systems and is based on the sled system used by helicopters.

Modular Influence Minesweeping System (MIMS)

MIMS is under development for the 'Osprey' class. It is a towed sweep and the system will include its own gas-turbine sweep-current generator.

MINEHUNTING SONAR

AN/SQQ-32

AN/SQQ-32 consists of two separate sonars: a search sonar for initial detection; and a high-frequency, high-resolution sonar for target classification. The detection sonar, designed and manufactured by Raytheon, detects mines and mine-like objects over a wide range of distances and bottom conditions, and the system incorporates a computer-aided detection facility to enable the sonar operator to discard the latter. Raytheon also provides the computer facilities and display consoles and is responsible for overall system integration.

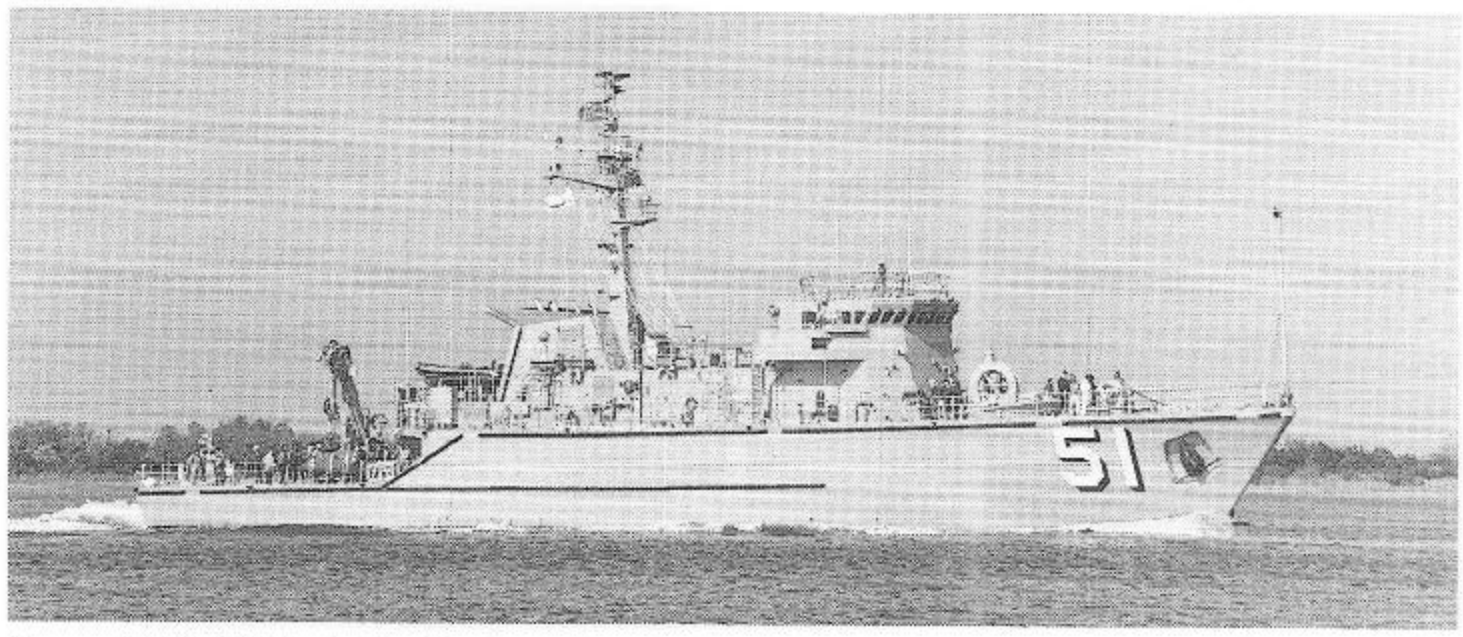
The classification sonar, designed and produced by Thomson-CSF, is based on its experience with the DUBM 21 and TSM 2022 minehunting sonars. The classification sonar provides very high-resolution transmission and reception of underwater signals to enable targets to be seen with near-picture quality.

AN/SQQ-32 has two identical operator consoles with high-resolution displays. Search and classification data can be displayed simultaneously or independently. Automated detection and control functions are performed by two AN/UYK-44 computers.

The sonars are mounted in a cylindrical towed body which is housed in a well under the forward part of the ship. The sensors can, however, also be operated from the housed position when in shallow water. Search frequency is 35 kHz and classification frequency 445-650 kHz.

Manufacturers/Contractors

Raytheon, Portsmouth, Rhode Island, USA (prime).
Thomson-CSF, Sophia Antipolis Cedex, France (sonar).



Osprey *(MHC 51), lead ship of a class of twelve. Note the large winch-wheel on the foredeck, which is used to lower and raise the AN/SQQ-32 minehunting sonar. The AN/SLQ-48(V)2 remotely operated vehicle can be seen below the crane on the sweep deck* (Intermarine)

WEAPONS SYSTEMS

GUNS

M2HB 12.7 mm machine guns

Two M2HB are carried. This is a selective short recoil automatic operation weapon with a 1,143 mm (45 in) long barrel.

Specifications
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Paramax AN/SYQ-13

The AN/SYQ-13 Navigational Command and Control System was developed specifically for the 'Osprey' class and is designed to integrate the major onboard systems, including:

- AN/SQQ-32 variable depth minehunting sonar
- AN/SLQ-48(V)2 Mine Neutralisation System (MNS)
- AN/SPS-64(V)9 surface search sonar
- precision navigation system
- environmental sensors
- AN/SSQ-109 machinery control system

It consists primarily of software packages hosted on the onboard computers.

RADAR

Raytheon AN/SPS-64(V)9

Specifications
Role: Navigation
Frequency: I-band
Beam: 1.9 × 22°
Peak power: 20 kW
Gain: 28 dB
Pulsewidth: 0.06/0.5/1.0 µs
PRF: 3,600/1,800/900 pps
Scan rate: 33 rpm

Manufacturer/Contractor
Raytheon, Portsmouth, Rhode Island, USA.

PROPULSION

Specifications
System: Diesel
Main machinery:
Passage: 2 Isotta-Fraschini ID 36 SS 8V-AM diesels; 1.18 MW (1,600 hp(m)) sustained
Minehunting: 3 Isotta-Fraschini ID 36 diesel generators, 984 kW

Auxiliary propulsion systems: 2 hydraulic motors, 265 kW (360 hp(m)), 1 bow thruster, (132 kW) (180 hp(m))
Propellers: 2 Voith-Schneider propellers

FURTHER INFORMATION

PROGRAMME

The original US Navy MCMV project (the 'Cardinal' class) was based on a surface-effect ship (SES) but this was cancelled in 1986 when the design failed shock testing. A design contract for 'Lerici' class minehunters was then awarded in August 1986 followed by a construction contract in May 1987 for the lead ship of the class. The Italian company, Intermarine SpA, then established Intermarine USA and purchased the Sayler Marine Corporation in Savannah, Georgia. On 2 October 1989 Avondale, Gulfport was mandated by the US Congress as the second construction source.

The programme has suffered repeated delays, which were due in part to the engine modifications.

DESIGN

The design and method of construction is similar to the Italian Navy's 'Gaeta' class, but the hull is somewhat larger as shown in the summary:

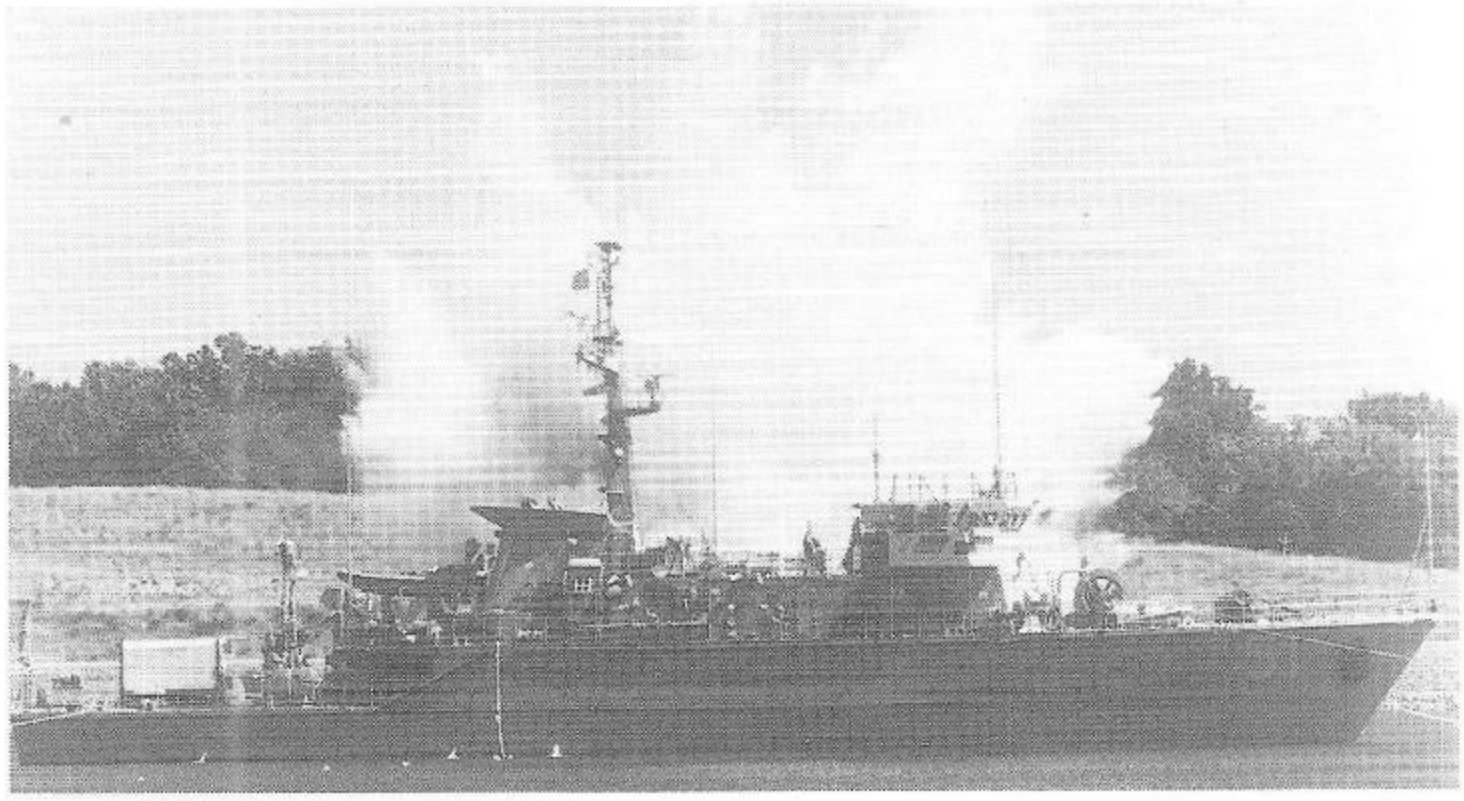
	Osprey	Gaeta
Displacement:		
full load	918 t	697 t
Dimensions:		
Length	57.3 m (188 ft)	52.5 m (172.1 ft)
Beam	11 m (35.9 ft)	9.9 m (32.5 ft)
Draught	2.9 m (9.5 ft)	2.6 m (8.6 ft)
Speed	12 kts	14 kts (6 kts hunting)
Range	1,500 n miles at 10 kts	1,500 n miles at 14 kts

At one time there was a plan to produce a lengthened version, in order to accommodate additional supplies for oceanic transits, but this has been cancelled.

The 'Osprey' class is fitted with US minehunting equipment, but a significant difference from all other versions of the Lerici/Gaeta design is that it is fitted with two Voith-Schneider cycloidal propellers.

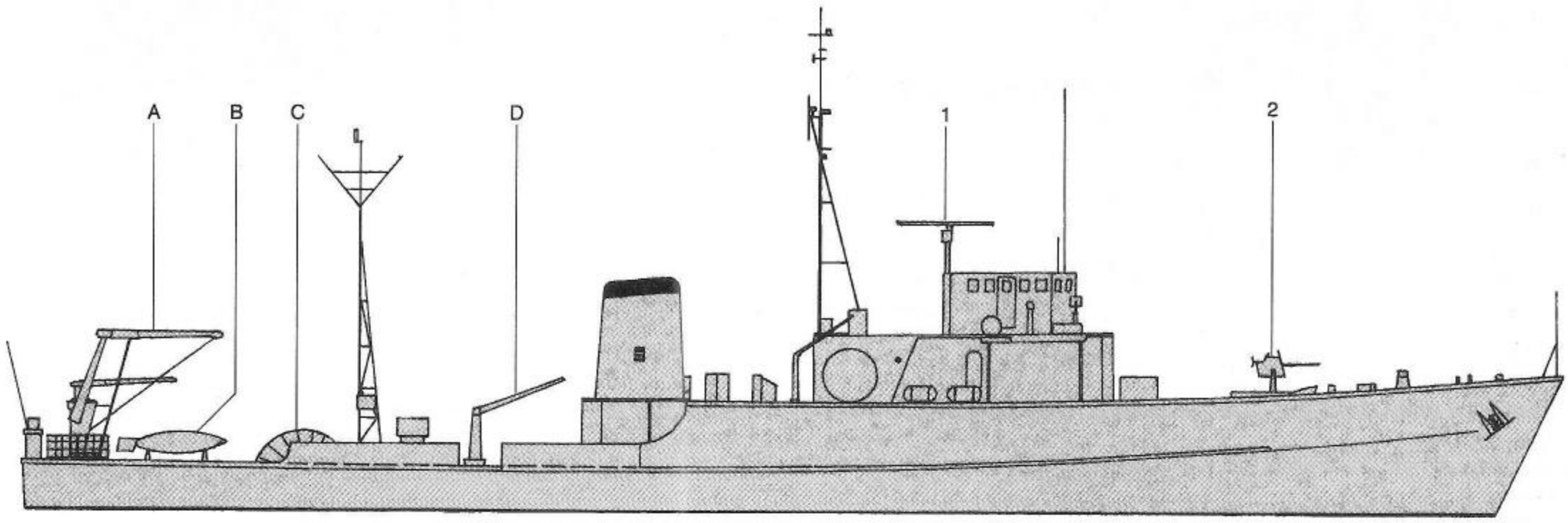
DEPLOYMENT

It is planned that one ship will be retained in the active fleet, while eleven will be transferred to the Naval Reserve Force (NRF) after a year in active service. *Heron* (MHC 52) was the first to transfer to the NRF in July 1995.



Osprey *(MHC 51) successfully undergoes a shock resistance test* (Intermarine)

HATSUSHIMA/UWAJIMA



Hatsushima (Ian Sturton)
MCM A *Crane* **B** *Floats* **C** *Main winch* **D** *Derrick*

General 1 *Fujitsu OPS-9 navigation radar* **2** *JM-61 20 mm/76 Sea Vulcan 20 gun*

GENERAL SPECIFICATIONS

Operator: Japan
Type: Coastal minehunter/sweepers

Class: HATSUSHIMA

Built: 23
Active: 20

Class: UWAJIMA

Built: 7
Active: 7
Building: 2

Displacement:
standard: 440 t (490 t MSC 670 onwards)
full load: 510 t

Dimensions
Length: 55 m (180.4 ft) (57.7 m, 189.3 ft MSC 670 onwards)

Beam: 9.4 m (30.8 ft)
Draught: 2.4 (7.9 ft)

Speed: 14 kts

Complement: 45 (40 from MSC 675 onwards)

SHIPS

HATSUSHIMA GROUP

ENOSHIMA (MSC 652)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 25 Dec 1980

UKISHIMA (MSC 653)
Builder Hitachi, Kanagawa, Japan
Commissioned 27 Nov 1980

OOSHIMA (MSC 654)
Builder Hitachi, Kanagawa, Japan
Commissioned 26 Nov 1981

NIIJIMA (MSC 655)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 26 Nov 1981

YAKUSHIMA (MSC 656)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 17 Dec 1982

NARUSHIMA (MSC 657)
Builder Hitachi, Kanagawa, Japan
Commissioned 17 Dec 1982

CHICHIJIMA (MSC 658)
Builder Hitachi, Kanagawa, Japan
Commissioned 16 Dec 1983

TORISHIMA (MSC 659)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 16 Dec 1983

HAHAJIMA (MSC 660)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 18 Dec 1984

TAKASHIMA (MSC 661)
Builder Hitachi, Kanagawa, Japan
Commissioned 18 Dec 1984

NUWAJIMA (MSC 662)
Builder Hitachi, Kanagawa, Japan
Commissioned 12 Dec 1985

ETAJIMA (MSC 663)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 12 Dec 1985

KAMISHIMA (MSC 664)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 16 Dec 1986

HIMESHIMA (MSC 665)
Builder Hitachi, Kanagawa, Japan
Commissioned 16 Dec 1986

OGISHIMA (MSC 666)
Builder Hitachi, Kanagawa, Japan
Commissioned 17 Dec 1987

MOROSHIMA (MSC 667)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 17 Dec 1987

YURISHIMA (MSC 668)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 15 Dec 1988

HIKOSHIMA (MSC 669)
Builder Hitachi, Kanagawa, Japan
Commissioned 15 Dec 1988

AWASHIMA (MSC 670)
Builder Hitachi, Kanagawa, Japan
Commissioned 13 Dec 1989

SAKUSHIMA (MSC 671)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 13 Dec 1989

UWAJIMA GROUP

UWAJIMA (MSC 672)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 19 Dec 1990

IESHIMA (MSC 673)
Builder Hitachi, Kanagawa, Japan
Commissioned 19 Dec 1990

TSUKISHIMA (MSC 674)
Builder Hitachi, Kanagawa, Japan
Commissioned 17 Mar 1993

MAEJIMA (MSC 675)
Builder Hitachi, Kanagawa, Japan
Commissioned 15 Dec 1993

KUMEJIMA (MSC 676)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 12 Dec 1994

MAKISHIMA (MSC 677)
Builder Hitachi, Kanagawa, Japan
Commissioned 12 Dec 1994

TOBISHIMA (MSC 678)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned 10 Mar 1995

— (MSC 679)
Builder Hitachi, Kanagawa, Japan
Commissioned Dec 1996

— (MSC 680)
Builder Nippon Koukan, Tsurumi, Japan
Commissioned Dec 1996

MINE COUNTERMEASURES SYSTEMS

CLEARANCE DIVERS

Four clearance divers are embarked in all ships.

Type S-4 ROV

***Enoshima* (MSC 652) to *Sakushima* (MSC 671) only.** The early series ships carry the Japanese Type S-4 ROV, which is designed to lay its own mine-demolition charges. It is electrically powered with two thrusters, one either side of the main body.

Type S-7 ROV

***Uwajima* (MSC 672) to MSC 680 only.** The later series ships carry a new ROV, designated the Type S-7. No details are known.

MINEHUNTING SONARS

Type ZQS-2B

***Enoshima* (MSC 652) to *Sakushima* (MSC 671) only.** Type ZQS-2B is a licence-produced version of the British Type 193M short-range, high-definition, sector-scanning sonar. This employs two frequencies: 100 kHz for long-range search and 300 kHz for short-range search and classification, with the transducers carried beneath the ship on a stabilised, steerable mounting, contained within a dome of either inflated fabric or GRP material. The receiver uses a modulation scanning technique with 15 beams, 1° wide in LF and 0.33° wide in HF, giving azimuth coverage of 15° and 6° respectively.

Searching wider areas of the sea bottom is achieved by an automatic search sequence selected in accordance with the nature of sea bottom, with returned echoes presented to operators on separate CRTs at the control console. One display shows range and bearing of targets while the other is used for expanded range presentation in search mode and also the presentation of the classification channel data. The controls for adjusting the transducer position, signal parameters such as frequency and pulse length and for co-ordinating with the rest of the minehunting and destruction systems, are also provided at the console.

Manufacturer/Contractor
NEC/Hitachi, Japan.

ZQS-3

***Uwajima* (MSC 672) to MSC 680 only.** ZQS-3 is a new, Japanese-designed, hull-mounted, minehunting sonar, which was developed for the 'Uwajima' class MCMVs. No details are known.

Manufacturer/Contractor
NEC/Hitachi, Japan.

WEAPONS SYSTEMS

GUNS

JM-61 20 mm/76 Sea Vulcan

The Sea Vulcan 20P/JM 61MB is essentially an M-197 gun on the mounting of the old 20 mm single US Navy Oerlikon Mk 10. A battery attached to the base of the mounting provides the power for up to 6,000 rounds and the working circle is 279.5 cm (110 in). The JM 61MB features two shoulder stocks compared with the two pistol grips of the Sea Vulcan 20P. This mounting provides convenient room for the installation of the 300-round ammunition can behind the right-hand shield, the battery and control box being mounted behind the other half. Twenty complements of ammunition can be fired without battery recharging; the battery conveniently can be connected to a main power source to provide a 28 V trickle feed, thus maintaining the battery in a charged condition.

COMMAND AND CONTROL SYSTEMS

RADARS

Fujitsu OPS-9

***Enoshima* (MSC 672) to *Ieishima* (MSC 673) only.**
An I-band surface search/navigation radar.

Fujitsu OPS-39 (MSC 674 onwards)

***Tsukishima* (MSC 654) to MSC 680) only.**
An I-band surface search/navigation radar.

PROPULSION

Specifications
System: Diesel
Main machinery:
***Enoshima* (MSC 652) to *Himeshima* (MSC 665) only:** 2 Mitsubishi YV122C-15/20 diesels 1.06 MW (1,440 hp(m))

***Ogishima* (MSC 666) to MSC 680 only:** 2 Mitsubishi 6NMU-TAI diesels, 1.03 MW (1,400 hp(m)).
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The first of these MCMVs was ordered in 1976 and the last two authorised in FY94, a very lengthy programme. There have been numerous minor changes as the series has progressed, but major changes from *Uwajima* (MSC 672) onwards caused this and later ships to be designated the 'Uwajima' class. For all practical purposes, however, they form one class.

DESIGN

These are typical, wooden-hulled MCMVs, similar in design and size to those constructed by numerous other navies. From *Awashima* (MSC 670) onwards the hull has been lengthened by 2.7 m (8.86 ft) in order to improve the sleeping accommodation from three tier to two tier bunks.

Numerous changes have been incorporated in the series as the programme has progressed:

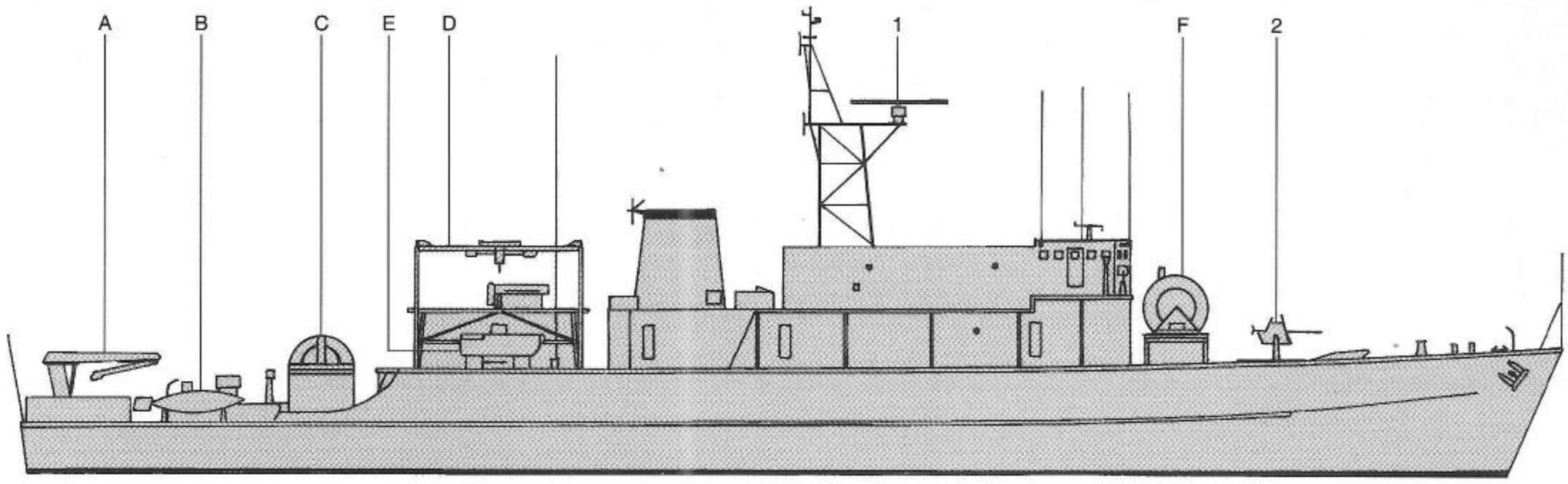
MSC 666 onwards. Improved type of diesel engine.
MSC 670 onwards. Length increased by 2.7 m (8.86 ft)
MSC 672 onwards. ZQS-3 minehunting sonar.
MSC 672 onwards. S-7 mine detonating equipment.
MSC 674 onwards. OPS-39 radar

DEPLOYMENT

The JMSDF formed the 'Minesweeper Squadron' to deploy to the Gulf in 1991. Somewhat surprisingly the squadron was made up of four ships of the first series (MSC 668, MSC 669, MSC 670 and MSC 671) rather than the 'Uwajima' (MSC 672) class ships.

Three of the earliest vessels of the class have already been paid off and more will follow.

YAEYAMA



Yaeyama (Ian Sturton)
MCM A *Crane* **B** *Float* **C** *Winch* **D** *Davits* **E** *AN/SLQ-48 MNS ROV* **F** Winch for AN/SQQ-32 sonar

General 1 *Fujitsu OPS-39 surface search/navigation radar* **2** *JM-61 20 mm/76 Sea Vulcan*

GENERAL SPECIFICATIONS

Operator: Japan
Type: Ocean minehunter/sweeper

Class: YAEYAMA

Built: 3
Active: 3

Displacement:
standard: 1,000 t
full load: 1,275 t

Dimensions
Length: 67 m (219.8 ft)
Beam: 11.8 m (38.7 ft)
Draught: 3.1 m (10.2 ft)

Speed: 14 kts

Complement: 60

SHIPS

YAEYAMA (MSO 301)	
Builder	Hitachi, Kanagawa, Japan
Laid down	30 Aug 1990
Launched	29 Aug 1991
Commissioned	16 Mar 1993

TSUSHIMA (MSO 302)	
Builder	Nippon Koukan, Tsurumi, Japan
Laid down	20 Jul 1990
Launched	20 Sep 1991
Commissioned	23 Mar 1993

HACHIJOU (MSO 303)	
Builder	Nippon Koukan, Tsurumi, Japan
Laid down	17 May 1991
Launched	15 Dec 1992
Commissioned	24 Mar 1994

MINE COUNTERMEASURES SYSTEMS

AN/SLQ-48(V)2 mine neutralisation system (MNS)

The AN/SLQ-48 ROV(V)2 Mine Neutralisation System (MNS) is centred on the remotely operated vehicle (ROV). The system is designed to detect, locate, classify and neutralise moored and bottom mines, using high-resolution sonar, low-light level TV, cable cutters and mine destruction charges.

The ROV operates at the end of a 1,066 m (3,000 ft) umbilical, which carries power cables from the ship, together with datalinks for the control systems and sensors. The ROV is powered by two 12 hp motors and two side thrusters, giving it a forward speed of 6 knots. Onboard equipment includes a high-definition sonar, a low-light TV for examining objects, cable cutters and an explosive charge for destroying a mine. There is also a tracking transponder to enable the parent ship to track the ROV.

Initial target detection and vehicle guidance information is provided by the ship's AN/SQQ-32 variable depth minehunting sonar. Initial vehicle navigation is plotted and monitored within the MNS acoustic tracking system, with the ROV's onboard sonar being used during the mid-course search and final homing phases; its high resolution enables operations in poor visibility by sonar guidance alone. Low-light TV is used in conjunction with sonar during the precision guidance phase near the target.

Specifications
(AN/SLQ-48(V)2 ROV)
Length: 3.8 m (12.47 ft)
Width: 0.9 m (2.95 ft)
Height: 1.2 m (3.94 ft)
Speed: 6 kts
Vehicle weight: 1,247 kg (2,749 lb) (in air)
Propulsion: Hydraulic, twin 15 hp
Thrusters: Horizontal/vertical/lateral
Cable length: 1,066 m (3,000 ft)
Power requirements: 43 kVA

Manufacturer/Contractor
Alliant Techsystems, USA.

MINESWEEPING

The Type S-8 deep sea moored minesweeping system is carried.

CLEARANCE DIVERS

Four clearance divers are carried.

MINEHUNTING SONAR

AN/SQQ-32

AN/SQQ-32 consists of two separate sonars: a search sonar for initial detection; and a high-frequency, high-resolution sonar for target classification. The detection sonar, designed and manufactured by Raytheon, detects mines and mine-like objects over a wide range of distances and bottom conditions, and the system incorporates a computer-aided detection facility to enable the sonar operator to discard the latter. Raytheon also provides the computer facilities and display consoles and is responsible for overall system integration.

The classification sonar, designed and produced by Thomson-CSF, is based on its experience with the DUBM 21 and TSM 2022 minehunting sonars. The classification sonar provides very high-resolution transmission and reception of underwater signals to enable targets to be seen with near-picture quality.

AN/SQQ-32 has two identical operator consoles with high-resolution displays. Search and classification data can be displayed simultaneously or independently. Automated detection and control functions are performed by two AN/UYK-44 computers.

The sonars are mounted in a cylindrical towed body which is housed in a well under the forward part of the ship. The sensors can, however, also be operated from the housed position when in shallow water. Search frequency is 35 kHz and classification frequency 445-650 kHz.

Manufacturers/Contractors
Raytheon, Portsmouth, Rhode Island, USA (prime).
Thomson-CSF, Sophia Antipolis Cedex, France (sonar).

WEAPONS SYSTEMS

GUNS

JM-61 20 mm/76 Sea Vulcan

The Sea Vulcan 20P/JM 61MB is essentially an M-197 gun on the mounting of the old 20 mm single US Navy Oerlikon Mk 10. A battery attached to the base of the mounting provides the power for up to 6,000 rounds and the working circle is 279.5 cm (110 in). The JM 61MB features two shoulder stocks compared with the two pistol grips of the Sea Vulcan 20P. This mounting provides convenient room for the installation of the 300-round ammunition can behind the right-hand shield, the battery and control box being mounted behind the other half. Twenty complements of ammunition can be fired without battery recharging; the battery conveniently can be connected to a main power source to provide a 28 V trickle feed, thus maintaining the battery in a charged condition.

COMMAND AND CONTROL SYSTEMS

RADAR

Fujitsu OPS-39

I-band surface search radar.

Manufacturer/Contractor

Fujitsu, Japan.

PROPULSION

Specifications

System: Diesel

Main machinery: 2 Mitsubishi 6NMU-TAI diesels; 1.76 MW (2,400 hp(m))

Shafts: 2

Bow thruster: 1 hydrojet bow thruster; 257 kW (350 hp(m))

FURTHER INFORMATION

PROGRAMME

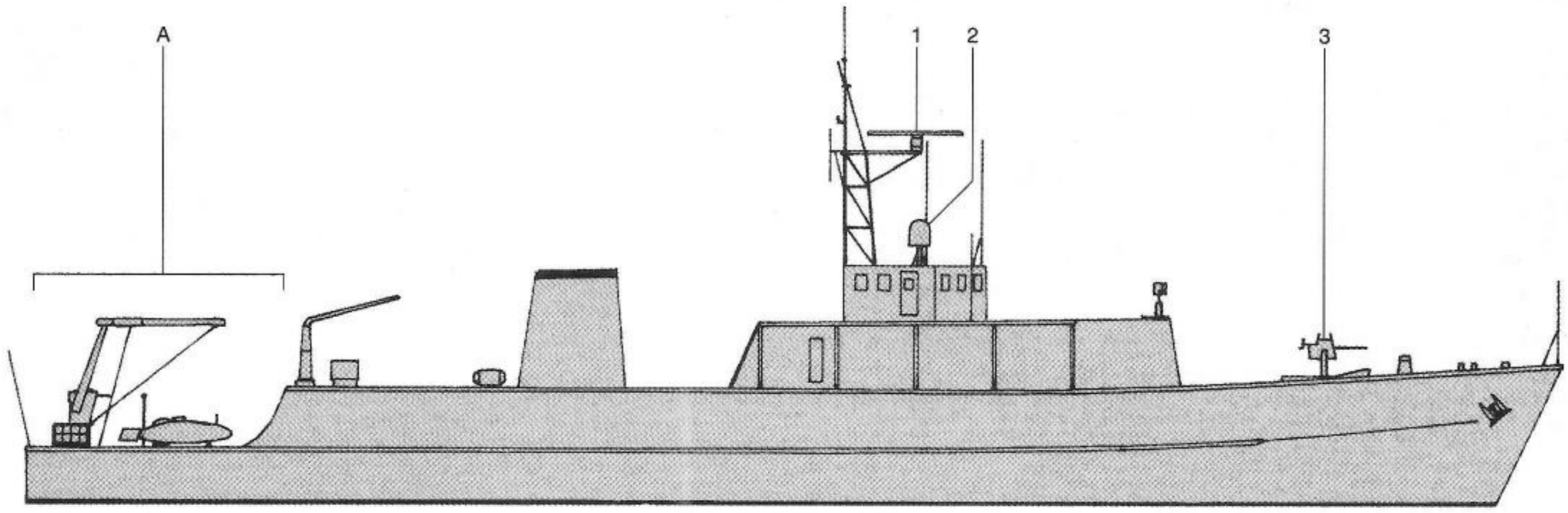
The first two were approved in the 1989 estimates, followed by the third in the 1990 estimates. It was understood at one time that it was intended to build at least six, but the programme has been terminated with the third, indicating a possibility of some dissatisfaction with some elements of the design.

DESIGN

The ships have GRP-sheathed wooden hulls and, as frequently happens with JMSDF ships, they are very similar in design and size to their contemporaries in the US Navy, in this case the 'Avenger' class.

They are fitted with the Type S-7 deep sea minehunting system and the Type S-8 deep sea moored minesweeping equipment. An integrated tactical system is also fitted.

NEW JMSDF COASTAL MINESWEEPERS



MSC (Ian Sturton)
MCM A *Sweep deck*

General 1 *Furuno OPS-39 surface search/navigation radar* **2** *Satcom* **3** *JM-61 20 mm/76 Sea Vulcan*

GENERAL SPECIFICATIONS

Operator: Japan
Type: Coastal minesweeper

Class: —

Active: 0
Building: 2
Proposed: 1 (?)

Displacement:
standard: 510 t

Dimensions
Length: 57.7 m (189.3 ft)
Beam: 9.4 m (30.8 ft)
Draught: 3 m (9.7 ft)

Speed: 14 kts

Complement: 40

SHIPS

MSC 681, MSC 682

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

ADI Mini-Dyad

It is reported that these ships will carry the mini-Dyad influence sweep, an emulation sweep developed in Australia. This is a modular, distributed dipolar system, based on combinations of positive buoyant permanent magnets (Dyads) and water-driven acoustic generators. The latter produce a ship-like acoustic signature in the low, audible and HF ranges. The mini-Dyads are designed to emulate degaussed and undegaussed ships of various sizes up to approximately 100,000 t dwt.

Manufacturer/Contractor
ADI, Australia.

MINEHUNTING

PAP Mk 5 ROV

The Japanese MCMs will carry two PAP Mk 5 (PAP = *poisson auto-propulsé*) ROVs, which have the capability simultaneously to hunt and destroy ground mines and tethered mines either by placing and remotely detonating a charge or by cutting the mooring rope of tethered mines. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via either a tether, which can be either a 2,000 m (6,562 ft) fibre optic cable or a 1,000 m (3,281 ft) coaxial cable. It is horizontally propelled by means of two side thrusters.

In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide-rope'. The winch in the PAP is instructed to deploy a selected length of rope and the operator then uses return signals from the vehicle to maintain the vehicle at the desired selected height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP Mk 5 is able to carry the 126 kg (277 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution nearfield sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

Specifications
(PAP Mk 5)
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.2 ft)
Performance:
Max vehicle velocity
mid-water transit: 6 kts (3 m/s)
bottom-following mode: 5.5 kts (2.75 m/s)
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s (2.3 ft/s)
Ascent velocity (charge released): 1.5 m/s (4.9 ft/s)
Payload:
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Horizontal range:
with fibre optic cable: 2,000 m (6,562 ft)
with coaxial cable: 1,000 m (3,281 ft)
Max continuous endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bars

Manufacturer/Contractor
Société ECA, 92707 Colombes, France.

MINEHUNTING SONAR

GEC-Marconi Type 2093

The Type 2093 sonar is designed to operate in either hull-mounted or variable depth mode, deployed through the ship's centre well, and will detect, localise and classify all current and future mine threats. Total system weight is 13,000 kg (28,650 lb). The variable depth, dual-frequency search and dual-frequency classification capability provides a sonar able to operate under all bottom and sea conditions at a range claimed to be twice that of hull-mounted sonar and with an increase of three times detection depth.

The towed body of the 2093 is cylindrical with hemispherical ends. The sonar arrays within the body consist of two 360° rings for LF and VLF operation, hydrophones for HF and VHF reception, and separate HF and VHF projectors. Below is a cylindrical VLF projector and finally a VLF depth sounder. LF and VLF are used for search, survey and moored mine classification; HF and VHF for classification and survey.

Sonar 2093 employs multiple operating modes which offer the MCM commander a choice of operational configurations to match the prevailing threat and environment. These multiple operating modes comprise VLF and LF search and moored mine classification, VLF and LF search, search and ground mine classification, also search and route survey. Sonar 2093 can combine these modes to enable concurrent operation.

Manufacturer/Contractor
GEC-Marconi, UK.

WEAPONS SYSTEMS

GUNS

JM-61 20 mm/76 Sea Vulcan

The Sea Vulcan 20P/JM 61MB is essentially an M-197 gun on the mounting of the old 20 mm single US Navy Oerlikon Mk 10. A battery attached to the base of the mounting provides the power for up to 6,000 rounds and the working circle is 279.5 cm (110 in). The JM 61MB features two shoulder stocks compared with the two pistol grips of the Sea Vulcan 20P. This mounting provides convenient room for the installation of the 300-round ammunition can behind the right-hand shield, the battery and control box being mounted behind the other half. Twenty complements of ammunition can be fired without battery recharging; the battery conveniently can be connected to a main power source to provide a 28 V trickle feed, thus maintaining the battery in a charged condition.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

GEC-Marconi/NEC NAUTIS M

The NAUTIS-M for the Japanese MSC is likely to be based on the three-console system, which has already been selected by the UK Royal Navy, Royal Saudi Navy and the US Navy. The system provides support for operational planning, ship control guidance, underwater and surface picture compilation, command and control for mine disposal together with a real-time MCM database.

Manufacturers/Contractors

GEC-Marconi, UK.
NEC Corporation, Japan.

RADAR

Furuno OPS-39

OPS-39 is a Japanese-designed, I-band, surface search and navigation radar.

Manufacturer/Contractor

Furuno, Japan.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 diesels, 1.33 MW (1,800 hp(m))
Shafts: 2

FURTHER INFORMATION

The first pair was authorised in FY95, followed by the third in FY96. The hull is similar to the 'Uwajima' class, but the upper deck is extended aft to provide greater stowage for mine disposal gear, and there are twin funnels. Some reports suggest that this class is for comparison with the US sonar and data system in the 'Yaeyama' class.

SWALLOW

GENERAL SPECIFICATIONS

Operator: Republic of Korea (South)
Type: Minehunter

Class: KANG KYEONG (SWALLOW)

Built: 6
Active: 6

Displacement:
standard: 470 t
full load: 520 t

Dimensions
Length: 50 m (164 ft)
Beam: 8.3 m (27.2 ft)
Draught: 2.6 m (8.6 ft)

Speed: 15 kts
Range: 2,000 n miles at 10 kts

Complement: 44 (5 officers) plus divers

SHIPS

KANG KYEONG (561)
Builder Kangnam Corporation, Pusan, South Korea
Commissioned Dec 1986

KANG JIN (562)
Builder Kangnam Corporation, Pusan, South Korea
Commissioned May 1991

KO RYEONG (563)
Builder Kangnam Corporation, Pusan, South Korea
Commissioned Nov 1991

KIM PO (565)
Builder Kangnam Corporation, Pusan, South Korea
Commissioned Apr 1993

KO CHANG (566)
Builder Kangnam Corporation, Pusan, South Korea
Commissioned Oct 1993

KUM WHA (567)
Builder Kangnam Corporation, Pusan, South Korea
Commissioned Apr 1994

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

The only known sweep equipment is a single-sweep mechanical gear which is deployed at 8 knots.

MINEHUNTING

Gaymarine Pluto ROV

Pluto is available in three configurations: battery-powered with a 6 mm, 500 m (1,640 ft) long umbilical cable; battery-powered with a 3 mm, 2,000 m (6,560 ft) long fibre optic umbilical cable; or remotely powered, unlimited endurance with 8 mm, 500 m (1,640 ft) long umbilical cable. The vehicle is powered by five thrusters: two horizontal for forward/reverse, two vertical for vertical and lateral shift, and a transversal thruster. The thrusters are controlled by two joysticks. The vehicle can maintain automatic depth control within ±10 cm (4 in). Maximum speed forwards is 4 knots and vertical speed 1 knot. Sensors are mounted in the forward tiltable section of the vehicle. Optional equipment includes black and white LLTV, colour TV or still-camera, search or scanning sonar, acoustic pinger, strobe flash, measuring instruments, manipulators and so on. There are 10 free channels for remote control and two four-digit telemetry channels for measurements. The console incorporates a 9 in TV monitor for display of information showing TV image, depth, compass, head tilt angle, elapsed time and sonar diagram. All displayed data can be video recorded.

Specifications

Length: 1,680 mm (66 in)
Width: 600 mm (23.6 in)
Height: 630 mm (24.8 in)
Weight: 160 kg (353 lb)
Service depth: 400 m (1,312 ft)
Payload: 15 kg (33 lb)

Manufacturer/Contractor

Gaymarine, Italy.

MINEHUNTING SONAR

GEC-Marconi Type 193M Mod 1

Type 193M Mod 1 is a British hull-mounted, short-range, high-definition, sector-scanning sonar, operating at two frequencies, providing detection and classification of both moored and ground mines. The sonar provides both bearing and range data; the fine range and bearing resolution enable the operator to assess accurately the shape of a target and hence its nature. Since the resolution depends both on operating frequency and pulse length, two selectable frequencies are provided, with a choice of pulse lengths in the classification mode.

Range and bearing data appear on two displays: in the search mode one display shows the total range covered; in the classification mode, a 27 m (30 yd) section of the search display is expanded to fill the second display screen and permit close examination of the target. Two frequencies are employed by the 193M sonar: 100 kHz for long-range search and 300 kHz for short-range search and classification. The transducers for these signals are carried beneath the ship on a stabilised, steerable mounting, the whole assembly contained within a dome.

Manufacturer/Contractor

GEC-Marconi Sonar Systems, UK.

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm cannon in US Mk 10 mount

Specifications

Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (1,476 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g
Elevation: −15 to +90°

7.62 mm machine guns

Two per ship.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Racal-Decca MAINS 500

MAINS (Minehunting Action Information and Hunting System) provides the following main functions: accurate navigation; ship control; guidance; integration of minehunting sonar; combined surface/subsurface tactical display; automatic hard-copy tactical plot with detailed data printout; patrol navigation/combat information operating characteristics as an optional second role.

'Own ship' position is fixed using one or more high-accuracy radio and microwave ranging systems such as the Racal Hi-Fix 6 or Hyperfix, or the portable line of sight Trisponder with a range of 80 km. Other navaids include the statutory navigational radar which has sufficient resolution to track marker buoys, Satnav, Decca, Loran C, the Doppler sonar, gyrocompass, and conventional EM or Doppler/acoustic log.

The MAINS computer can also be used for ship control and steering guidance. An automatic plotter and printer provides a hard-copy record of operations necessary for subsequent operations covering the same area.

The interactive PPI display is the Racal ED1202 which combines both radar surface situation and own vessel position relative to sonar search plan together with underwater contacts as a single presentation. The displayed picture has multilevel brilliance and correlated data and is presented in alphanumeric form.

Manufacturer/Contractor
Racal, UK.

RADAR

Raytheon
One Raytheon surface search/navigation radar; model not known.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 MTU diesels, 1.5 MW (2,040 hp(m)) sustained

Propellers: 2 Voith-Schneider cycloidal propulsion units
Thruster: 1 bow thruster, 75 kW (102 hp(m))

FURTHER INFORMATION

PROGRAMME

The first of class was delivered at the end of 1986 for trials. A further two, incorporating some modifications, were ordered in 1988, followed by three more in 1990. There were reports in 1992 of two more being ordered but this is not confirmed and no more ships have been reported.

It is more likely that a follow-on class will be built, which will be larger, have a variable depth sonar and be equipped with a fully integrated minehunting system.

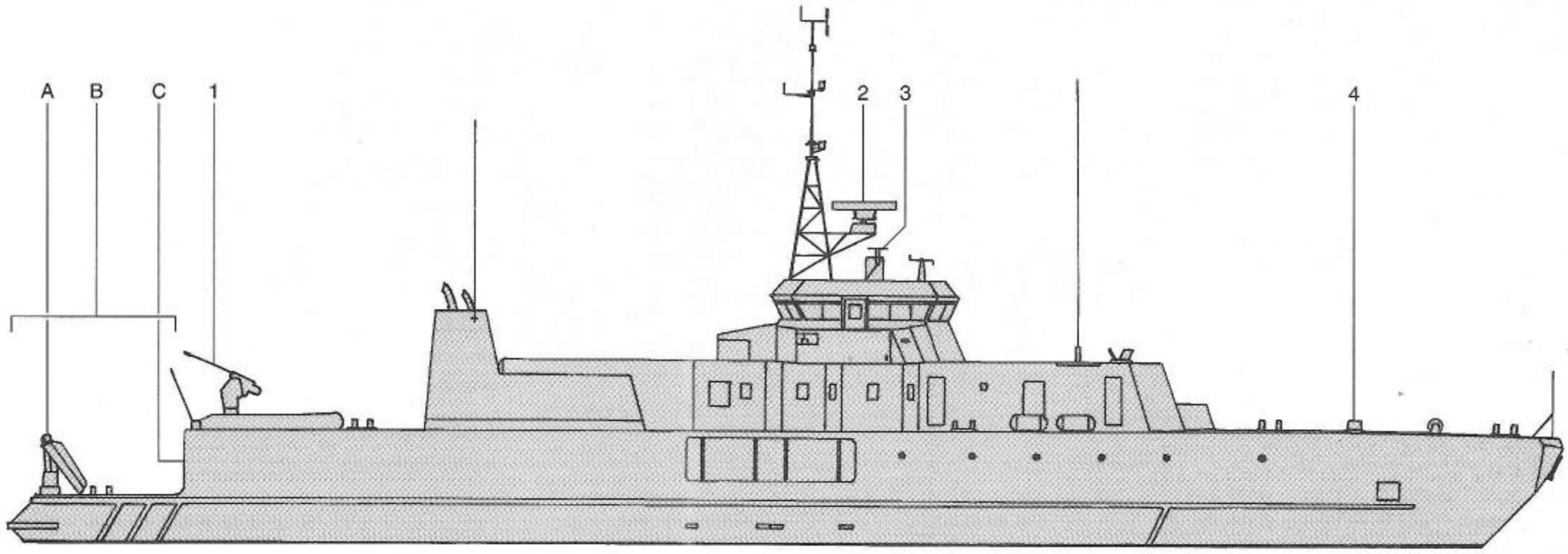
DESIGN

This design bears a certain resemblance both physically and dimensionally to the Italian 'Lerici' class, but is officially stated to be an independent design developed by the Kangnam Corporation in South Korea.

MODERNISATION

GEC-Marconi tactical minehunting system may be fitted in due course.

OKSØY/ALTA



Oksøy/Alta (Ian Sturton)
MCM A *Crane (two)* **B** *Sweep deck* **C** *Hangar (ROV, sweeps)*

General 1 *Rheinmetall Rh-202 20 mm cannon* **2** *Racal-Decca surface search radar* **3** *Racal-Decca navigation radar* **4** *Site for 20 mm cannon or Sadral SAM launcher*

GENERAL SPECIFICATIONS

Operator: Norway
Type: Minehunters and minesweepers

Class: OKSØY/ALTA

Minehunters
Built: 4
Active: 4

Minesweepers
Built: 4
Active: 4
Building: 1

Displacement:
standard: 335 t
full load: 375 t

Dimensions
Length: 55.2 m (181.1 ft)
Beam: 13.6 m (44.6 ft)

Draught:
hullborne: 2.5 m (8.2 ft)
cushionborne: 0.84 m (2.76 ft)

Speed: 30 kts
Range: 1,500 n miles at 20 kts

Complement:
minehunters: 38 (12 officers)
minesweepers: 32 (10 officers)

SHIPS

Minehunters

OKSØY (M 340)
Builder Kværner Mandal, Mandal, Norway
Commissioned 7 Jul 1994

KARMØY (M 341)
Builder Kværner Mandal, Mandal, Norway
Commissioned 22 Dec 1994

MAALOY (M 342)
Builder Kværner Mandal, Mandal, Norway
Commissioned 24 Mar 1995

HINNØY (M 343)
Builder Kværner Mandal, Mandal, Norway
Commissioned 8 Sep 1995

Minesweepers

ALTA (M 350)
Builder Kværner Mandal, Mandal, Norway
Commissioned Mar 1996

OTRA (M 351)
Builder Kværner Mandal, Mandal, Norway
Commissioned Jul 1996

RAUMA (M 352)
Builder Kværner Mandal, Mandal, Norway
Commissioned Nov 1996

ORKLA (M 353)
Builder Kværner Mandal, Mandal, Norway
Commissioned Apr 1997

GLOMMA (M 354)
Builder Kværner Mandal, Mandal, Norway
Commissioned Oct 1997

MINE COUNTERMEASURES SYSTEMS

MISSION CONTROL

MICOS

MICOS (MIssion COntrol System) is a Norwegian integrated mission control system which can be configured for either minehunting or minesweeping. It is an open architecture design with a high COTS content. There are two configurations:

- **'Oksøy' class minehunters:** an integrated bridge system; an MCM command and control system; the sonar system; and an ROV and mine disposal system.
- **'Alta' class minesweepers:** an integrated bridge system; an MCM command and control system in the operations room; the sonar system; interfaces to the sweep gear.

The integrated bridge system comprises a Simrad ADP 701 navigation and dynamic positioning system for high-precision navigation and automatic control of the vessel, and a Norcontrol DB 2000 officer-of-the-watch ARPA system for surface surveillance.

The MCM command and control system comprises two Simrad ATC 900 multifunction tactical consoles, two operator consoles for the Simrad/Thomson Sintra TSM 2023 detection and classification minehunting sonars and a control console for the ROV operator. The system components are all integrated via a dual-redundant Ethernet LAN.

The command and control system has a wide range of functions for planning, operation, reporting and documentation of an MCM mission. The system comprises a database containing 2D electronic charts, 3D bottom terrain models, previous observations of bottom objects, navigation routes and so on. Also available are functions for performing MCM calculations for coverage and system performance analysis, including updating of the MCM database.

The Dynamic Positioning (DP) system is based on Simrad's ADP 701 which is in service with a great number of offshore vessels. It includes functions for automatic control of the vessel comprising a full 3-axis manual mode, autopilot (for transit), hovering mode, auto-track and auto-sail modes. The two latter modes are used to steer the vessel automatically on a planned course with minimum cross-track error. The DP system is interfaced to the sweep gear for automatic calculation of the gear's position and coverage and for measuring and counteracting the forces induced by the gear on the vessel.

Manufacturer/Contractor
Simrad Subsea A/S, Norway

MINESWEEPING

The minesweeping version, ('Alta' class) is fitted with an A-frame to deploy the various sweeps. The sweeps include mechanical, acoustic and magnetic types.

MINEHUNTING

Gaymarine Pluto ROV

Pluto is available in three configurations: battery-powered with a 6 mm, 500 m (1,640 ft) long umbilical cable; battery-powered with a 3 mm, 2,000 m (6,560 ft) long fibre optic umbilical cable; or remotely powered, unlimited endurance with 8 mm, 500 m (1,640 ft) long umbilical cable. The vehicle is powered by five thrusters: two horizontal for forward/reverse, two vertical for vertical and lateral shift, and a transversal thruster. The thrusters are controlled by two joysticks. The vehicle can maintain automatic depth control within ±10 cm. Maximum speed forwards is 4 knots and vertical speed 1 knot. Sensors are mounted in the forward tiltable section of the vehicle. Optional equipment includes black and white LLTV, colour TV or still-camera, search or scanning sonar, acoustic pinger, strobe flash, measuring instruments, manipulators and so on. There are 10 free channels for remote control and two four-digit telemetry channels for measurements. The console incorporates a 9 in TV monitor for display of information showing TV image, depth, compass, head tilt angle, elapsed time and sonar diagram. All displayed data can be video recorded.

Specifications
Length: 1,680 mm (66 in)
Width: 600 mm (23.6 in)
Height: 630 mm (24.8 in)
Weight: 160 kg (353 lb)
Service depth: 400 m (1,312 ft)
Payload: 15 kg (33 lb)

Manufacturer/Contractor
Gaymarine, Italy.

MINEHUNTING SONARS

Thomson-CSF TSM 2023N

The TSM 2023 minehunting sonar has been developed by Thomson-CSF as the main contractor with Simrad Subsea as subcontractor responsible for the detection sonar. The TSM 2023 performs mine detection and classification simultaneously, and comprises:

- a detection sonar which covers a bearing sector of 90° electronically steerable through 360°
- a classification sonar which can perform shadow analysis at three different frequencies. The three different frequencies allow the beam resolution and bearing sector to be adjusted according to the size of the detected object
- two sonar consoles, one for detection, one for classification, equipped with CAD and CAC processing and a performance indicator.

Manufacturer/Contractor
Thomson Sintra Activités Sous-Marines.

Simrad SA 950

Minesweepers only. SA 950 is a mine-detection and mine-avoidance sonar developed specifically for the 'Alta' classs minesweepers. It uses a retractable hull-mounted transducer, operationg at 95 kHz.

Manufacturer/Contractor
Simrad Subsea A/S, Norway.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Mistral

One Sadral twin launcher for IR-homing missiles. Sadral is a remotely operated system on a two-axis stabilised mount for six launcher-containers and a closed-circuit television camera.

Specifications
Length: 1.81 m (6.0 ft)
Diameter: 9.2 cm (3.6 in)
Wing span: 1.9 cm (0.7 in)
Weight: 18.4 kg (40.5 lb)
Speed: Mach 2.6
Range: 700 m to 5 km (2,296 to 16,400 ft)

Manufacturer/Contractor
Matra, France.

GUNS

20 mm KV-SV-20

One or two per ship. KV-SV-20 is a low-cost, light calibre weapon, for use against enemy attack craft in confined waters, which is derived from the single-barrelled Rh 202 which had been produced by Kongsberg as FK 20-2.

Specifications
Calibre: 20 mm
Length of barrel: 85 calibres
Muzzle velocity: 1,050-1,250 m/s (3,445-4,101 ft/s)
Rate of fire: 800-1,000 rds/min
Traverse: 360°
Elevation: −15 to +70°
Mounting weight: 418 kg (921.5 lb) (loaded)
Crew: 1-2
Range: 1 n mile (2 km)

Manufacturer/Contractor
Rheinmetall, Germany.

M2HB 12.7 mm machine guns

Two M2HB are carried. This is a selective short recoil automatic operation weapon with a 1,143 mm (45 in) long barrel.

Specifications
Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca RN-80

I-band navigation radar.

Racal-Decca surface search

There is a single Racal-Decca surface seach radar.

OTHER EQUIPMENT

Other MCM equipment includes:
Simrad Albatross tactical system including mapping
Cast/Del Norte mobile positioning system with GPS.
Two-man diver's decompression chamber

PROPULSION

Specifications
System: Diesel
Main machinery:
propulsion: 2 MTU 12V 396 TE84 diesels, 2.72 MW (3,700 hp(m)) sustained; 2 Kvaerner Eureka water-jets
lift: 2 MTU 8V 396 TE54 diesels, 1.28 MW (1,740 hp(m)/60Hz) sustained

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FURTHER INFORMATION

PROGRAMME

Orders for nine were placed with Kvaerner on 9 November 1989, of which four are minehunters ('Oksøy' class), and five minesweepers ('Alta' class). An option on a tenth of class will not be taken up.

DESIGN

The design of these unique MCMVs was developed by the Norwegian Navy in consultation with the Defence Research Institute and Norsk Veritas. It uses an air cushion created by the surface effect between two hulls. The hull is built of Fibre-Reinforced Plastics (FRP) in sandwich configuration. All machinery is mounted on the maindeck, which reduces the ship's acoustic signature.

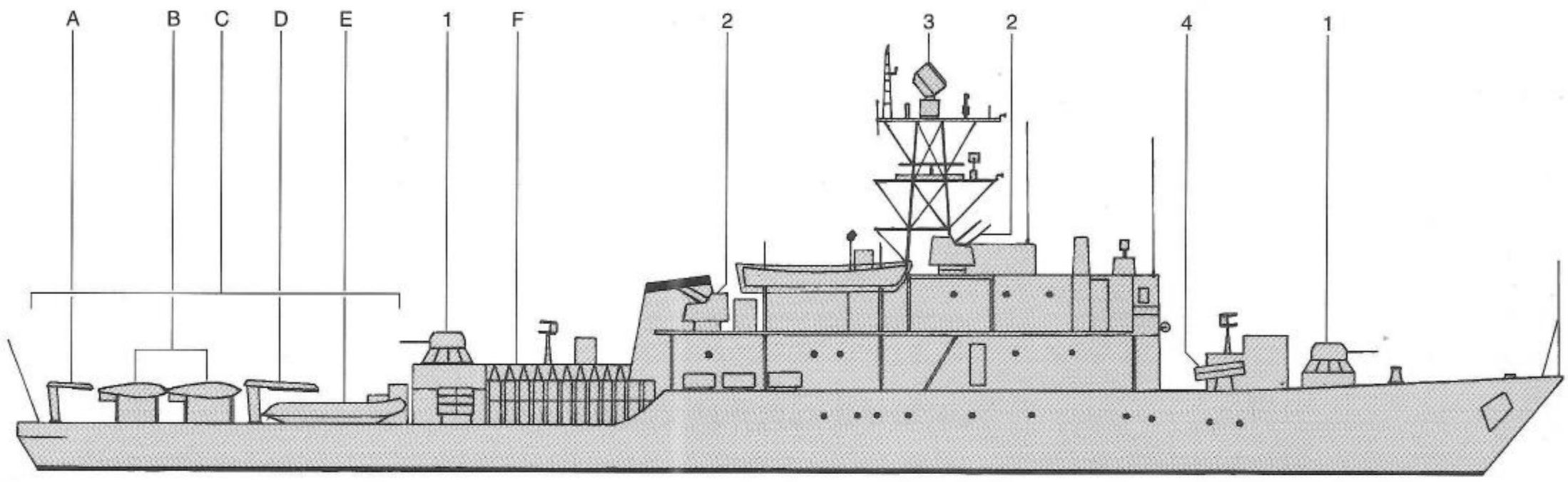
The unique design is the result of a requirement which stresses maximum transit speed between MCM operations along the long Norwegian coastline. The catamaran design also reduces water disturbance and magnetic and acoustic signatures, while also enhancing sonar response and shock resistance. There is also a large deck area, especially aft; an important consideration in an MCMV.

The SAM launcher is mounted forward of the bridge. The catamaran design is claimed to give higher transit speeds with lesser installed power than a traditional hull design. Other advantages are lower magnetic and acoustic signatures, more comfortable motion, clearer water for sonar operations, and less susceptibility to shock.

First of class, Oksøy *(M 340). These new Norwegian surface-effect ships represent a totally new approach to the MCMV requirement. Their high speed enables them to move very rapidly from one MCM operation to another* (Kvaerner Mandal)

The ROVs are carried in a large hangar and are launched by two hydraulic cranes. The minesweeper has an A-frame aft for the sweep gear.

MUSCA



'Musca' class (Ian Sturton)
MCM A *Sweep davit (2)* **B** *Oropesa floats* **C** *Sweep deck* **D** *Davit* **E** *Divers' boat* **F** *Swept-channel markers*

General 1 *AK-230 30 mm twin CIWS* **2** *Quad 14.5 mm machine gun* **3** *Drum Tilt fire-control radar* **4** *RBU-1200 fire barrel ASW mortar*

GENERAL SPECIFICATIONS

Operator: Romania
Type: Minesweeper

Class: MUSCA

Built: 4
Active: 4

Displacement:
full load: 790 t

Dimensions
Length: 60.8 m (199.4 ft)
Beam: 9.5 m (31.1 ft)
Draught: 2.8 m (9.2 ft)

Speed: 17 kts

Complement:

SHIPS

LIEUTENANT REMUS LEPRI (24)
Builder Mangalia, Shipyard, Romania
Commissioned 23 Apr 1987

LIEUTENANT LUPU DINESCU (25)
Builder Mangalia, Shipyard, Romania
Commissioned 6 Jan 1989

LIEUTENANT DIMITRI NICOLESCU (29)
Builder Mangalia, Shipyard, Romania
Commissioned 7 Dec 1989

SUB-LIEUTENANT ALEXANDRU AXENTE (30)
Builder Mangalia, Shipyard, Romania
Commissioned 7 Dec 1989

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Details of the minesweeping equipment cannot be confirmed but they appear to carry mechanical sweeps, and may also be equipped with acoustic and magnetic sweeps. They are probably of Russian design.

These ships have a particularly long sweep deck, and one slightly unusual feature is the large number of swept-channel markers (dan buoys).

MINEHUNTING SONARS

These ships are fitted with hull-mounted, active, high-frequency, minehunting sonar.

WEAPONS SYSTEMS

30 mm/65 AK 230

There are two twin 30 mm AK-230 mounts; one on the foredeck, the second aft.

Specifications

NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to + 87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.24 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D
Type: High explosive
Weight (complete round): 1.40 kg (3.08 lb)
Projectile: 0.27 kg (0.59 lb)
Explosive: 30 g (A-XI-2)

ASW MORTARS

RBU 1200

There are two five-tube RBU-1200s, sited on the foredeck. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm, is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (75 lb) warhead and a range of about 0.8 n miles (1.48 km).

MACHINE GUNS

There are four quad 14.5 mm machine gun mountings.

COMMAND AND CONTROL SYSTEMS

RADARS

Krivach
There is one I-band, Krivach, surface search/navigation radar.

Drum Tilt
The ship carries one Drum Tilt H/I-band fire-control radar, which is mounted at the masthead. The cylindrical radar is permanently tilted upwards at 30° and approximate ranges are reported to be: acquisition 21.6 n miles (40 km); tracking 12.4 n miles (23 km). Russian name is *Rys*.

PROPULSION

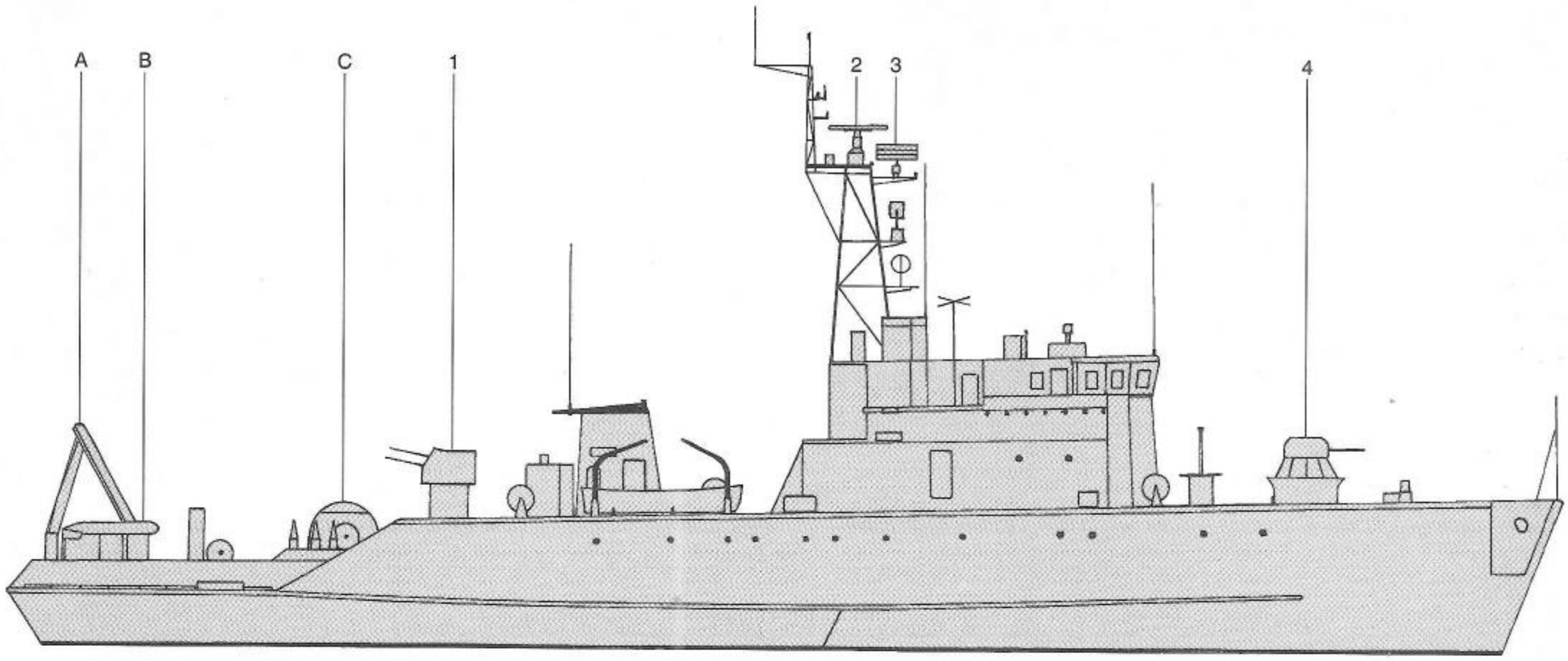
Specifications
System: Diesel
Main machinery: 2 diesels; 3.5 MW (4,800 hp(m))
Shafts: 2

FURTHER INFORMATION

These four ships were part of the Romanian fleet expansion during the 1980s and were built at the same time as the 'Cosar' class minelayers. They are steel-hulled and appear to be conventional sweepers.

As the Romanian Navy has used either Russian ships or built its own ships based on Russian naval ideas, it would be surprising if these ships did not have two mine rails, to enable them to lay mines at the start of a conflict. It also seems likely that, as with most other small surface combatants, they will include in their armament at least one SA-N-5 'Grail' SAM launcher.

SONYA (TYPE 1265/1265M)



'Sonya' class (later Russian Navy version) (Ian Sturton)
MCM A *Swan-neck crane* **B** *Floats* **C** *Main winch*

General 1 *2-M-3 twin 25 mm/80* **2** *Don-2 navigation radar* **3** *Square Head IFF (two)* **4** *AK-630 twin 30 mm*

GENERAL SPECIFICATIONS

Operator: Russia
Type: Coastal minehunter/sweeper

Class: SONYA

National designation: *bazovy tralshchik* (base minesweeper)

Built: 72
Active: 62

Displacement:
standard: 430 t
full load: 450 t

Dimensions
Length: 48 m (157.4 ft)

Beam: 8.8 m (28.9 ft)
Draught: 2 m (6.6 ft)

Speed: 15 kts
Range: 3,000 n miles at 10 kts

Complement: 43

SHIPS

72 were built for the Russian Navy between 1971 and 1991.

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Russian minesweeping gear to be found in the 'Sonya' class MCMV includes:

- Mechanical sweep. One set per ship.
- Acoustic sweep. One set per ship. A low-frequency 'fish' can be seen on the quarterdeck of most Sonyas.
- Magnetic sweep. One set per ship.

Deck gear includes:

- A single davit with 2,250 kg (4,960 lb) capacity and jib reach of 4.73 m (15.5 ft)
- A drum winch for contact and acoustic sweeps.
- Cable reel for the magnetic sweep.

MINEHUNTING SONAR

MG 69/79
A hull-mounted, high-frequency, active minehunting sonar.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Igla-1 (SA-N-5 Grail)
Some ships carry the Igla-1 system using the Strela 2 9M43M missile (NATO = SA-N-5), which is housed in a glass fibre launcher-container; these ships carry a total of 18 missiles. The missile has an uncooled lead sulphide infra-red seeker, operating in the 1.7 to 2.8 µm range and with a spinning reticle, centre-null tracking system with a 1.9° field of view. On acquiring the target the operator activates the thermal battery and when the seeker has acquired the target an audio signal is received telling the operator to take the first pressure on the trigger and activate the missile gyros which warm up in four to six seconds. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target and then takes the second pressure on the trigger to launch the missile. The booster burns for 0.05 seconds to eject the missile from the launch tube at a speed of 28 m/s (91.8 ft/s) and spin it up and then, at a distance of 6 m (19.6 ft), the sustainer ignites and the trailing fins pop out. The missile homes on the 'hottest' part of the target and has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M the warhead has improved fragmentation uniformity.

Specifications
Length: 1.45 m (4.75 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (22 lb)

Speed: Mach 1.7
Range:
anti-surface: 2.6 n miles (4.8 km)
anti-air: 18-4,500 m (59-14,764 ft)

Manufacturer/Contractor
Fakel, Russia.

GUNS

Earlier units have two twin AK-230 30 mm/65, with two twin 25 mm guns. Later units have two AK-630 30 mm Gatling, but neither 25 mm guns nor Drum Tilt radar.

30 mm/65 AK 230

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,445 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D
Type: High explosive
Weight (complete round): 1.40 kg (3.0 lb)
Projectile: 0.27 kg (0.6 lb)
Explosive: 30 g (A-XI-2)

30mm AK-630

Specifications
Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,920 ft/s)
Traverse: 360° (depending on location of turret) at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (13,120 ft)
electro-optic fire control: 5,000 m (16,400 ft)
Rate of fire: 4,000-5,000 rds/min
Ammunition:
round: 1.224 kg (2.7 lb)
projectile weight:
UOF-84: 384 g
UOR-84: 388 g

25 mm/80 2-M-3

Specifications
2-M-3
Calibre: 25 mm
Length of barrel: 60 calibres
Traverse: 360°at 25°/s
Elevation: −10 to +85°at 15°/s
Rates of fire: 450 rds/min/barrel
Projectile: 0.28 kg (0.6 lb) HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,184 ft)

25 mm/60 (2-M-3)

MINES

Eight mines are carried.

COMMAND AND CONTROL SYSTEMS

RADAR

Don 2/Kivach/Nayada
I-band surface search/navigation radars.

IFF
Square Head (2 per ship)
High Pole B.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kolomna Type 9-D-8 diesels; 1.47 MW (2,000 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

PROGRAMME

This class was first reported in 1973 and was built at a rate of about two per year over a period of some 20 years in two yards (one in St Petersburg, the other at Vladivostok). The last was commissioned in January 1995.

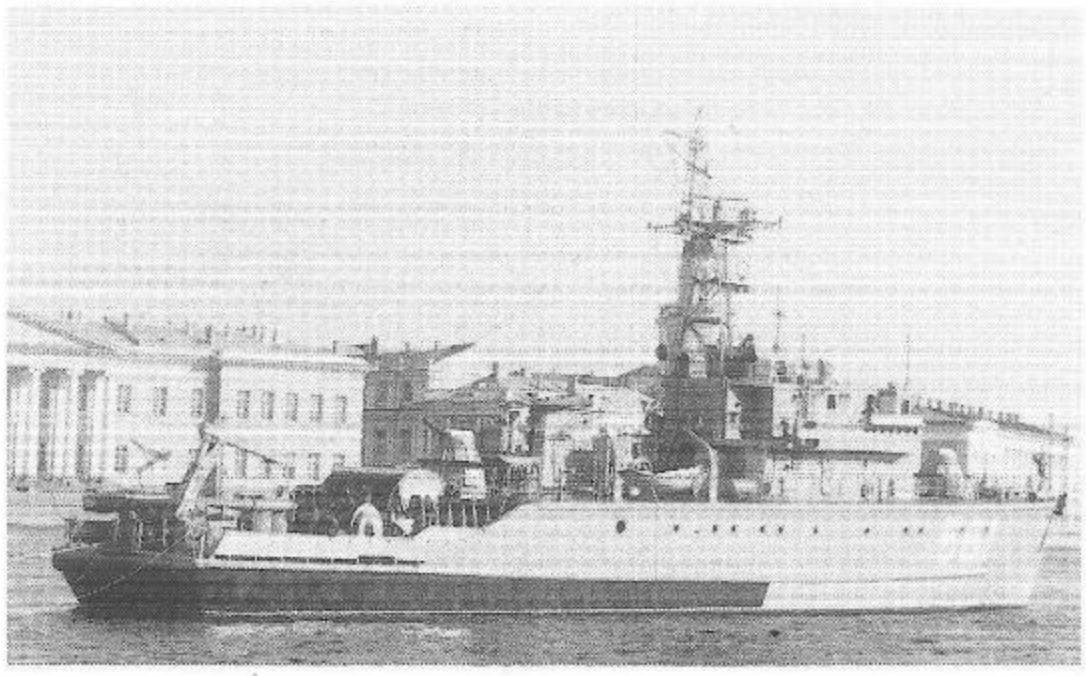
DESIGN

The Sonya is a conventional minesweeper with a wooden hull and a GRP sheath. There are minor differences in the armament, with some having two twin 30 mm Gatling guns, others one 30 mm/65 (twin) plus one 25 mm (twin). An unusual feature is that the AK-630 installation is not accompanied by the Drum Tilt fire-control system.

Deployment
Current deployment is:
Pacific Fleet — 28
Northern Fleet — 10
Baltic Fleet — 15
Black Sea Fleet — 4
Caspian Fleet — 3 (shared with Azerbaijan)
Early models are being scrapped.

Sales
Sales comprise:
Bulgaria — 4 (1981-85)
Cuba — 4 (1980-85)
Syria — 1 (1986)
Vietnam — 4 (1987-1990)
Ethiopia — 1 (1991)

'Sonya' class MCMV at St Petersburg in 1996 (H & L van Ginderen Collection)



'Sonya' class showing gear on the sweep deck (H & L van Ginderen Collection)

BRIZ (SONYA TYPE 1265)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Bulgaria
Type: Coastal minehunter/sweeper (Sonya 1265)

Class: BRIZ

Acquired: 4
Active: 4

Displacement:
standard: 430 t
full load: 450 t

Dimensions
Length: 48 m (157.4 ft)
Beam: 8.8 m (28.9 ft)
Draught: 2 m (6.6 ft)

Speed: 15 kts
Range: 3,000 n miles at 10 kts

Complement: 43

SHIPS

BRIZ 61
SHKVAL 62
PRIBOY 63
SHTORM 64

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Russian minesweeping gear to be found in the 'Sonya' class MCMV includes:

- Mechanical sweep. One set per ship.
- Acoustic sweep. One set per ship. A low-frequency 'fish' can be seen on the quarterdeck of most Natyas.
- Magnetic sweep. One set per ship.

Deck gear includes:

- A single davit with 2,250 kg (4,960 lb) capacity and jib reach of 4.73 m (15.5 ft)
- A drum winch for contact and acoustic sweeps.
- Cable reel for the magnetic sweep.

MINEHUNTING SONARS

MG 69/79
A hull-mounted, high-frequency, active minehunting sonar.

WEAPONS SYSTEMS

GUNS

30 mm/65 AK 230
Bulgarian Sonyas are armed with two twin 30 mm/65 mounts.

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D
Type: High explosive
Weight (complete round): 1.40 kg (3.0 lb)
Projectile: 0.27 kg (0.6 lb)
Explosive: 30 g (A-XI-2)

MINES

Eight mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Kivach
I-band surface search/navigation radar.

IFF
Square Head (two per ship)
High Pole B

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kolomna Type 9-D-8 diesels; 1.47 MW (2,000 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

These are very similar to the Russian ships. They were transferred in 1981-84 and are all in service, based at Atiya.

532 (SONYA TYPE 1265)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Syria
Type: Coastal minehunter/sweeper (1265)

Class: SONYA

Acquired: 1
Active: 1

Displacement:
standard: 430 t
full load: 450 t

Dimensions
Length: 48 m (157.4 ft)
Beam: 8.8 m (28.9 ft)
Draught: 2 m (6.6 ft)

Speed: 15 kts
Range: 3,000 n miles at 10 kts

Complement: 43

SHIPS

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Russian minesweeping gear to be found in this 'Sonya' class MCMV includes:

- Mechanical sweep. One set per ship.
- Acoustic sweep. One set per ship. A low-frequency 'fish' can be seen on the quarterdeck of most Sonyas.
- Magnetic sweep. One set per ship.

Deck gear includes:

- A single davit with 2,250 kg (4,960 lb) capacity and jib reach of 4.73 m (15.5 ft)
- A drum winch for contact and acoustic sweeps.
- Cable reel for the magnetic sweep.

MINEHUNTING SONAR

MG 69/79
A hull-mounted, high-frequency, active minehunting sonar.

WEAPONS SYSTEMS

GUNS

30 mm/65 AK 230
532 is armed with two twin AK-230 30 mm/65 mounts.

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D
Type: High explosive
Weight (complete round): 1.40 kg (3.0 lb)
Projectile: 0.27 kg (0.6 lb)
Explosive: 30 g (A-XI-2)

Rates of fire (per barrel): 450 rds/min
Projectile: 0.28 kg (0.6 lb) HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,186 ft)

25 mm/80 2-M-3

Specifications
2-M-3
Calibre: 25 mm
Length of barrel: 60 calibres
Traverse: 360° at 25°/s
Elevation: −10 to +85° at 15°/s

MINES

Eight mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Kivach
I-band surface search/navigation radar.

IFF
Square Head (two per ship)
High Pole B

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kolomna Type 9-D-8 diesels; 1.47 MW (2,000 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

This is a standard export 'Sonya' class MCMV. It was formally transferred in January 1986 and is based at Tartous.

SONYA (TYPE 1265)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Vietnam
Type: Coastal minehunter/sweeper (1265)

Class: SONYA

Acquired: 4
Active: 4

Displacement:
standard: 430 t
full load: 450 t

Dimensions
Length: 48 m (157.4 ft)
Beam: 8.8 m (28.9 ft)
Draught: 2 m (6.6 ft)

Speed: 15 kts
Range: 3,000 n miles at 10 kts

Complement: 43

SHIPS

Four — numbers and names not known.

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Russian minesweeping gear to be found in the 'Sonya' class MCMV includes:

- Mechanical sweep. One set per ship.
- Acoustic sweep. One set per ship. A low-frequency 'fish' can be seen on the quarterdeck of most Sonyas.
- Magnetic sweep. One set per ship.

Deck gear includes:

- A single davit with 2,250 kg (4,960 lb) capacity and jib reach of 4.73 m (15.5 ft)
- A drum winch for contact and acoustic sweeps.
- Cable reel for the magnetic sweep.

MINEHUNTING SONAR

MG 69/79
A hull-mounted, high-frequency, active minehunting sonar.

WEAPONS SYSTEMS

GUNS

30 mm/65 AK 230

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,440 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D
Type: High explosive
Weight (complete round): 1.40 kg (3.0 lb)
Projectile: 0.27 kg (0.6 lb)
Explosive: 30 g (A-XI-2)

Elevation: −10 to +85° at 15°/s
Rates of fire: 450 rds/min/barrel
Projectile: 0.28 kg (0.6 lb) HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,186 ft)

25 mm/80 2-M-3

Specifications
2-M-3
Calibre: 25 mm
Length of barrel: 60 calibres
Traverse: 360° at 25°/s

MINES

Eight mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Kivach
I-band surface search/navigation radar.

IFF
Square Head (two per ship)
High Pole B

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kolomna Type 9-D-8 diesels; 1.47 MW (2,000 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

These are standard, new-production ships. The first transferred from Russia on 16 February 1987, followed by the second in February 1988, the third in July 1989, and the fourth in March 1990.

T 43 (TYPE 254, 254A)

OVERVIEW

Several hundred of these ocean minesweepers were built in various yards in the (then) Soviet Union between 1948 and 1957. A further twelve were built in Poland ('Zubr' class, now deleted) and 21 were built in China between 1956 and 1966. In a surprising sequel to that, however, the Chinese shipyards restarted production of the T 43 in the mid-1980s with 20 or so being produced by 1996, and an export order for four has recently been placed by Bangladesh. If the type is still being built in China in two years' time it will have been in production for 40 years, which must be some sort of a record.

The type designation in the (then) Soviet Union was *morskoy tralshchik* (seagoing minesweeper) and they were given 'MK' pennant numbers, but the class was given the reporting designation 'T 43' by NATO, rather than a name.

As with other minesweepers the type has proved readily adaptable to other uses and a number of this class have been converted into radar pickets, diving ships, tenders and patrol ships.

Exports
A number was exported abroad:

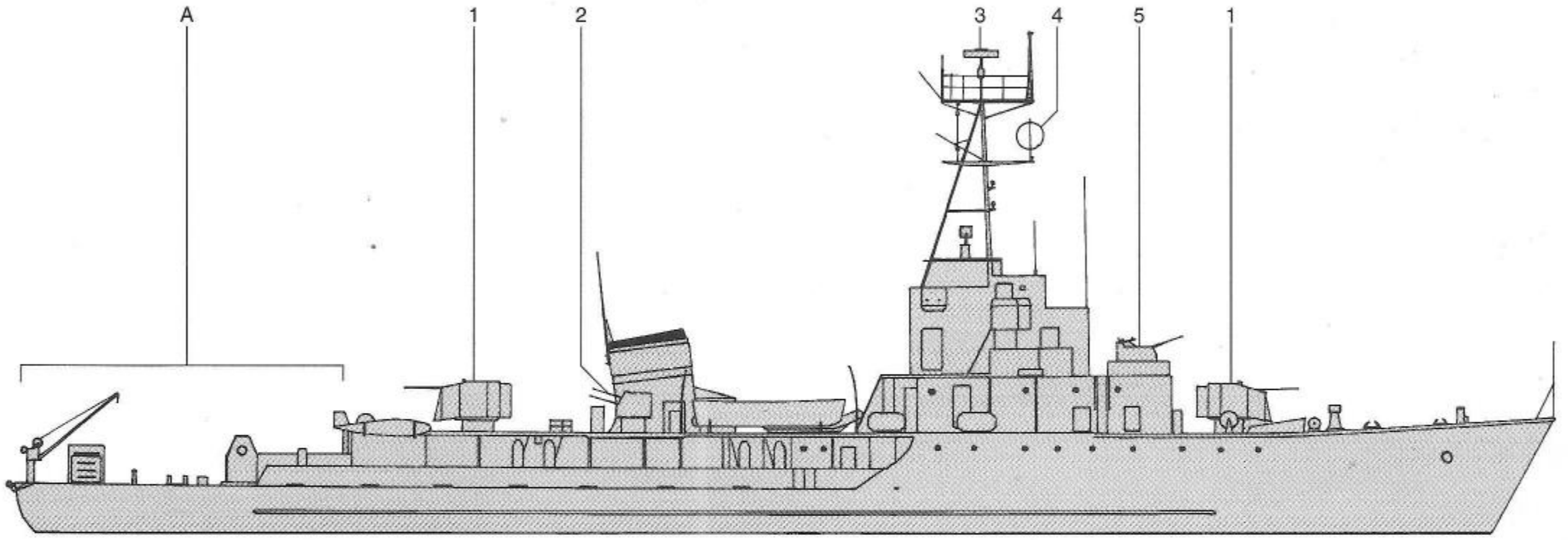
Algeria (two)
Albania (two)
Bulgaria (three)
China (four) (two later returned)
Egypt (seven)
Indonesia (six)
Iraq (two)
Syria (two)

Overseas construction

12 were built in Poland for the Polish Navy, one of which was converted to a radar picket in the late 1970s.

All have been stricken.

T 43 (TYPE 254)



T 43 (Type 254) (Ian Sturton)
MCM A *Sweep deck*

General 1 *Twin 37 mm/63 in W-11-M mounting* **2** *Twin 25 mm/60 cannon (two)* **3** *Fin Curve surface search/navigation radar* **4** *Cross Loop DF* **5** *Single 37 mm/63*

GENERAL SPECIFICATIONS

Operator: Russia
Type: Ocean minesweeper (254)

Class: T 43

National designation: *morskoy tralshchik* (seagoing minesweeper

Built: 200+
Active: 5

Displacement:
standard: 535 t
full load: 580 t

Dimensions
Length: 60 m (196.8 ft)

Beam: 8.4 m (27.6 ft)
Draught: 2.3 m (7.5 ft)

Speed: 15 kts
Range: 3,000 n miles at 10 kts; 2,000 n miles at 14 kts

Complement: 65

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Sweeping gear includes:

- MT-1 and MT-2 mechanical sweeps
- Acoustic sweep
- Magnetic sweep

MINEHUNTING SONAR

Stag Ear
Stag Ear is a hull-mounted, minehunting sonar derived from the Russian Tamir sonar, itself derived from British wartime searchlight sonars.

WEAPONS SYSTEMS

GUNS

37 mm/63 (W-11-M)
Two twins in open 'tub'-type mounts.

Specifications
Calibre: 37 mm
Length of barrel: 62.8 calibres

Muzzle velocity: 880 m/s (2,887 ft/s)
Traverse: 360°
Elevation: −10 to +85°
Traverse speed: 17°/s
Elevation speed: 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.6 lb)

Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,842 ft)
Crew: 3

14.5 mm machine guns
One or two twin heavy machine guns.

DEPTH CHARGES

Two projectors.

MINES

Sixteen mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Ball End
Ball End is a 1950s-vintage surface search radar.

Specifications
Frequency: E/F-band (2,950-3,020 MHz)
Beam: 7°
Peak power: 150 kW
Pulsewidth: 1 µs
PRF: 430 pps

Don 2 or Spin Trough
I-band navigation radars

IFF
Square Head.
High Pole A.

The Russian 'T 43' class was produced in greater numbers than any other post-Second World War MCMV
(H & L van Ginderen Collection)

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kolomna Type 9-D-8 diesels; 1.47 MW (2,000 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

Three of the survivors are in the Caspian Sea, one of which belongs to Azerbaijan. These are used as radar picket ships (PGR).

501 (T 43)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Albania
Type: Ocean minesweeper

Class: T 43

Acquired: 2
Active: 1

Displacement:
standard: 500 t
full load: 580 t

Dimensions
Length: 58 m (190.2 ft)
Beam: 8.4 m (27.6 ft)
Draught: 2.1 m (6.9 ft)

Speed: 15 kts
Range: 3,000 n miles at 10 kts; 2,000 n miles at 14 kts

Complement: 65

SHIPS

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Sweeping gear includes:

- MT-1 and MT-2 mechanical sweeps
- Acoustic sweep
- Magnetic sweep

MINEHUNTING SONAR

Stag Ear
Stag Ear is a hull-mounted, minehunting sonar derived from the Russian Tamir sonar, itself derived from British wartime searchlight sonars.

WEAPONS SYSTEMS

GUNS

37 mm/63 (W-11-M)
Two twins in open 'tub'-type mounts.

Specifications
Calibre: 37 mm
Length of barrel: 62.8 calibres
Muzzle velocity: 880 m/s (2,887 ft/s)
Traverse: 360°

Elevation: −10 to +85°
Traverse speed: 17°/s
Elevation speed: 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.6 lb)

Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,842 ft)
Crew: 3

14.5 mm machine guns
One or two twin heavy machine guns.

DEPTH CHARGES
Two projectors.

MINES
Sixteen mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Ball End
Ball End is a 1950s-vintage surface search radar.

Specifications
Frequency: E/F-band (2,950-3,020 MHz)
Beam: 7°
Peak power: 150 kW
Pulsewidth: 1 µs
PRF: 430 pps

Neptun
I-band navigation radar.

IFF
Square Head.
High Pole A.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kolomna Type 9-D-8 diesels; 1.47 MW (2,000 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

Two were transferred from the (then) USSR in 1960.
One was seen at sea in mid-1995.

SAGAR (T43)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Bangladesh
Type: Ocean minesweeper T 43

Class: SAGAR

Active: 1
Building: 3

Displacement:
standard: 520 t
full load: 590 t

Dimensions
Length: 60 m (196.8 ft)
Beam: 8.8 m (27.6 ft)
Draught: 2.3 m (6.9 ft)

Speed: 14 kts
Range: 3,000 n miles at 10 kts

Complement: 70 (10 officers)

SHIPS

SAGAR (M 91)
Builder Guangzhou Shipyard, China
Commissioned 27 Apr 1995

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Minesweeping gear includes:

- MPT-1 mechanical sweep (paravanes)
- MPT-3 mechanical sweep
- Acoustic and magnetic gear

MINEHUNTING SONAR

Tamir II
Tamir II is a hull-mounted, high-frequency sonar derived from British Second World War searchlight sonars.

WEAPONS SYSTEMS

GUNS

Chinese 37 mm/63
Two twin mounts. The 37 mm gun is a 62.8 calibre weapon with 2.32 m (7.6 ft) long barrel at the end of which is a flash suppressor. In the air-cooled single mounting there is an enclosed spring recuperator while in the twin mounting the barrels are enclosed in separate water jackets with exposed spring recuperators. Both weapons have a hydraulic recoil buffer underneath the barrel.

Specifications
Calibre: 37 mm
Length of barrel: 62.8 calibres
Traverse: 360°
Elevation: −10 to +85°
Traverse speed: 17°/s
Elevation speed: 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.6 lb)

Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,842 ft)
Crew: 3

25 mm/80 2-M-3
Two twin mounts.

Specifications
2-M-3
Calibre: 25 mm
Length of barrel: 60 calibres
Traverse: 360° at 25°/s
Elevation: −10 to +85° at 15°/s
Rates of fire: 450 rds/min/barrel
Projectile: 0.28 kg (0.6 lb) HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,186 ft)

China 14.5 mm/93
Two twin mounts.

DEPTH CHARGES

BMB-2 projectors
Two projectors for total of 20 depth charges.

MINES

12 to 16 mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADAR

Fin Curve
I-band surface search radar.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 PRC/Kolomna Type 9-D-8 diesels; 1.47 MW (2,000 hp(m))
Shafts: 2

FURTHER INFORMATION

These four ships were ordered from China in 1993 and are expected to be delivered at a rate of one a year.

These are new build ships but the details given are for those in service in the Chinese Navy. There may be some changes.

TYPE 010 (T 43)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: People's Republic of China
Type: Ocean minesweeper
Chinese Type: Type 010

Class: T 43

Acquired from USSR: 4
Built in PRC: 21 (1956-66); 20 plus (1985-)

Active: 28
Reserve: 6

Displacement:
standard: 520 t
full load: 590 t

Dimensions
Length: 60 m (196.8 ft)

Beam: 8.8 m (27.6 ft)
Draught: 2.3 m (6.9 ft)

Speed: 14 kts
Range: 3,000 n miles at 10 kts

Complement: 70 (10 officers)

SHIPS

Among the pennant numbers known to exist are: 364-6, 377-9, 386-9, 396-9, 801-3, 807-9, 821-3, 829-832, 853-4, 863, 994-6

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Minesweeping gear includes:

- MPT-1 mechanical sweep (paravanes)
- MPT-3 mechanical sweep
- Acoustic and magnetic gear

MINEHUNTING SONAR

Tamir II
Tamir II is a hull-mounted, active search and attack, high-frequency, minehunting sonar derived from British wartime searchlight sonars.

WEAPONS SYSTEMS

GUNS

Armament in this class varies considerably:

37 mm/63. All ships have a twin 37 mm aft in 'X' position, and all except the three with the 85 mm (below) have a second twin 37 mm forward in 'A' position.
85 mm/52 Mk 90K. There are reports that some carry an 85 mm. This is presumably the same mounting/weapon that used to be seen aboard 'Kronshtadt' class patrol craft.
25 mm/60. All have two twin 25 mm/60 mounts
14.5 mm machine guns. All have two twin 14.5 mm machine guns

Chinese 37 mm/63
One or two twin mounts. The 37 mm gun is a 62.8 calibre weapon with 2.32 m (7.6 ft) long barrel at the end of which is a flash suppressor. In the air-cooled single mounting there is an enclosed spring recuperator while in the twin mounting the barrels are enclosed in separate water jackets with exposed spring recuperators. Both weapons have a hydraulic recoil buffer underneath the barrel.

Specifications
Calibre: 37 mm
Length of barrel: 62.8 calibres
Traverse: 360°
Elevation: −10 to +85°
Traverse speed: 17°/s
Elevation speed: 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.6 lb)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,840 ft)
Crew: 3

25 mm/80 2-M-3
Two twin mounts.

Specifications
2-M-3
Calibre: 25 mm
Length of barrel: 60 calibres
Traverse: 360° at 25°/s
Elevation: −10 to +85° at 15°/s
Rates of fire: 450 rds/min/barrel
Projectile: 0.28 kg (0.6 lb) HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,186 ft)

Chinese 14.5 mm/93
Two twin 14.55 mm machine guns.

85 mm L/55.2 (90K)
Some of these ships mount a single 85 mm/52 gun in 'A' position. This Russian-designed weapon was found mainly in Russian-built 'Kronshtadt' class patrol boats, a number of which served in the PLA-N, and these weapons may have come from those boats when they were scrapped in the later 1980s. The 90K 85 mm mounting weighs 5.5 t, is 2.7 m (8.85 ft) high, 6 m (19.7 ft) long (including the barrel) and 3 m (9.8 ft) wide. It is of monobloc construction with vertical sliding wedge breech and a muzzle brake. The barrel fits into a cradle on a powered, turntable mounting which incorporates reflector sights and transmitters. The weapon fires a 9.54 kg (21 lb) fixed round with about 0.75 kg (1.6 lb) bursting charge of TNT. The mount is locally controlled.

Specifications
85 mm L/55.2 (90K)
Calibre: 85 mm
Length of barrel: 55.2 calibres
Muzzle velocity: 825 m/s (2,707 ft/s)
Traverse: 360°
Elevation: −5 to +75°
Ammunition (total): 9.54 kg (21.0 lb)
Rate of fire: 18 rds/min
Range:
anti-surface: 7 n miles (14 km)
anti-air: 8,400 m (27,559 ft)

DEPTH CHARGES

BMB-2
Two projectors per ship for 20 depth charges.

MINES

12 to 16 mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Fin Curve or Type 756
I-band surface search radar.

IFF
High Pole or Yard Rake.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 PRC/Kolomna Type 9-D-8 diesels; 1.47 MW (2,000 hp(m))
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The PLA-N received four T 43 MCMVs from the (then) Soviet Navy in the mid-1950s, of which two were later returned in 1960. 21 were then produced between 1956 and 1966, of which three were later converted to survey ships and three became civilian-manned research ships.

Unconfirmed reports in the late 1980s said the PLA-N was considering building 'Lerici' class MCMVs under licence, but if this was true it came to naught. It does, however, indicate a requirement for MCMVs and the fact that the T 43 was placed back in production at the end of the 1980s must be directly related to this.

The type is still in production at Wuzhang and at Guangzhou, and is also being exported to Bangladesh.

DEPLOYMENT

There are between 30 and 40 in service. Of these ten are in the North Sea Fleet, nine in the East Sea Fleet and eight in the South Sea Fleet, and some of these are employed as patrol ships with the sweep gear removed. Six are in reserve.

GHARBIYA (T 43)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Egypt
Type: Ocean minesweeper

Class: T 43

Acquired: 7
Active: 6

Displacement:
standard: 500 t
full load: 580 t

Dimensions
Length: 58 m (190.2 ft)
Beam: 8.4 m (27.6 ft)
Draught: 2.1 m (6.9 ft)

Speed: 15 kts
Range: 3,000 n miles at 10 kts; 2,000 n miles at 14 kts

Complement: 65

SHIPS

GHARBIYA 501
SHARKIYA 504
DAQAHLIYA 507
BAHARIYA 510
SINAI 513
ASSIOUT 516

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Minesweeping gear includes:

- MPT-1 mechanical sweep (paravanes)
- MPT-3 mechanical sweep
- Acoustic and magnetic gear

MINEHUNTING SONAR

Stag Ear

Tamir II (NATO = Stag Ear) is a hull-mounted, high-frequency sonar developed from the Russian Tamir I sonar, which was itself derived from British wartime searchlight sonars.

WEAPONS SYSTEMS

GUNS

37 mm/63

Two twin mounts. The 37 mm gun is a 62.8 calibre weapon with 2.32 m (7.6 ft) long barrel at the end of which is a flash suppressor. In the air-cooled single mounting there is an enclosed spring recuperator while in the twin mounting the barrels are enclosed in separate water jackets with exposed spring recuperators. Both weapons have a hydraulic recoil buffer underneath the barrel.

Specifications
Calibre: 37 mm
Length of barrel: 62.8 calibres
Traverse: 360°
Elevation: −10 to +85°
Traverse speed: 17°/s
Elevation speed: 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.6 lb)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9.842 ft)
Crew: 3

12.7 mm machine guns

The ships are reported to have four twin 12.7 mm machine guns each.

MINES

20 mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADAR

Don 2

I-band navigation radar.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kolomna Type 9-D-8 diesels; 1.47 MW (2,000 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

The T 43s were delivered from the (then) Soviet Union in the early 1970s. Others of the class have been sunk or used as targets or cannibalised for spares. The plan to fit these ships with VDS sonars and ROVs has been shelved in favour of new minehunters, although there may well be funding problems for such a plan. All were still in service in 1995.

T 43 #513 of the Egyptian Navy. Note the quad 12.7 mm machine guns before the bridge and the absence of any sensors on the mast except for one navigation radar at the masthead (H & L van Ginderen Collection)

T 43

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Indonesia
Type: Ocean minesweeper

Class: T 43

Acquired: 6
Active: 2

Displacement:
standard: 500 t
full load: 580 t

Dimensions
Length: 58 m (190.2 ft)
Beam: 8.4 m (27.6 ft)
Draught: 2.1 m (6.9 ft)

Speed: 15 kts
Range: 3,000 n miles at 10 kts; 2,000 n miles at 14 kts

Complement: 77

SHIPS

PULAU RANI (701)
PULAU RATAWO (702)

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Minesweeping gear includes:

- MPT-1 mechanical sweep (paravanes)
- MPT-3 mechanical sweep
- Acoustic and magnetic gear

MINEHUNTING SONAR

Stag Ear
Tamir II (NATO = Stag Ear) is a hull-mounted, high-frequency sonar developed from the Russian Tamir I sonar, which was itself derived from British wartime searchlight sonars.

WEAPONS SYSTEMS

GUNS

37 mm/63
Two twin mounts. The 37 mm gun is a 62.8 calibre weapon with 2.32 m (7.6 ft) long barrel at the end of which is a flash suppressor. In the air-cooled single mounting there is an enclosed spring recuperator while in the twin mounting the barrels are enclosed in separate water jackets with exposed spring recuperators. Both weapons have a hydraulic recoil buffer underneath the barrel.

Specifications
Calibre: 37 mm
Length of barrel: 62.8 calibres
Traverse: 360°
Elevation: −10 to +85°
Traverse speed: 17°/s
Elevation speed: 13°/s
Rate of fire: 80 rds/min/barrel
Ammunition (projectile): 0.732 kg (1.6 lb)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 3,000 m (9,842 ft)
Crew: 3

12.7 mm machine guns
The ships are reported to have four twin 12.7 mm machine guns each.

MINES

20 mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca 110
I-band navigation radar.

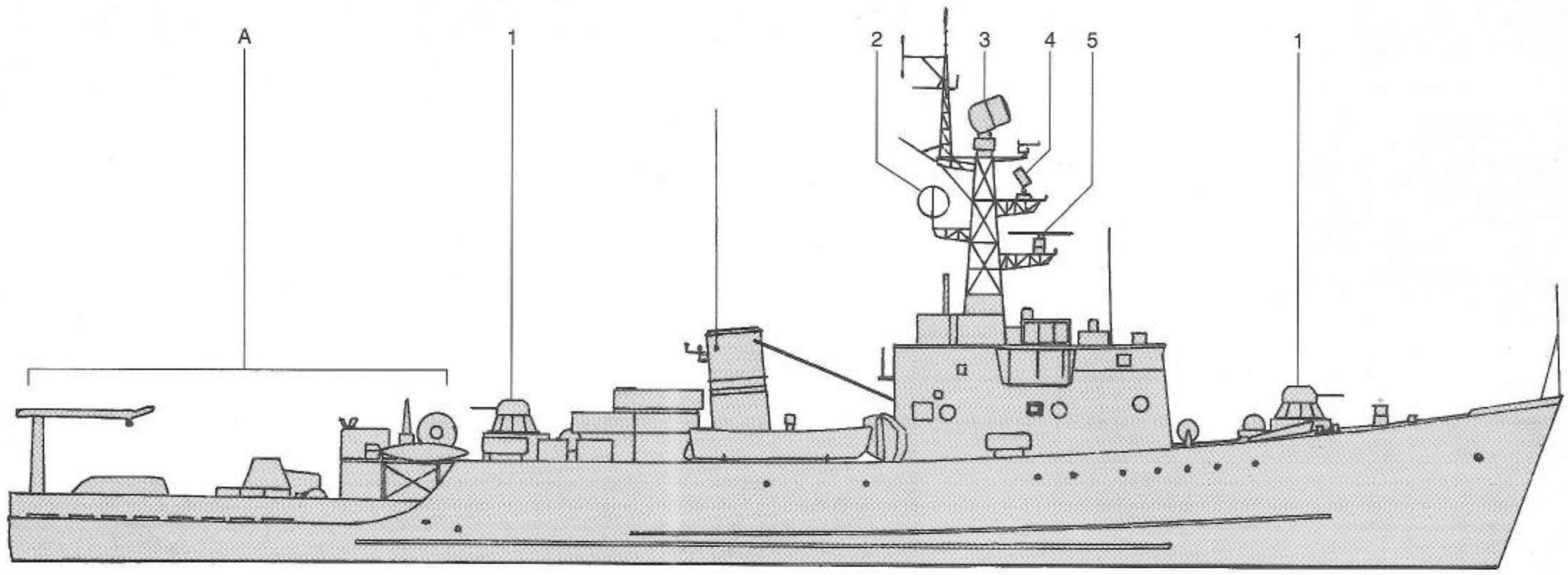
PROPULSION

Specifications
System: Diesel
Main machinery: 2 Kolomna Type 9-D-8 diesels; 1.47 MW (2,000 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

The Indonesian Navy received four T 43 MCMVs from the (then) USSR in 1962, followed by a further two in 1964. Only two now remain and both are used primarily as patrol craft. Both were at sea in 1995.

YURKA (TYPE 266)



'Yurka' class (Ian Sturton)
MCM A *Sweep deck*

General 1 *Twin AK-230 30 mm/65 cannon* **2** *Crossed Loop DF* **3** *Drum Tilt fire-control radar* **4** *Square Head IFF (2)* **5** *Spin Trough surface search/navigation radar*

GENERAL SPECIFICATIONS

Operator: Russia
Type: Ocean minesweeper (266)

Class: YURKA

National designation: *morskoy tralshchik* (sea-going minesweeper)

Built: 40
Active: 2

Displacement:
standard: 520 t
full load: 540 t

Dimensions
Length: 52.4 m (171.9 ft)

Beam: 9.4 m (30.8 ft)
Draught: 2.6 m (8.5 ft)

Speed: 17 kts
Range: 1,500 n miles at 12 kts

Complement: 45

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Fitted for wire, magnetic and acoustic sweeping.

MINEHUNTING SONAR

Tamir II
Tamir II (NATO = Stag Ear) is a hull-mounted, active, high-frequency, minehunting sonar. It is a development of the Russian Tamir I series sonars, which was, itself, derived from British wartime searchlight sonars.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Igla-1 (SA-N-5 Grail)
Some ships carry the Igla-1 system using the *Strela 2* 9M43M missile (NATO = SA-N-5), which is housed in a glass fibre launcher-container; these ships carry a total of 18 missiles. The missile has an uncooled lead sulphide infra-red seeker, operating in the 1.7 to 2.8 µm range and with a spinning reticle, centre-null tracking system with a 1.9° field of view. On acquiring the target, the operator activates the thermal battery and when the seeker has acquired the target an audio signal is received telling the operator to take the first pressure on the trigger and activate the missile gyros which warm up in four to six seconds. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target and then takes the second pressure on the trigger to launch the missile. The booster burns for 0.05 seconds to eject the missile from the launch tube at a speed of 28 m/s (91.8 ft/s) and spin it up and then, at a distance of 6 m (19.6 ft), the sustainer ignites and the trailing fins pop out. The missile homes on the 'hottest' part of the aircraft and has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M the warhead has improved fragmentation uniformity.

Specifications
Length: 1.45 m (4.7 ft)
Diameter: 7 cm (2.7 in)
Weight: 9.97 kg (22 lb)
Speed: Mach 1.7
Range:
anti-surface: 2.6 n miles (4.8 km)
anti-air: 18-4,500 m (59-14,764 ft)

Manufacturer/Contractor
Fakel, Russia.

GUNS

30 mm/65 AK 230
Two twin AK-230.

Specifications
30 mm/65 AK 230
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D
Type: High explosive
Weight (complete round): 1.40 kg (3.0 lb)
Projectile: 0.27 kg (0.6 lb)
Explosive: 30 g (A-XI-2)

MINES

Ten mines can be carried.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog
Watch Dog is an intercept and radar warning system which has been in service for over 30 years. It is a wide-open system with an array consisting of four tiers of eight microwave horns. It covers frequencies from D- to H-band and normally has two arrays, one on each side of the ship.

COMMAND AND CONTROL SYSTEMS

RADARS

Don 2/Spin Trough
I-band surface search/navigation radars.

Drum Tilt
There is one Drum Tilt, H/I band radar for the twin 30 mm guns. The cylindrical radar is permanently tilted upwards at 30° and approximate ranges are reported to be: acquisition 21.6 n miles (40 km) tracking 12.4 n miles (23 km). Russian name is *Rys*.

IFF
Square Head: Two per ship.
High Pole B.

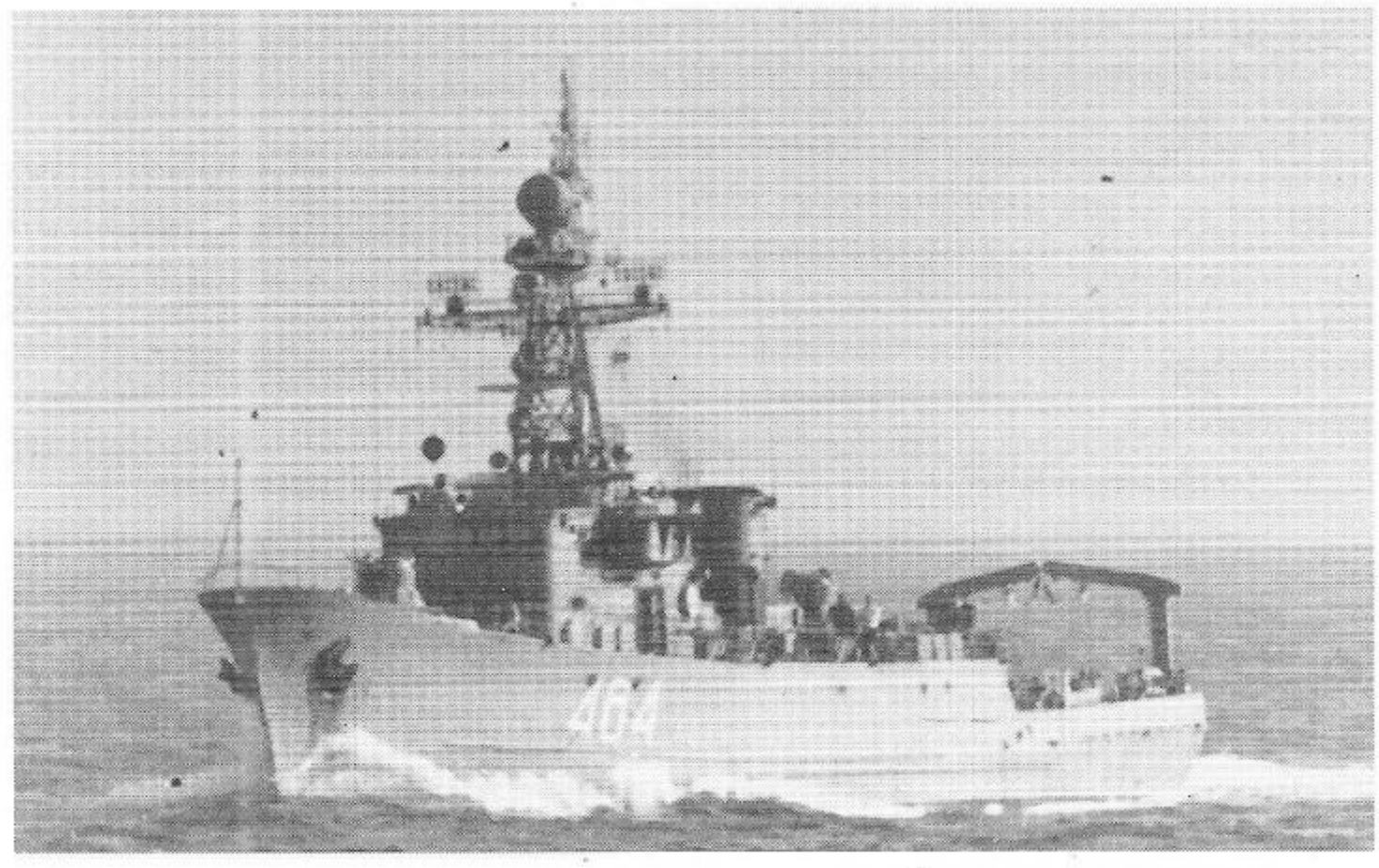
PROPULSION

Specifications
System: Diesel
Main machinery: 2 Type M 503 diesels; 3.91 MW (5,350 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

This class of medium-sized ocean-going minesweepers was built between 1963 and 1972 at Kolpino and Khabarovsk. A total of 42 was built. They have a hull constructed of low-magnetic steel and an unusual wide stack, indicating that the two deisel engines are situated side by side.

One sank in the Black Sea in August 1989 after an explosion. There are just two survivors in the Russian Navy and of those only one is in an operational state. Six were exported: Egypt — 4 (1969); Vietnam — 2 (1979).



Yurka *at sea. Note the swan-neck cranes afts, Drum Tilt at masthead and two Square Head IFF on yardarms* (H & L van Ginderen Collection)

GIZA (YURKA TYPE 266)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Egypt
Type: Ocean minesweeper (266)

Class: YURKA

Purchased: 4
Active: 4

Displacement:
standard: 520 t
full load: 540 t

Dimensions
Length: 52.4 m (171.9 ft)
Beam: 9.4 m (30.8 ft)
Draught: 2.6 m (8.5 ft)

Speed: 17 kts
Range: 1,500 n miles at 12 kts

Complement: 45

SHIPS

GIZA (530)
ASWAN (533)
QENA (536)
SOHAG (539)

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Fitted for wire, magnetic and acoustic sweeping.

MINEHUNTING SONAR

Tamir II

Tamir II (NATO = Stag Ear) is a hull-mounted, active, high-frequency, minehunting sonar. It is a development of the Russian Tamir I series sonars, which was, itself, derived from British wartime searchlight sonars.

WEAPONS SYSTEMS

GUNS

30 mm/65 AK 230

Two twin AK-230. Note that there is no Drum Tilt fire control for these weapons.

Specifications

30 mm/65 AK 230
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D
Type: High explosive
Weight (complete round): 1.40 kg (3.0 lb)
Projectile: 0.27 kg (0.6 lb)
Explosive: 30 g (A-XI-2)

MINES

Ten mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADAR

Don 2

I-band navigation radar.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Type M 503 diesels; 3.91 MW (5,350 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

These steel-hulled ocean-going minesweepers were built between 1963 and 1969 and were transferred from the (then) Soviet Union in 1969. The Egyptian 'Yurka' class does not carry Drum Tilt fire-control radar and has a number of ship's-side scuttles (possibly to improve ventilation in the hot climate). A plan was made at one stage to equip them with VDS, but this has been shelved in favour of new minehunters. At least one operates an ROV of an unknown type.

Centre is one of the four Egyptian Navy 'Yurka' class ocean minesweepers. Others in the picture are (left to right): Romeo submarine #855; 'Shanyha II' class FAC #795; (Yurka); 'Polnocny A' class LSM. Note that the 'Yurka' MCMV does not have a Drum Tilt fire-director radar

HQ 851 (TYPE 266)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Vietnam
Type: Ocean minesweeper (266)

Class: YURKA

Acquired: 2
Active: 2

Displacement:
full load: 540 t

Dimensions
Length: 52.4 m (171.9 ft)
Beam: 9.4 m (30.8 ft)
Draught: 2.6 m (8.5 ft)

Speed: 17 kts
Range: 1,500 n miles at 12 kts

Complement: 45

SHIPS

HQ 851
HQ 852

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Fitted for wire, magnetic and acoustic sweeping.

MINEHUNTING SONAR

Tamir II
Tamir II (NATO = Stag Ear) is a hull-mounted, active, high-frequency, minehunting sonar. It is a development of the Russian Tamir I series sonars, which was, itself, derived from British wartime searchlight sonars.

WEAPONS SYSTEMS

GUNS

30 mm/65 AK 230
Two twin AK-230.

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D
Type: High explosive

Weight (complete round): 1.40 kg (3.0 lb)
Projectile: 0.27 kg (0.6 lb)
Explosive: 30 g (A-XI-2)

MINES

Ten mines can be carried.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Watch Dog
Watch Dog is an intercept and radar warning system which has been in service for over 30 years. It is a wide-open system with an array consisting of four tiers of eight microwave horns. It covers frequencies from D to H-band and normally has two arrays, one on each side of the ship.

COMMAND AND CONTROL SYSTEMS

RADARS

Don 2
I-band surface search/navigation radar.

Drum Tilt
There is one Drum Tilt, H/I band radar for the twin 30 mm guns. The cylindrical radar is permanently tilted upwards at 30° and approximate ranges are reported to be: acquisition — 40,000 m (131,233 ft); tracking 23,000 m (75,459 ft). Russian name is *Rys*.

IFF
Square Head: Two per ship.
High Pole B.

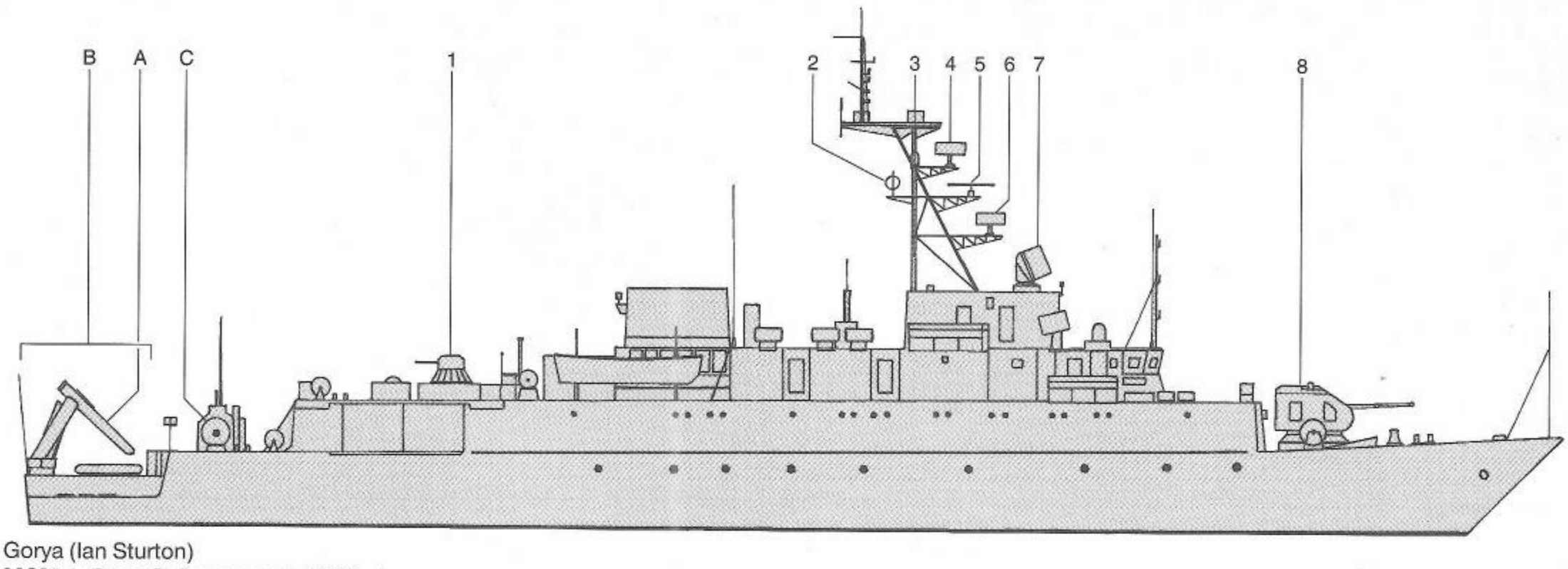
PROPULSION

Specifications
System: Diesel
Main machinery: 2 Type M 503 diesels; 3.91 MW (5,350 hp(m)) sustained
Shafts: 2

FURTHER INFORMATION

These ships were transferred from the (then) Soviet Union in December 1979 and would appear to be standard Russian Navy versions, rather than the export model supplied to Egypt, as they have the Drum Tilt fire-control radar.

GORYA (TYPE 1260)



Gorya (Ian Sturton)
MCM A *Crane* **B** *Sweep deck* **C** *Winch*

General 1 *AK-630 30 mm CIWS* **2** *Cross Loop DF* **3** *Salt Pot* **4** *Palm Frond surface search radar* **5** *Nayada navigation radar* **6** *Square Head IFF (two)* **7** *Bass Tilt fire control* **8** *AK-176 76 mm (3 in)/60*

GENERAL SPECIFICATIONS

Operator: Russia
Type: Ocean minehunter (1260)

Class: GORYA

Built: 2
Active: 2

Displacement:
standard: 900 t
full load: 1,130 t

Dimensions
Length: 66 m (216.5 ft) (oa); 60 m (200.1 ft) (wl)
Beam: 11 m (36.1 ft)
Draught: 3.3 m (10.8 ft)

Speed: 17 kts
Range: n/k

Complement: 70

SHIPS

A ZHELEZNYAKOV
Builder Kolpino Yard, St Petersburg, Russia
Completed late 1986

A GUMANENKO
Builder Kolpino Yard, St Petersburg, Russia
Completed 1991

MINE COUNTERMEASURES SYSTEMS

These expensive ships appear to have been designed and built to counter a specific US/NATO threat. They carry:

- Two remotely controlled submersibles which are launched/recovered through large sliding doors in the superstructure beneath the after AKG-630 mount. These submersible carry large demolition charges.
- Special sweeping gear, which is launched and recovered using the large crane on the quarterdeck.
- The ships may also be fitted with accurate positional fixing equipment.

MINEHUNTING SONAR

It is a reasonable assumption that these ships are fitted with a hull-mounted, high-frequency, active search, mine detecting sonar.

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

SA-N-5 Grail

Two SA-N-5 Grail launchers are carried. The Strela 2 9M43M missile uses an infra-red seeker, operating in the 1.7 to 2.8 µm range and with a spinning reticle, centre-null tracking system with a 1.9° field of view. On acquiring the target, the operator activates the thermal battery and when the seeker has acquired the target an audio signal is received, which tells the operator him to take the first pressure on the trigger. This activates the missile gyros which warm up in four to six seconds. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target then fully engages the trigger to launch the missile.

The booster ejects the missile from the launch tube and spins it up, and when it has travelled some 6 m (19.6 ft), the sustainer ignites and the trailing fins pop out. The missile homes on the 'hottest' part of the aircraft and probably has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M the warhead has improved fragmentation uniformity.

Specifications
Length: 1.45 m (4.7 ft)
Diameter: 7 cm (2.7 in)
Weight: 9.97 kg (22 lb)
Speed: Mach 1.7
Range: 2.6 n miles (4.8 km)
Altitude: 18-4,500 m (59-14,760 ft)

Manufacturer/Contractor
Fakel, Russia.

GUNS

AK-176 76 mm (3 in)/60

There is one AK-176 in 'A' position, which can be operated from the weapon control centre or under local control.

Specifications
Calibre: 76 mm
Length of barrel: 59 calibres
Traverse: 360°
Elevation: −3 to +85°
Traverse speed: 35°/s
Elevation speed: 30°/s
Ammunition (total): 16 kg (35.3 lb)
Rate of fire: 120 rds/min
Range:
anti-surface: 3.75 n miles (7 km)
anti-air: 10,000 m (32,800 ft)

30 mm/65 AK 630

One AK 630 CIWS is mounted aft, consisting of a water-cooled, six-barrelled, Gatling-principle, AO-18, high volume-of-fire gun system, a separate fire-control radar and a below-deck control station with remote optical and/or electro-optical sensor. It has four roles; engaging anti-ship missiles, engaging aircraft, engaging small surface vessels and drifting mines and engaging unprotected targets ashore.

Specifications
Calibre: 30 mm
Length of barrel: 65 calibres
Muzzle velocity: 890 m/s (2,920 ft/s)
Traverse: 360°
Elevation: −12 to +88°
Traverse speed: 70°/s
Elevation speed: 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (13,120 ft)
electro-optic fire control: 5,000 m (16,400 ft)
Rate of fire: 4,000-5,000 rds/min

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES (ESM)

Cross Loop; Long Fold
These ships have two ESM devices identified as Cross Loop and Long Fold.

DECOYS

PK-16
Two PK-16 decoy launchers for chaff.

COMMAND AND CONTROL SYSTEMS

RADARS

Palm Frond
I-band surface search radar.

Nayada
I-band navigation radar.

Bass Tilt fire-control radar
Bass Tilt is the NATO reporting name for the Russian H-band naval fire-control radar which directs the fire of the AK-630 30 mm guns. The weapon system and director are mounted on a pedestal, with the drum-shaped antenna radome, 1.2 m (3.9 ft) in diameter, inclined at an angle of approximately 45°. The director is 2 m (6.56 ft) high and 1.45 m (4.7 ft) long. The radar is probably linked to a ballistic computer and each director controls one or two gun mountings.

IFF
Salt Pot C
Square Head

PROPULSION

Specifications
System: Diesel
Main machinery: Probably four diesel engines
Shafts: Probably 2

FURTHER INFORMATION

PROGRAMME

The 'Gorya' class was originally intended to be some 20 strong, but construction ended with the completion of the second, although it is reported that a third was partially built at the time the programme was cancelled

DESIGN

The Goryas are very sophisticated and therefore expensive, and appear to have been intended — at least in part — to counter the US Navy's CAPTOR mines which are designed to be moored at depths exceeding 300 m (1,000 ft). The hull is constructed of steel and the superstructure may be aluminium alloy.

The principal MCM system is a submersible ROV, two of which are housed in a hangar at the after end of the supersturcture. They are launched and recovered through two large side doors using either extending rails or an overhead crane. The ROVs carry two 100 kg (220 lb) demolition charges.

The sweep deck aft is very small, although the presence of a large swan-neck crane and a winch indicate that at least one mechanical sweep can be deployed.

DEPLOYMENT

Zheleznyakov is used for training in the Black Sea. *Gumanenko* conducted sea trials in 1992 in the Baltic but has not been seen since then.

Zheleznyakov, *one of two 'Gorya' class MCMVs completed before this very expensive programme was abandoned* (US Navy)

VANYA

OVERVIEW

The 'Vanya' class was a completely new design which first appeared in 1960 and, at the time, was felt to bear a more than passing resemblance to the NATO coastal minesweepers then under construction in US and European shipyards. Like Western designers, the Russians wanted to reduce the magnetic, acoustic and hydrodynamic signatures of these MCMVs and two versions of the same design were produced, one with a wooden hull the other with amagnetic steel hull. The wooden version, Type 257D, was selected for production.

As with the NATO designs there is a long forecastle with a relatively short sweepdeck on which the gear is stored. One unusual feature of the Russian design is the absence of a stack, the diesel exhausts using vents in the hull and accounting for the extensive black stains to be seen on the after part of the hull of most Vanyas. The only weapon to be carried is a special low-magnetic signature AK-230 on the forecastle.

The early ships (Type 257D) carried only two types of sweeping equipment, a mechanical sweep and an electromagnetic sweep, only one of which could be used at a time. A later version (Type 257DM) could handle combination sweeps and an improved mechanical sweep. This version was also exported as Type 257DME.

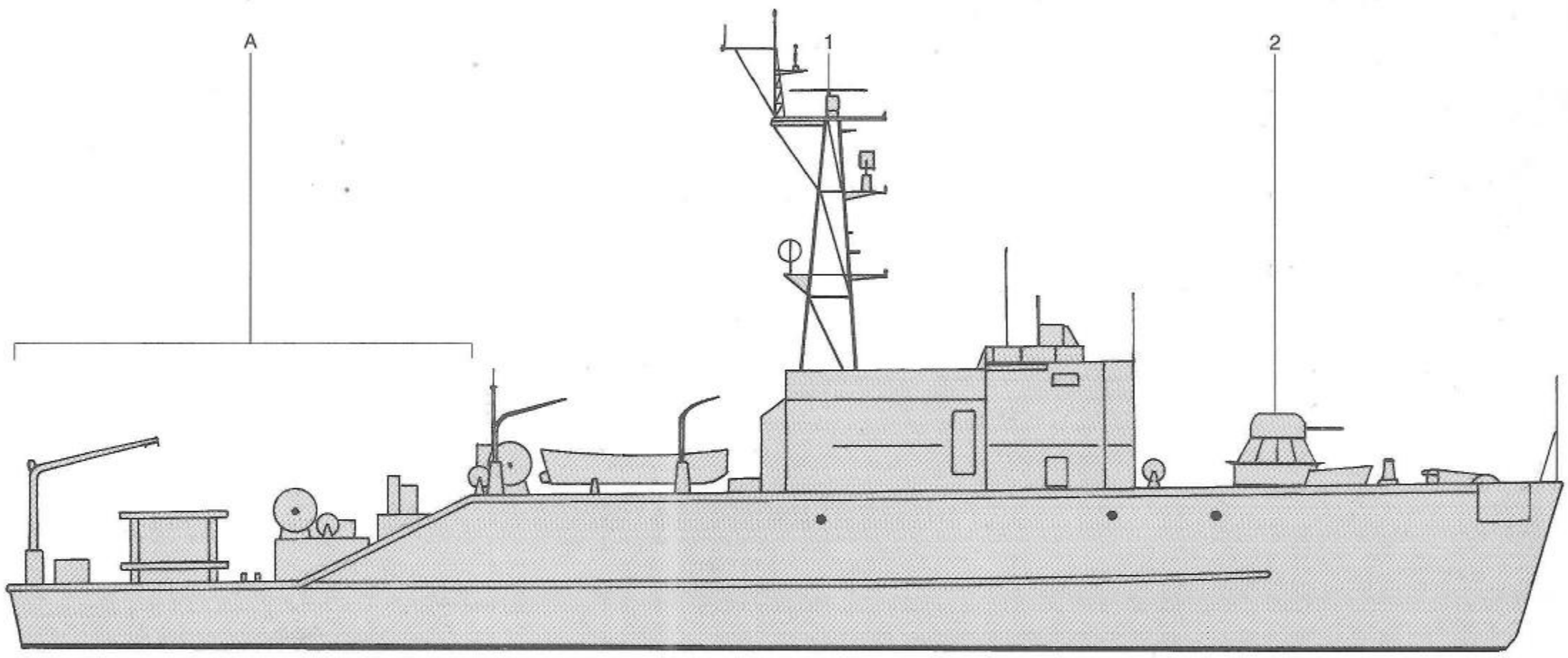
Another version, given the reporting name Vanya II by NATO, and with the Russian designation Type 699, was developed later, and three were built. These have an extended superstructure, a 25 mm mounting on the forecastle in place of 30 mm, a lattice mast at the break amidships and two boats stowed on the quarterdeck.

A total of 44 Vanya Is were built, plus three Vanya IIs. The majority of these have been deleted, starting in 1988, and in early 1997 only 13 Vanya Is and two Vanya IIs remain in service, and these are expected to be stricken in the near future.

EXPORTS

The only model to be exported was Type 257DME, of which Bulgaria received six between 1970 and 1985, and two went to Syria in 1973.

VANYA



'Vanya' class (Ian Sturton)
MCM A *Sweep deck*

General 1 *Don 2 navigation radar* **2** *AK-230 twin 30 mm*

GENERAL SPECIFICATIONS

Operator: Russia
Type: Coastal minehunter/sweeper

Class: VANYA (TYPE 257D)

National designation: *Bazovy tralshchik* (base minesweeper)

Active: 13

Class: MOD. VANYA (TYPE 257DM/DT)
Active: 2

Displacement:
standard: 200 t
full load: 245 t

Dimensions
Length: 40 m (131.2 ft)

Beam: 7.3 m (23.9 ft)
Draught: 1.8 m (5.9 ft)

Speed: 16 kts
Range: 1,400 n miles at 14 kts; 2,400 n miles at 10 kts

Complement: 36

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Type 257D
The earlier ships, Type 257D, carry a mechanical sweep and an electromagnetic sweep, only one of which can be used at a time.

Type 257DM/Type 257DME
The later ships, Type 257DM, and those built for export (Type 257DME) carry several types of combination sweeps, and an improved mechanical sweep.

MINEHUNTING SONAR

MG 69/79 hull-mounted minehunting sonar.

WEAPONS SYSTEMS

GUNS

30 mm/65 AK 230

Vanya I only. One twin AK 230 – 30 mm/65 is mounted on the foredeck. It is used for self-defence but is also used to detonate buoyant mines which have been brought to the surface.

Specifications

AK-230
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D
Type: High explosive
Weight (complete round): 1.40 kg (3.1 lb)
Projectile: 0.27 kg (0.6 lb)
Explosive: 30 g (A-XI-2)

2-M-3 25 mm/60

Vanya II only. The Vanya IIs have one twin 25 mm/60 mount in place of the AK-230 in the Vanya Is. As in the earlier ships, this weapon is also used for mine destruction.

Specifications
Calibre: 25 mm
Length of barrel: 60 calibre
Traverse: Unlimited
Elevation: −10 to +85°
Traverse speed: 25°/s
Elevation speed: 15°/s
Rates of fire: 450 rds/min/barrel
Projectile: 0.28 kg (0.6 lb) HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,186 ft)

MINES

These MCMVs can also be used to carry and lay mines: eight in Vanya I and twelve in Vanya II.

COMMAND AND CONTROL SYSTEMS

RADARS

Don 2

Vanya I only. One of the standard Russian, I-band navigation radars.

Don Kay

Vanya II only. The later ships mount the Don Kay I-band navigation radar.

IFF

Square Head (unmodified)
High Pole B.

PROPULSION

Specifications
System: Diesel
Main machinery:
Vanya I: 2 M 503 diesel; 1.84 MW (2,502 hp(m))
Vanya II: 2–2,500 hp diesels, type unknown
Shafts: 2

FURTHER INFORMATION

Only 13 Vanya I plus two Vanya II remain in service and are likely to be deleted in the near future. Five are based in the Caspian Sea.

ISCAR (TYPE 257DME)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Bulgaria
Type: Coastal minesweeper

Class: ISCAR (VANYA, TYPE 257DME)

Purchased: 6
Active: 4

Displacement:
full load: 245 t

Dimensions
Length: 40 m (131.2 ft)
Beam: 7.3 m (23.9 ft)
Draught: 1.8 m (5.9 ft)

Speed: 16 kts
Range: 1,400 n miles at 14 kts; 2,400 n miles at 10 kts

Complement: 36

SHIPS

ISKAR 31
ZIBAR 32
DOBROTICH 33
EVSTATI VINAROV 34

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Type 257DME

The ships built for export (Type 257DME) carry several types of combination sweeps, and an improved mechanical sweep.

MINEHUNTING SONAR

MG 69/79 hull-mounted minehunting sonar.

WEAPONS SYSTEMS

GUNS

30 mm/65 AK 230

One twin AK 230 30 mm/65 is mounted on the foredeck. It is used for self-defence but is also used to detonate buoyant mines which have been brought to the surface.

Specifications

AK-230
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)

Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83
Type: Armour-piercing tracer

Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D
Type: High explosive
Weight (complete round): 1.40 kg (3.0 lb)
Projectile: 0.27 kg (0.6 lb)
Explosive: 30 g (A-XI-2)

MINES

These MCMVs can also be used to carry and lay eight mines.

COMMAND AND CONTROL SYSTEMS

RADARS

Don 2

I-band surface search radar.

IFF

Square Head
High Pole B

PROPULSION

Specifications

System: Diesel
Main machinery: 1 M 503 diesel; 1.84 MW (2,502 hp(m))
Shafts: 1

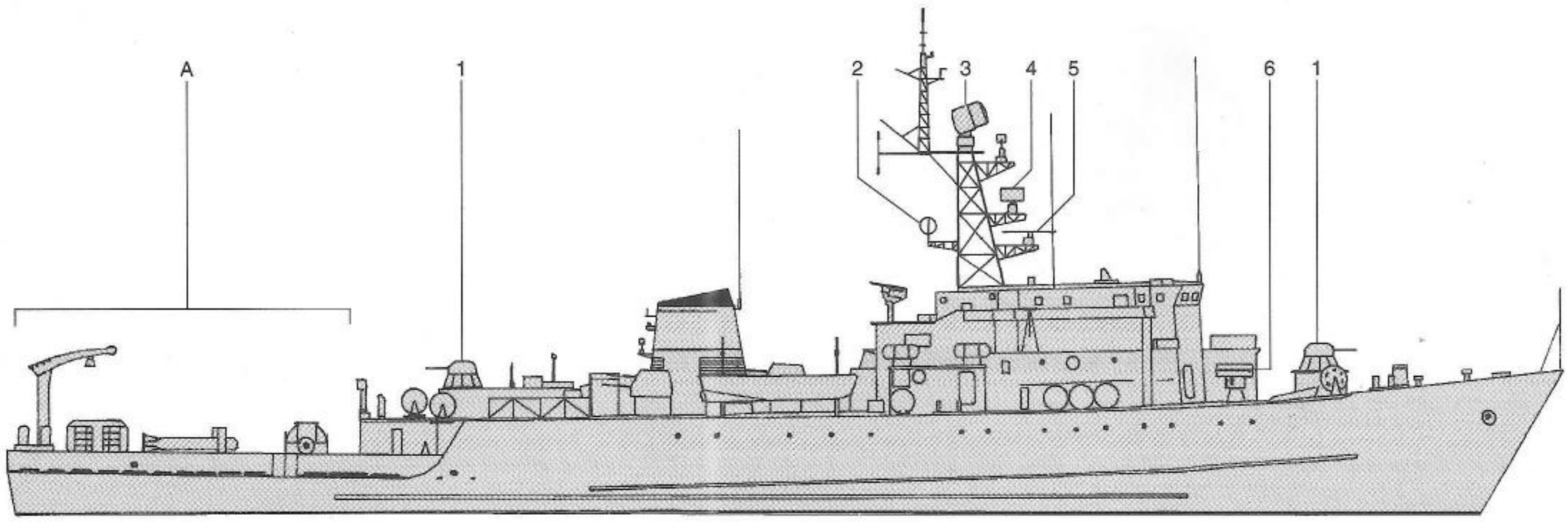
FURTHER INFORMATION

These ships were transferred from the (then) Soviet Union: two in 1970, two in 1971 and two in 1985. Two were paid off into reserve in 1992, only to return to service briefly in 1994-95 and were then scrapped.

The survivors are all based at Varna and can be employed as minehunters as well as minesweepers.

NATYA

OVERVIEW



Natya I (Ian Sturton)
MCM A *Sweep deck*

General 1 *AK-230 twin 30 mm CIWS* **2** *Cross Loop DF* **3** *Drum Down Tilt fire-control radar* **4** *Low Trough surface search radar* **5** *Don 2 navigation radar* **6** *RBU-1200 ASW rocket launcher*

The 'Natya' class ocean minesweeper was first observed in the West in 1970, following which 31 were built at Kolpino and Khabarovsk as successors to the 'Yurka' class. Construction for the Russian Navy ended in 1980 with the single Natya II, although the last two for the export versions of the Natya I were not completed until 1991.

	Natya I Type 266M		Natya I Type 266ME		Natya II Type 266DM	
	Number	Year	Number	Year	Number	Year
Russia	31	1970-1980			1	1982
India			2	1978		
			2	1979		
			2	1980		
			1	1986		
			2	1987		
			3	1988		
Libya			2	1981		
			3	1983		
			1	1984		
			1	1985		
			1	1986		
Syria			1	1985		
Yemen			1	1991		
Ethiopia			1	1991		
Totals	31		23		1	

NATYA I

These ships all have an aluminium/steel alloy hull, with a built-in degaussing system. A particular advance over the 'Yurka' class was the greatly improved layout and handling arrangements for the sweeping gear, with a ramp inset in the transom, making it much easier to set and recover sweeps. There are some relatively minor differences between early and late production ships. Earlier ships have rigid, goose-neck gantries aft, later ships have articulated, hydraulic gantries. Also, the earlier ships have two AK-230 guns with Drum Tilt, while the final three ships (sometimes referred to as 'Natya III') have an AK-630 Gatling turret, and neither 25 mm guns nor the Drum Tilt radar.

NATYA II

The single Natya II appears to have been a development ship for a new minehunting system. It has no minesweeping gear, the space thus freed aft being used for a lengthened superstructure. In addition, the transom has been cut away amidships to take a 1.5 m (5 ft) sheave.

NATYA I — TYPE 266ME

This is the export version which is basically the Natya I but with minor amendments: there is, for example, no ramp on the stern.

NATYA I AND II

GENERAL SPECIFICATIONS

Operator: Russia
Type: Ocean minesweeper

Classes: NATYA I (AKVAMAREN) (TYPE 266M); NATYA II (MINER) (TYPE 266DM)

National designation: *Morskoy tralshchik* (sea-going minesweeper)

Natya I
Built: 31
Active: 26

Natya II
Built: 1
Active: 1

Displacement:
standard: 750 t
full load: 804 t

Dimensions
Length: 61.0 m (200.1 ft)
Beam: 10.2 m (33.5 ft)
Draught: 2.98 m (9.78 ft)

Speed: 16.5 kts
Range:
two engines: 3,000 n miles at 12 kts
one engine: 5,500 n miles at 12 kts
Endurance: 15 days

Complement: 67

SHIPS

DIZELIST, SNAYPR, SOKOLOV, SVYAZIST, ELEKTRIK, TURBINIST, URKOVSKY, DESANTNIK, POLEMETCHIK, ZENITCHIK, SABANYEV, RAKETCHIK, RADIST, ARTILLERIST, KHOROSHKIN, SEMEN, ROSHALB, NAVODCHIK, ZHUKOV, PERSHIN, DMITRY, LBISOV, MINER, VINOGRADOV, RAZVEDCHIK, MACHINIST, MOTORIST, VLASOV, KOMENDOR

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Russian minesweeping gear to be found in the 'Natya' class MCMV includes:

- GKT-2 mechanical sweep. One or two sets per ship. This deep-water mechanical system sweeps an effective width of 260 to 280 m (853 to 918 ft) at a depth of 200 m (656 ft).
- AT-2 acoustic sweep. One set per ship. A low-frequency 'fish' can be seen on the quarterdeck of most Natyas.
- TEM-3 magnetic sweep. One set per ship. The feeder is 455 m (1,492 ft) long and the ship operates at a speed of 10 knots.

Deck gear includes:

- Two davits with 2,250 kg (4,960 lb) capacity and jib reach of 4.73 m (15.5 ft)
- Three-drum winch for contact and acoustic sweeps
- Cable reel for the TEM-3 magnetic sweep.

MINEHUNTING SONAR

MG 79/89

MG 79/89 is a hull-mounted, high-frequency, active minehunting sonar. The ship's claimed capabilities include detection of mines at 800 m (2,624).

WEAPONS SYSTEMS

SURFACE-TO-AIR MISSILES (SAM)

Igla-1 (SA-N-5 Grail)

The Igla-1 system uses the Strela 2 9M43M missile (NATO = SA-N-5) and is housed in a glass fibre launcher-container; these ships carry a total of 18 missiles. The missile has an uncooled lead sulphide infrared seeker, operating in the 1.7 to 2.8 micron range and with a spinning reticle, centre-null tracking system with a 1.9° field of view. On acquiring the target, the operator activates the thermal battery and when the seeker has acquired the target, an audio signal is received informing the operator to take the first pressure on the trigger and activate the missile gyros which warm up in four to six seconds. The operator uses stadia reference marks in the optical sight to compute the lead angle to the target and then takes the second pressure on the trigger to launch the missile. The booster burns for 0.05 seconds to eject the missile from the launch tube at a speed of 28 m/s (92 ft/s) and spin it up and then, at a distance of 6 m (19.7 ft), the sustainer ignites and the trailing fins pop out. The missile homes on the 'hottest' part of the aircraft and has an impact fuze on its 1.1 kg (2.4 lb) armour-piercing RDX warhead. In Strela 2M the warhead has improved fragmentation uniformity.

Specifications

Length: 1.45 m (4.75 ft)
Diameter: 7 cm (2.75 in)
Weight: 9.97 kg (22 lb)
Speed: Mach 1.7
Range:
anti-surface: 2.6 n miles (4.8 km)
anti-air: 18-4,500 m (59-14,760 ft)

Manufacturer/Contractor

Fakel, Russia.

GUNS

Earlier units have two twin AK-230 30 mm/65, with two twin 25 mm guns, together with a Drum Tilt fire-control radar. Other units have two AK-630 30 mm Gatling, but no 25 mm guns and no Drum Tilt radar.

30 mm/65 AK-230

Specifications

NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D:
Type: High explosive
Weight (complete round): 1.40 kg (3 lb)
Projectile: 0.27 kg (0.6 lb)
Explosive: 30 g (A-XI-2)

30mm AK-630

Specifications

Calibre: 30 mm
Length of barrel: 65 calibres
Number of barrels: 6
Muzzle velocity: 890 m/s (2,919 ft/s)
Traverse: 360° (depending on location of turret) at 70°/s
Elevation: −12 to +88° at 50°/s
Crew: 1 (off mount)
Range:
radar fire control: 4,000 m (13,120 ft)
electro-optic fire control: 5,000 m (16,400 ft)
Rate of fire: 4,000-5,000 rds/min

Ammunition:
Round: 1.224 kg (2.7 lb)
Projectile weight:
UOF-84: 384 g
UOR-84: 388 g

25 mm/80 2-M-3

All Natya I. There are two twin 25 mm mounts

Specifications

(2-M-3)
Calibre: 25 mm
Length of barrel: 60 calibre
Traverse: 360°at 25°/s
Elevation: −10 to +85°at 15°/s
Rate of fire: 450 rds/min/barrel
Projectile: 0.28 kg HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,184 ft)

ANTI-SUBMARINE MORTARS

RBU 1200

Natya I only. There are two five-tube mountings. Each is about 1.5 m high (4.9 ft) and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm, is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (75 lb)warhead and a range of about 0.8 n miles (1.48 km).

DEPTH CHARGES

32 BB-1 depth charges.

MINES

10 mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Don 2/Low Trough

I-band surface search radars.

Drum Tilt

The ships with AK-230 have one Drum Tilt H/I-band fire-control radar. The cylindrical radar is permanently tilted upwards at 30° and approximate ranges are reported to be: acquisition — 21.6 n miles (40 km); tracking 12.4 n miles (23 km). Russian name is *Rys*.

IFF

Two Square Head.
High Pole B.

PROPULSION

Specifications
System: Diesel
Main machinery:
temperate climate version: Type M 504 diesels; 3.73 MW (5,000 hp(m)) sustained
tropical version: 3.36 MW (4,500 hp) diesels
Shafts: 2
Propellers: 2, three-bladed, shrouded, cp

Auxiliary power:
temperate climate version: 3 200 kW diesel-generator sets
tropical version: 3 180 kW diesel-generator sets

FURTHER INFORMATION

PROGRAMME

First observed in the West in 1970, 31 of these ocean-going minesweepers were built for the Russian Navy at Kolpino and Khabarovsk as successors to the 'Yurka' class. Construction for the Russian Navy ended in 1980 with the single Natya II.

DESIGN

Natya I
The Type 266 was designed at the Western Design Bureau at St Petersburg. These ships have a hull and main superstructure constructed of austenitic (low magnetic) steel, with aluminium-magnesium alloys used elsewhere. Transverse hull frames are used, with the decks and bottom reinforced by longitudinal ribs.

There is a built-in degaussing system and a particular advance over the 'Yurka' class was the greatly improved layout and handling arrangements, with a ramp inset in the transom, making it much easier to set and recover sweeps. There are some relatively minor differences between early and late production ships. Earlier ships have rigid, goose-neck gantries aft, later ships have articulated, hydraulic gantries. Also, the earlier ships are two AK-230 guns with Drum Tilt, while the final three ships (sometimes referred to as 'Natya III') have an AK-630 Gatling turret, and neither 25 mm guns nor the Drum Tilt radar.

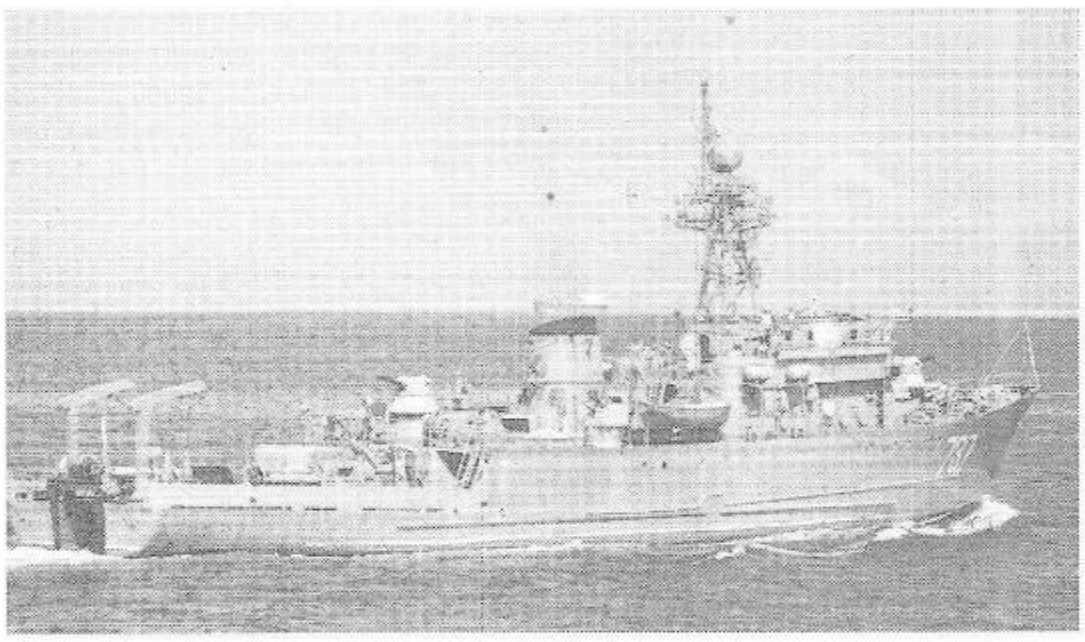
Natya II
The single Natya II appears to have been a development ship for a new minehunting system. It has no minesweeping gear, the space thus freed aft being used for a lengthened superstructure. In addition, the transom has been cut away amidships to take a 1.5 m (5 ft) sheave.

DEPLOYMENT

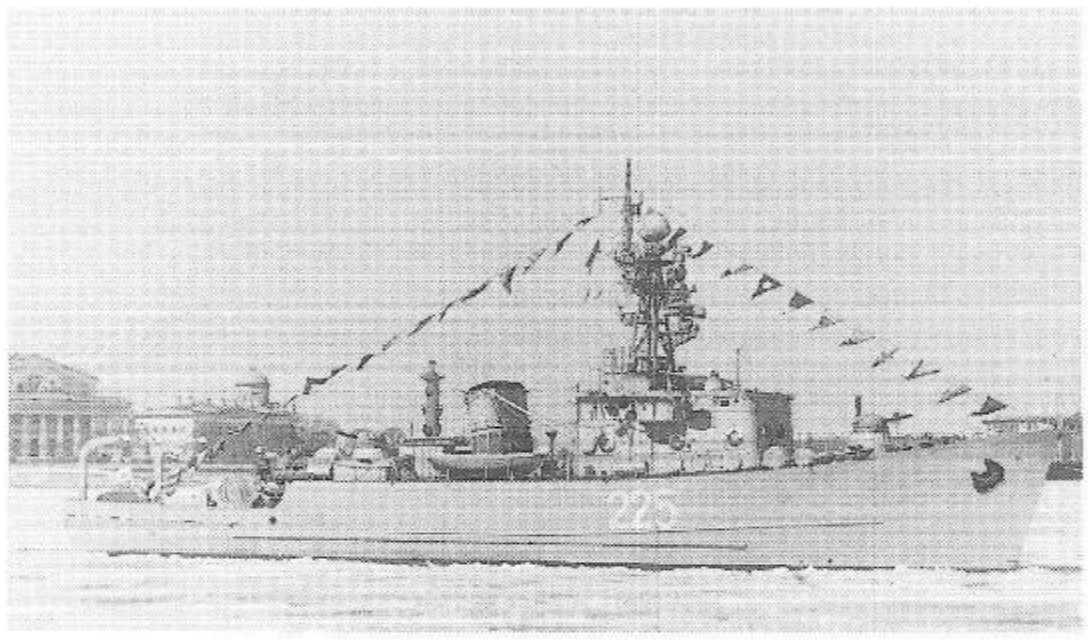
The Natyas usually operate in home waters but on occasions have deployed to the Mediterranean, Indian Ocean and West Africa. Sweep speed is 14 kts.

FUTURE

Earlier ships are being paid off and a new type, fitted for minehunting, is expected in due course, possibly developed from the Natya II.



Natya I with a good view of the sweep deck (US Navy)



Natya I (H & L van Ginderen Collection)

PONDICHERRY (NATYA I)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: India
Type: Type 266ME

Class: PONDICHERRY (NATYA I)

Purchased: 12
Active: 12

Displacement:
standard
full load: 804 t

Dimensions
Length: 61 m (200.1 ft)
Beam: 10.2 m (33.5 ft)
Draught: 3 m (9.8 ft)

Speed: 16 kts
Range: 3,000 n miles at 12 kts

Complement: 65

SHIPS

PONDICHERRY (M 61)
Builder Isora Yard, St Petersburg, Russia
Delivered Apr 1978

PORBANDAR (M 62)
Builder Isora Yard, St Petersburg, Russia
Delivered Apr 1978

BEDI (M 63)
Builder Isora Yard, St Petersburg, Russia
Delivered Jul 1979

BHAVNAGAR (M 64)
Builder Isora Yard, St Petersburg, Russia
Delivered Jul 1979

ALLEPPEY (M 65)
Builder Isora Yard, St Petersburg, Russia
Delivered Aug 1980

RATNAGIRI (M 66)
Builder Isora Yard, St Petersburg, Russia
Delivered Aug 1980

KARWAR (M 67)
Builder Isora Yard, St Petersburg, Russia
Delivered Oct 1986

CANNANORE (M 68)
Builder Isora Yard, St Petersburg, Russia
Delivered Jun 1987

CUDDALORE (M 69)
Builder Isora Yard, St Petersburg, Russia
Delivered Dec 1987

KAKINADA (M 70)
Builder Isora Yard, St Petersburg, Russia
Delivered May 1988

KOZHIKODA (M 71)
Builder Isora Yard, St Petersburg, Russia
Delivered Nov 1988

KONKAN (M 72)
Builder Isora Yard, St Petersburg, Russia
Delivered Early 1989

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Russian minesweeping gear to be found in the 'Natya' class MCMV includes:

- GKT-2 contact sweeps. One or two sets per ship.
- AT-2 acoustic sweep. One set per ship. A low-frequency 'fish' can be seen on the quarterdeck of most Natyas.
- TEM-3 magnetic sweep. One set per ship.
- RBU-1200. The ASW rocket launcher is used to destroy mines brought to the surface by the GKT-2 sweep.

MINEHUNTING SONAR

MG 79/89

MG 79/89 is a hull-mounted, high-frequency, active minehunting sonar.

WEAPONS SYSTEMS

GUNS

The Indian ships have two twin AK-230 30 mm/65, with two twin 25 mm guns, together with a Drum Tilt fire-control radar.

30 mm/65 AK-230

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D:
Type: High explosive
Weight (complete round): 1.40 kg (3 lb)
Projectile: 0.27 kg (0.6 lb)
Explosive: 30 g (A-XI-2)

2-M-3 25 mm/60

Specifications
Calibre: 25 mm
Length of barrel: 60 calibre
Traverse: Unlimited at 25°
Elevation: −10 to +85°at 15°/s
Rate of fire: 450 rds/min/barrel
Projectile: 0.28 kg HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,184 ft)

RBU 1200

There are two five-tube mountings. Each is about 1.5 m (4.9 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm, is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (75 lb) warhead and a range of about 0.8 n miles (1.48 km).

MINES

Ten mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Don 2

I-band navigation radar.

Drum Tilt

The ships with AK-230 have one Drum Tilt H/I-band fire-control radar. The cylindrical radar is permanently tilted upwards at 30° and approximate ranges are reported to be: acquisition — 21.6 n miles (40 km); tracking 12.4 n miles (23 km) m. Russian name is *Rys*.

IFF

Square Head.
High Pole B.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Type M 504 diesels; 3.67 MW (5,000 hp(m)) sustained
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

The first six were delivered at a rate of two per year in 1978, 1979 and 1980. There was then a gap and the last six were delivered: 1986 — 1; 1987 — 3; 1988 — 2.

DESIGN

These are the Type 266ME export version. They have steel hulls and the two AK-230 and two 2-M-3 25 mm armament as in the Russian ships, but do not have a stern ramp. Some are fitted with two quad SA-N-5 systems.

The ships can be used as ASW escorts, but would not appear to be particularly well equipped for the task, lacking effective sonars and ASW weapons.

DEPLOYMENT

Pondicherry (M 61) was painted white and used as the Presidential yacht for the Indian Fleet Review by President R Venkataramen on 15 February 1989; it reverted to its normal role and colour on completion. One serves as an AGI.

AL TIYAR (NATYA I)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Libya
Type: Ocean minesweeper

Class: AL TIYAR (NATYA I, TYPE 266ME)

Purchased: 8
Active: 8

Displacement:
full load: 804 t

Dimensions
Length: 61 m (200.1 ft)
Beam: 10.2 m (33.5 ft)
Draught: 3 m (9.8 ft)

Speed: 16 kts
Range: 3,000 n miles at 12 kts

Complement: 67

SHIPS

AL TIYAR (111)
Builder Almaz, Kolpino, Russia
Delivered Feb 1981

AL ISAR (113)
Builder Almaz, Kolpino, Russia
Delivered Feb 1981

RAS AL HAMMAN (115)
Builder Almaz, Kolpino, Russia
Delivered Feb 1983

RAS AL FULAIJAH (117)
Builder Almaz, Kolpino, Russia
Delivered Feb 1983

RAS AL QULA (119)
Builder Almaz, Kolpino, Russia
Delivered Aug 1983

RAS AL MADWAR (121)
Builder Almaz, Kolpino, Russia
Delivered Jan 1984

RAS AL MASSAD (123)
Builder Almaz, Kolpino, Russia
Delivered Jan 1985

RAS AL HANI (125)
Builder Almaz, Kolpino, Russia
Delivered Oct 1986

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Russian minesweeping gear to be found in the 'Natya' class MCMV includes:

- GKT-2 contact sweeps. One or two sets per ship.
- AT-2 acoustic sweep. One set per ship. A low-frequency 'fish' can be seen on the quarter-deck of most Natyas.
- TEM-3 magnetic sweep. One set per ship.
- RBU-1200. The ASW rocket launcher is used to destroy mines brought to the surface by the GKT-2 sweep.

MINEHUNTING SONAR

MG 89
MG 89 is a hull-mounted, high-frequency, active minehunting sonar.

WEAPONS SYSTEMS

GUNS

The Libyan ships have two twin AK-230 30 mm/65, with two twin 25 mm guns, together with a Drum Tilt fire-control radar.

30 mm/65 AK 230

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D:
Type: High explosive
Weight (complete round): 1.40 kg (3.0 lb)
Projectile: 0.27 kg (0.6 lb)
Explosive: 30 g (A-XI-2)

2-M-3 25 mm/60

Specifications
Calibre: 25 mm
Length of barrel: 60 calibres
Traverse: Unlimited
Elevation: −10 to +85°
Traverse speed: 25°/s
Elevation speed: 15°/s
Rate of fire: 450 rds/min/barrel
Projectile: 0.28 kg HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9,186 ft)

RBU 1200
There are two five-tube mountings. Each is about 1.5 m (5.0 ft) high and has a pyramid-shaped pintle with five rocket launcher tubes; a row of three along the top and one each on either side. The tubes cannot be trained and have a maximum elevation of +65°. Each tube has a diameter of 250 mm (9.8 in), is 1.4 m (4.6 ft) long and is reloaded manually. The 70 kg (154 lb) RGB-12 rocket has a 34 kg (75 lb) warhead and a range of about 0.8 n miles.

MINES

Ten mines can be carried.

COMMAND AND CONTROL SYSTEMS

RADARS

Don 2
I-band navigation radar.

Drum Tilt
The ships have one Drum Tilt H/I-band fire-control radar. The cylindrical radar is permanently tilted upwards at 30° and approximate ranges are reported to be: acquisition — 21.6 n miles (40 km); tracking 12.4 n miles (23 km). Russian name is *Rys*.

IFF
Square Head.
High Pole B.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Type M 504 diesels; 3.67 MW (5,000 hp(m)) sustained
Shafts: 2
Propellers: cp

FURTHER INFORMATION

PROGRAMME

The ships were delivered from Russia: 1981 — 2; February 1983 — 2; August 1983 — 1; January 1984 — 1; January 1985 — 1; October 1986 — 1.

DESIGN

These are to the standard Type 266ME export design.

DEPLOYMENT

At least one of this class was painted in green striped camouflage in 1991, and others have been seen with the hull painted a deep blue and the superstructure white.

Although capable of magnetic, acoustic and mechanical sweeping, these ships have never been seen minesweeping and appear to be used primarily for coastal patrols. Most ships in the class have been seen at sea in 1994 and 1995.

Ras Al Massad (123) has been used for training cruises.

201 (NATYA I) (TYPE 266ME)

GENERAL SPECIFICATIONS

Country of origin: Russia
Operator: Yemen
Type: Ocean minesweeper (Type 266ME)

Class: 201 (NATYA I)

Acquired: 1
Active: 1

Displacement:
full load: 804 t

Dimensions
Length: 61 m (200.1 ft)
Beam: 10.2 m (33.5 ft)
Draught: 3 m (9.8 ft)

SHIPS

Speed: 16 kts
Range: 3,000 n miles at 12 kts

Complement: 67

201	
Builder	Almaz, Kolpino, Russia
Delivered	Mar 1991

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Russian minesweeping gear to be found in the 'Natya' class MCMV includes:

- GKT-2 contact sweeps. One or two sets per ship.
- AT-2 acoustic sweep. One set per ship. A low-frequency 'fish' can be seen on the quarter-deck of most Natyas.
- TEM-3 magnetic sweep. One set per ship.
- RBU-1200. The ASW rocket launcher is used to destroy mines brought to the surface by the GKT-2 sweep.

MINEHUNTING SONAR

MG 89
MG 89 is a hull-mounted, high-frequency, active mine-hunting sonar.

WEAPONS SYSTEMS

GUNS

The Yemeni ship has two twin AK-230 30 mm/65, with two twin 25 mm guns, together with a Drum Tilt fire-control radar.

30 mm/65 AK 230

Specifications
NN-30 gun
Calibre: 30 mm
Length of barrel: 64.2 calibres
Muzzle velocity: 1,050 m/s (3,444 ft/s)
Range:
anti-surface: 2.2 n miles (4 km)
anti-air: 4,000 m (13,120 ft)
Rate of fire: 1,000 rds/min/gun

Mounting
Traverse: 360° at 70°/s
Elevation: −12 to +87° at 50°/s
Mounting weight: 1,857-1,905 kg (4,094-4,200 lb)
Crew: 2 (off mount)

Ammunition
BR-83:
Type: Armour-piercing tracer
Weight (complete round): 1.47 kg (3.2 lb)
Weight (projectile): 0.35 kg (0.77 lb)

OF-83D:
Type: High explosive
Weight (complete round): 1.40 kg (0.6 lb)
Projectile: 0.27 kg
Explosive: 30 g (A-XI-2)

2-M-3 25 mm/60

Specifications
Calibre: 25 mm
Length of barrel: 60 calibres
Traverse: Unlimited
Elevation: −10 to +85°
Traverse speed: 25°/s
Elevation speed: 15°/s
Rate of fire: 450 rds/min/barrel
Projectile: 0.28 kg (0.6 lb) HEI-T
Range:
anti-surface: 1.5 n miles (2.75 km)
anti-air: 2,800 m (9.186 ft)

COMMAND AND CONTROL SYSTEMS

RADARS

Don 2
I-band navigation radar.

Drum Tilt
The ship has one Drum Tilt H/I-band fire-control radar. The cylindrical radar is permanently tilted upwards at 30° and approximate ranges are reported to be: acquisition 21.6 n miles (40 km) tracking 12.4 n miles (23 km). Russian name is *Rys*.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Type M 504 diesels; 3.67 MW (5,000 hp(m)) sustained

Shafts: 2
Propellers: cp

IFF
Square Head.
High Pole B.

FURTHER INFORMATION

PROGRAMME

This ship was supplied by Russia and delivered in February 1991.

Ethiopian Natya
Reports that a second 'Natya' class ship had been seen in Aden in early 1992 led to the conclusion that another had been supplied to the Yemeni Navy from Russia. It transpired, however, that it was an Ethiopian Navy 'Natya' class ship which had taken refuge in Aden for what appear to have been political reasons. The ship returned to Massawa in July 1992 and was subsequently based at Djibouti. It was, presumably, one of the ships offered for sale in 1996 when the assets of the now-disbanded Ethiopian Navy were auctioned off.

CME

GENERAL SPECIFICATIONS

Operator: Spain
Type: Minehunter

Class: CME

National designation: *Contra Minas Espanõl* (Spanish MCMV)

Active: 0
Building: 4

Displacement
full load: 530 t

Dimensions
Length: 54 m (167.3 ft)

Beam: 10.7 m (35.1 ft)
Draught: 2.2 m (7.2 ft)

Speed: 14 kts
Range: 2,000 n miles at 12 kts

Complement: 40 (7 officers)

SHIPS

M 51

Builder	Bazan, Cartagena, Spain	**Launched**	Jun 1997
Laid down	30 May 1995	**Commissioned**	May 1998

MINE COUNTERMEASURES SYSTEMS

Gaymarine Pluto Plus ROV

Two per ship. The basic configuration of Pluto Plus is the same as the standard Pluto, but with a number of improvements.

The vehicle has been redesigned to have an improved hydrodynamic design with the lowest possible drag factor, which has enabled speed to be increased to 7 knots, while these improvements allied to a doubling of the battery capacity, has increased endurance from six to ten hours. Observation capabilities have also been improved, this increasing the standoff range. Pluto Plus also uses a new type of fibre optic floating, reusable, 2 km long, cable.

The vehicle is fitted with sonar sensors for navigation, search, obstacle avoidance and identification. The sensors are all mounted in a single package featuring ±100° tilt and ±80° pan. A single control console monitor gathers and displays the video picture, navigational data, sonar graphics and maps of the investigated area.

The vehicle has low-magnetic and acoustic signatures and is resistant to shock and vibration to MIL-SPEC standards for minehunting.

Specifications
(Pluto Plus)
Length: 1,950 mm (77 in)
Width: 510 mm (20 in)
Height: 550 mm (22 in)
Weight: 200 kg (441 lb)
Service depth: 400 m (1,312 ft)
Payload: 15 kg (33.0 lb)

Manufacturer/Contractor
Gaymarine, Italy.

MINEHUNTING SONAR

AN/SQQ-32

AN/SQQ-32 consists of two separate sonars: a search sonar for initial detection; and a high-frequency, high-resolution sonar for classification of the targets. The detection sonar, designed and manufactured by Raytheon, detects mines over a wide range of distances and bottom conditions. This system incorporates a computer-aided detection facility which is designed to help the sonar operator to discard non-mine objects detected by the sonar. Raytheon is also providing the computer facilities and display consoles and is responsible for overall system integration. The classification sonar, designed and fabricated by Thomson Sintra ASM, is based on its experience with the DUBM 21 and TSM 2022 minehunting sonars. The classification sonar provides very high-resolution transmission and reception of underwater signals to enable targets to be identified with near-picture quality. The AN/SQQ-32 has two identical operator consoles with high-resolution displays. Search and classification data can be displayed simultaneously or independently. Automated detection and control functions are performed by two AN/UYK-44 computers.

Manufacturer/Contractor
ENOSA, Spain.

WEAPONS SYSTEMS

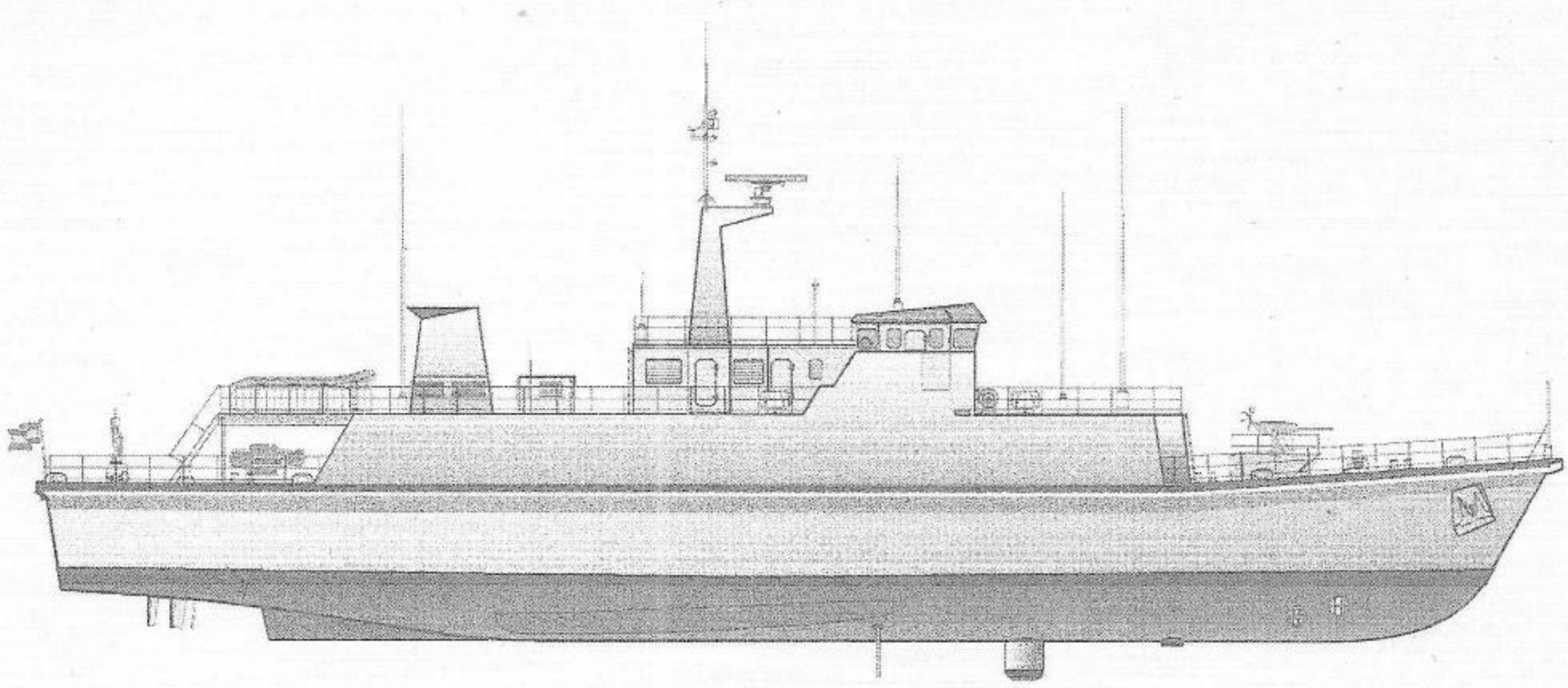
GUNS

Bazan/Oerlikon 20 mm GAM-BO1.

There will be one manually operated Oerlikon cannon on the foredeck.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range
anti-surface: 0.8 n miles (1.5 km)
anti-air: 1,150 m (3,773 ft)

Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g



CME (Bazan)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

FABA/GEC-Marconi Nautis M

NAUTIS-M can be a one, two or three console system, to provide support for operational planning, ship control guidance, underwater and surface picture compilation and command and control for mine disposal together with a real-time MCM database. The version of NAUTIS M for the CME is likely to be based on the three-console (minehunting, operations, bridge) monochrome system that has been purchased for the UK Royal Navy, Royal Saudi Arabian Navy and US Navy for the 'Avenger' class MCM ships.

Manufacturers/Contractors
FABA, Spain/GEC-Marconi, UK.

RADAR

Navigation/Surface Search

There will be one navigation/surface search, I-band radar. Type is not yet known.

PROPULSION

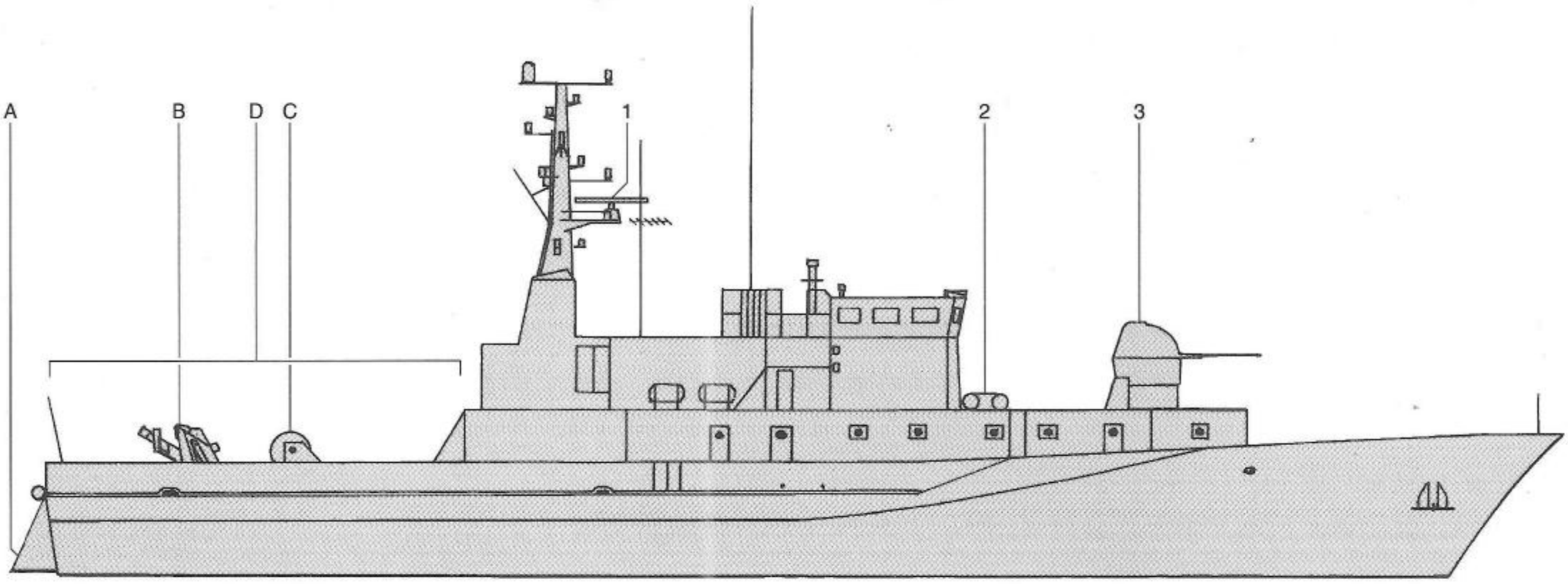
Specifications
System: Diesel
Main machinery: 2 MTU-Bazan 6V 396 TB83 diesels, 1.12 MW (1,523 hp(m)); two electric motors (for hunting), 200 kW
Propellers: 2 Voith Schneider
Thrusters: 2 side thrusters, 110 kW (150 hp(m))
Shafts: 2

FURTHER INFORMATION

Spain currently operates a number of elderly ex-US minesweepers and has been searching for a replacement vessel for some years. Current designs from foreign nations were examined, including Eridan (Tripartite), Lerici (Italy), Avenger (USA), Sandown (UK), and a Spanish design. A contract was signed with Vosper Thornycroft on 4 July 1989 for a technology transfer, to enable Bazan to design a new MCM vessel based on the 'Sandown' class. The order for four of the class was authorised on 7 May 1993 and it was reported that the programme involved eight minehunters and four minesweepers, all based on the UK Sandown design.

On 26 November 1993, however, a further agreement was signed between DCN and Bazan, which provides for training in GRP technology and the design appears to have changed, with four minehunters of a Bazan design being produced. The eventual requirement is reported to be still for eight minehunters and four minesweepers.

LANDSORT



MCM A *Divers platform* **B** *Double-folding crane* **C** *Main winch* **D** *Sweep deck*

General 1 *Terma Skanter radar* **2** *Elma ASW grenade launchers* **3** *Bofors 40 mm/70*

GENERAL SPECIFICATIONS

Operator: Sweden
Type: Minehunter

Class: LANDSORT

Built: 7
Active: 7

Displacement:
standard: 270 t
full load: 360 t

Dimensions
Length: 47.5 m (155.8 ft)
Beam: 9.6 m (31.5 ft)
Draught: 2.2 m (7.3 ft)

Speed: 15 kts
Range: 2,000 n miles at 12 kts

Complement: 39 (7 officers)

SHIPS

LANDSORT (M 71)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 2 Nov 1982
Commissioned 19 Apr 1984

ARHOLMA (M 72)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 2 Aug 1984
Commissioned 23 Nov 1984

KOSTER (M 73)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 16 Jan 1986
Commissioned 30 May 1986

KULLEN (M 74)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 15 Aug 1986
Commissioned 28 Nov 1986

VINGA (M 75)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 14 Aug 1987
Commissioned 27 Nov 1987

VEN (M 76)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 10 Aug 1988
Commissioned 12 Dec 1988

ULVON (M 77)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 4 Mar 1992
Commissioned 9 Oct 1992

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

The Landsort MCMVs are fitted for:

- Mechanical sweeps for moored mines
- Magnetic sweeps
- Acoustic sweeps
- It is also possible to operate two SAM drones for remotely controlled preliminary sweeps.

SAM remote-control minesweeping drone

The remote-control SAM uses a diesel-powered rudder propeller to drive the GRP catamaran hull. The craft is fully equipped for power supply, sweeping of acoustic and magnetic mines, navigation and remote-control from a 'Landsort' class MCMV, which can control a number of the unmanned sweeps, providing remote control of the diesel engine, steering, minesweeping equipment, control and monitoring. The hull of the SAM is fitted with a number of coils which are used for sweeping magnetic mines, and a towed acoustic transmitter is used to counter acoustic mines. A number of buoys is carried to mark the swept passage. A digital GPS and microplotter is also installed to monitor the sweeping track.

Onboard power is provided by a Volvo Penta TAMD 70D diesel engine with a continuous output of about 159 kW at 2,200 rpm, to give the craft a speed of 8 knots. Power is fed to a Schottel-type propeller unit via reversing gear couplings and a shaft. The diesel and reversing gear are mounted on a girder framework which is shockmounted in an aluminium structure onto the main platform. Although the machinery is normally remotely controlled from the MCMV, it can also be controlled at the engine or from the operating platform. Remote-control functions include diesel engine control, steering control, minesweeping equipment control and monitoring.

Specifications

Length: 18.2 m (59.7 ft)
Beam: 6.2 m (20.3 ft)
Draught: 1.6 m (5.2 ft)
Displacement: 27 m^3 (953 ft^3)
Speed: 8 kts
Range: 330 n miles at 7 kts
Engine: Volvo Penta TAMD 70D diesel engine, 159 kW at 2,200 rpm

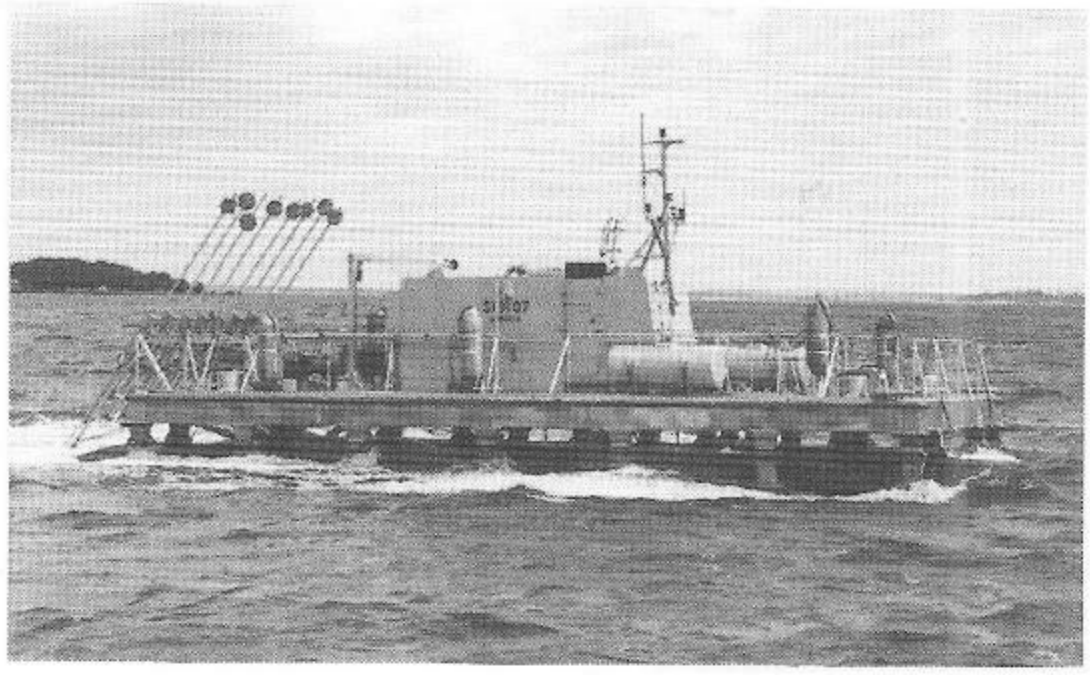
Manufacturer/Contractor

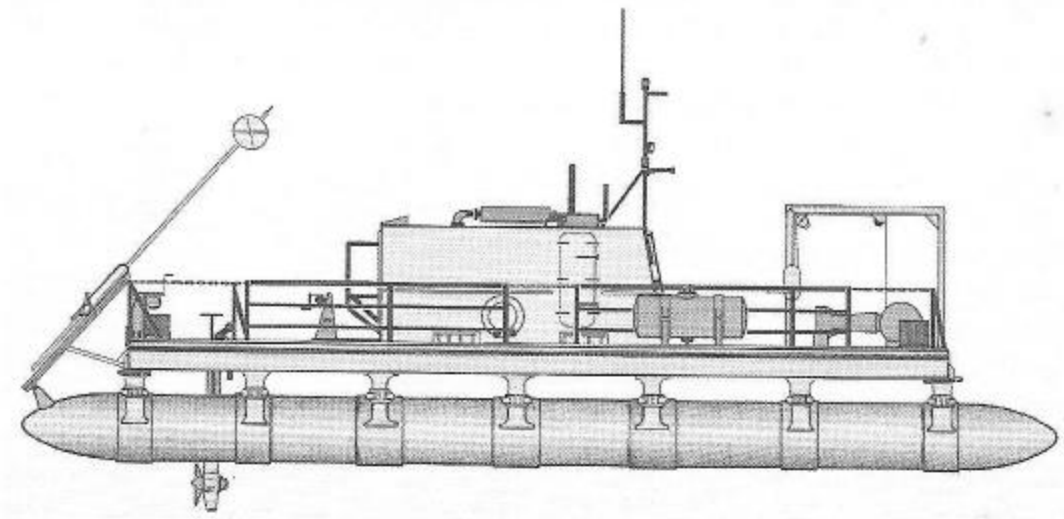
Karlskronavarvet, Karlskrona.

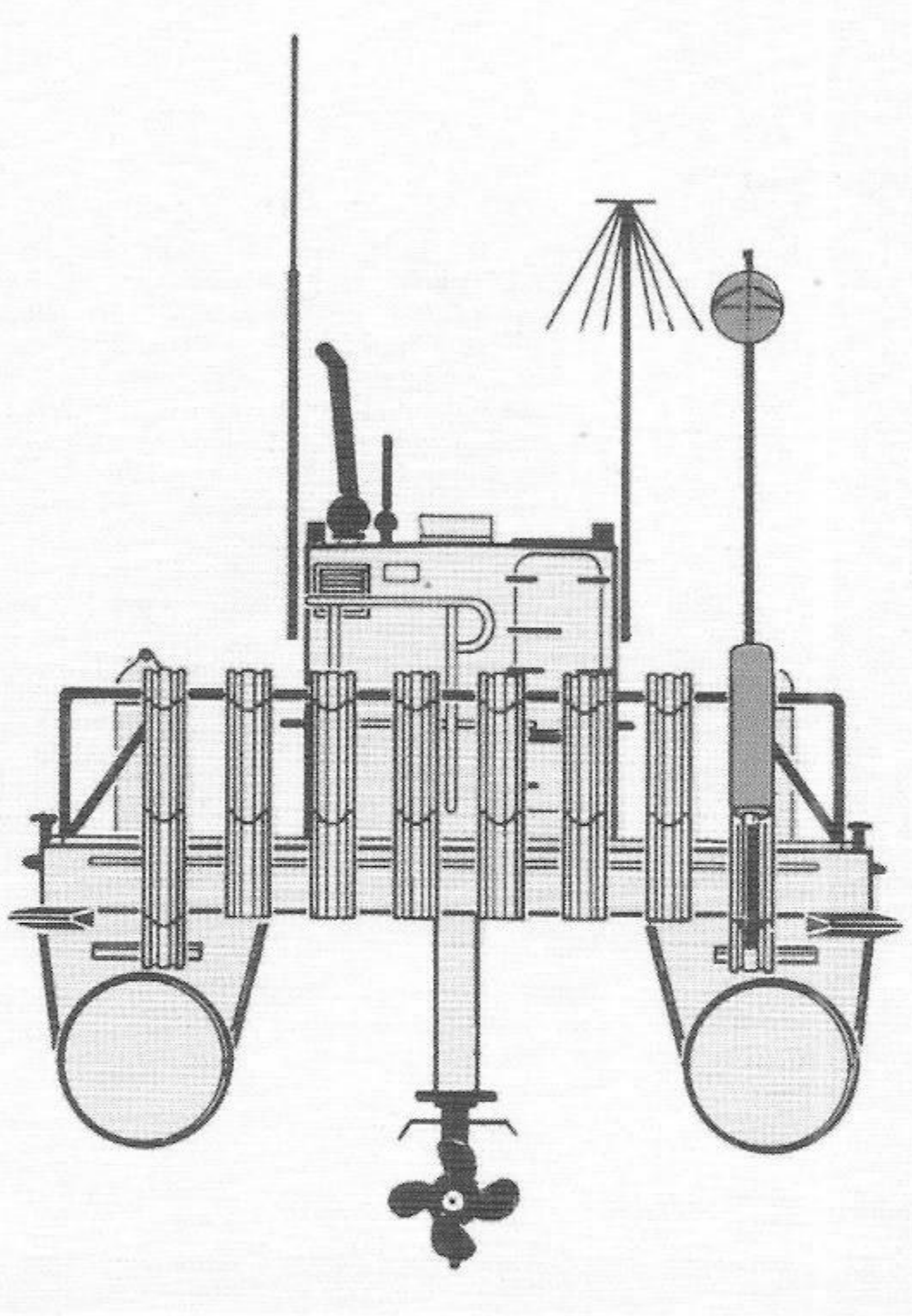
MINEHUNTING

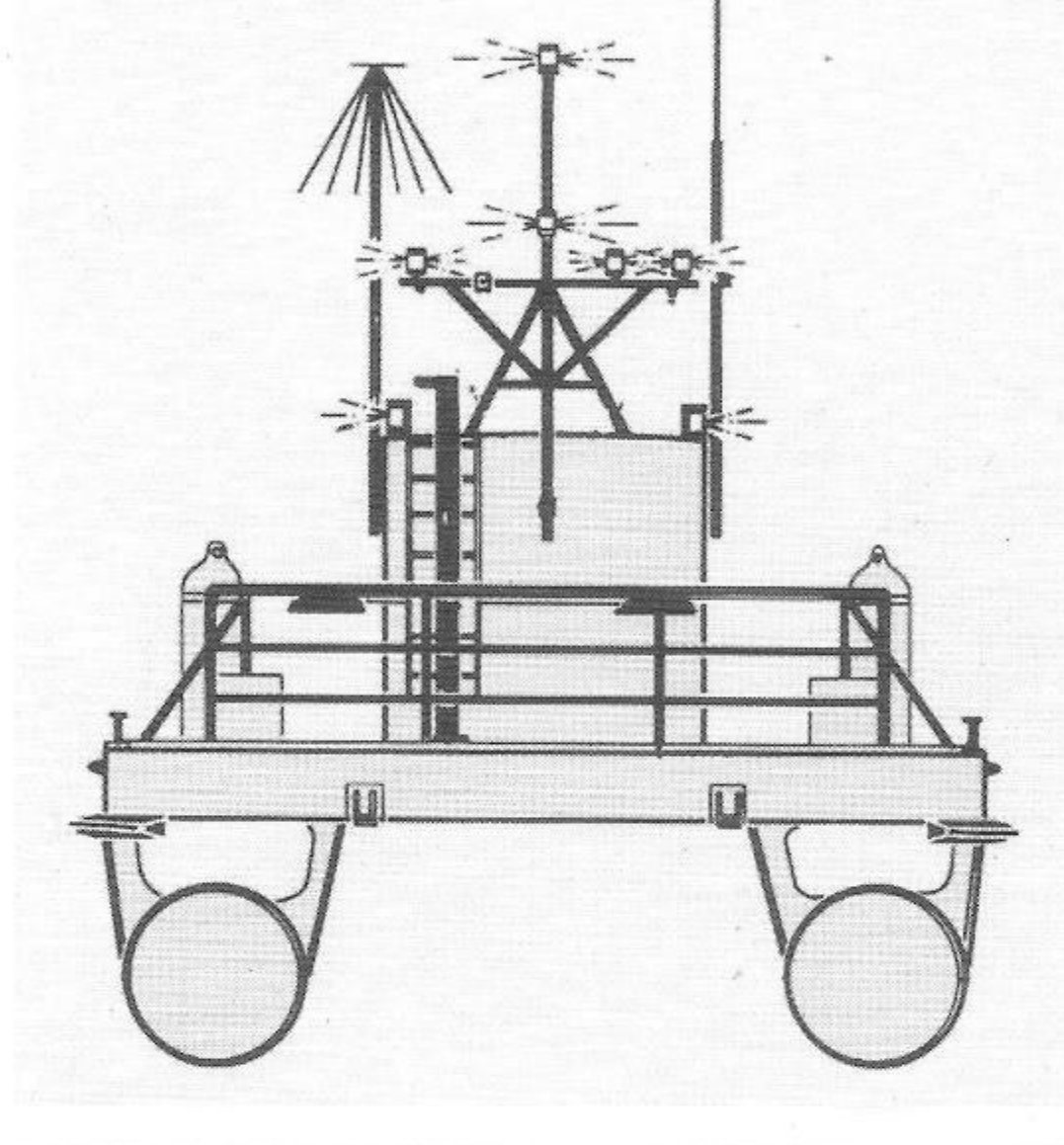
CelsiusTech 9 MJ 400 minehunting AIO system

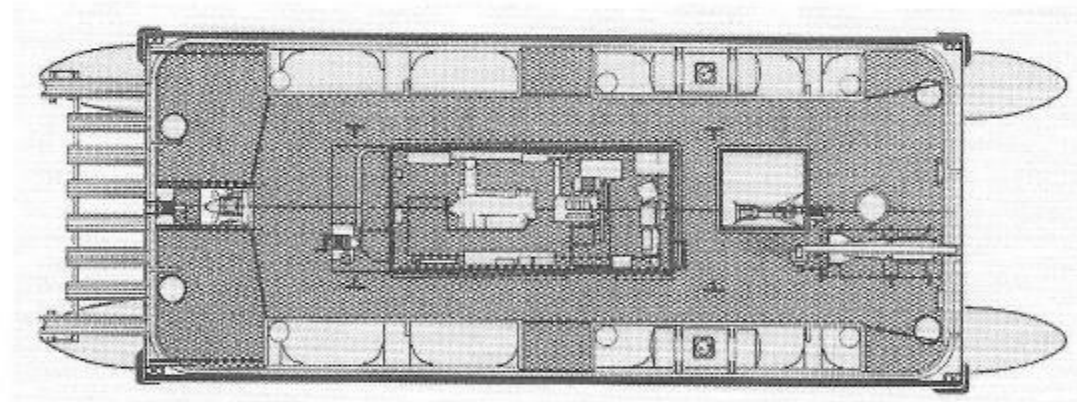
The CelsiusTech 9 MJ 400 AIO system incorporates a Racal Minehunting Action & Navigation System (MAINS) and the 9LV100 optronic director. The 9LV100 uses the minehunting target plot for target detection, designation and tracking to control the main gun. A common display presents both radar and sonar data. The 9MJ 400 also controls the SAM remote-controlled minesweeping system.

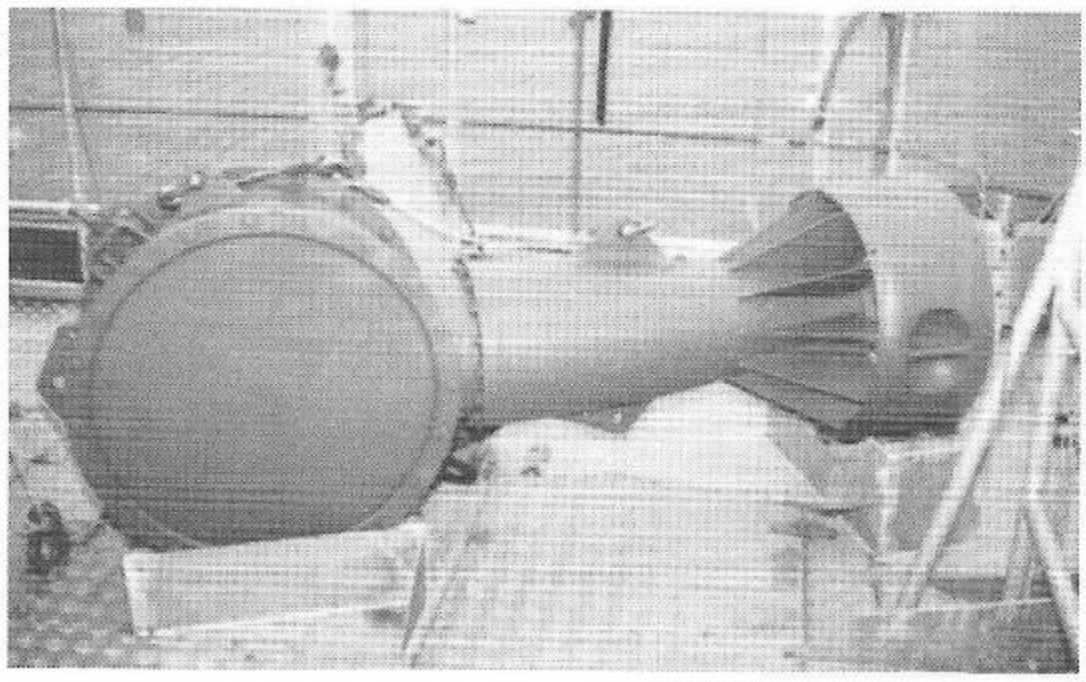


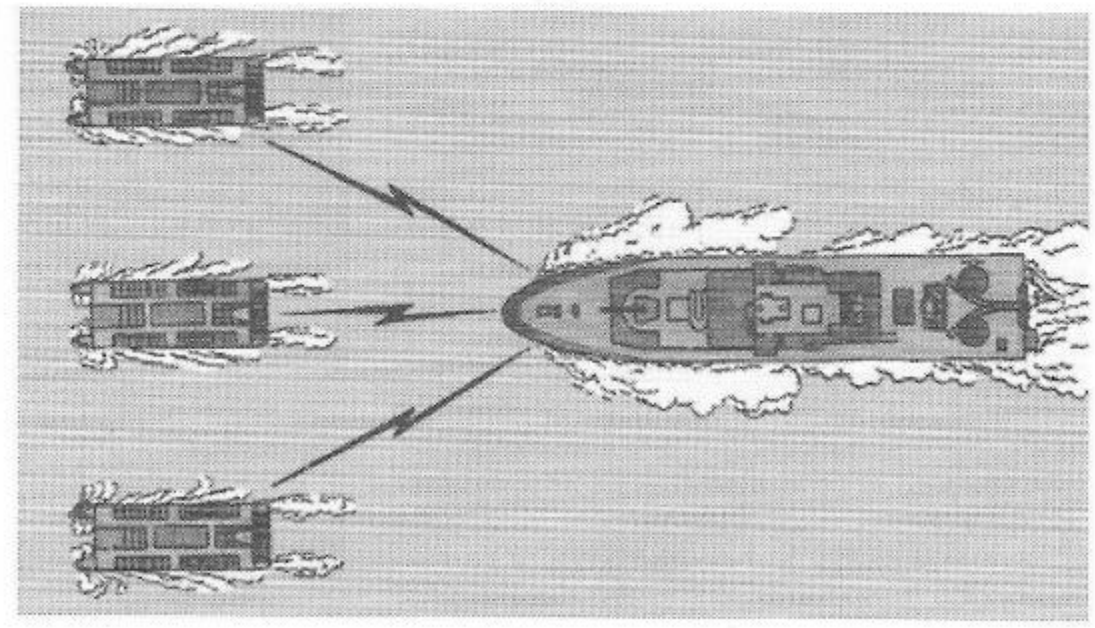












The Swedish SAM is a diesel-driven, catamaran ROV which has been selected for the Singaporean and Swedish navies and has been bought in small numbers for the US Navy. It is 18.2 m (59.7 ft) long and 6.2 m (20 ft) wide and is powered by a Volvo Penta 159 kW diesel driving a Schottel propeller unit. Up to three SAMs can be controlled by one MCMV mothership (below right). The SAM can undertake a number of tasks, including towing an acoustic transmitter (below left), and magnetic sweeping (using on-board coils), and is also capable of deploying marker buoys from the stern

Manufacturer/Contractor
CelsiusTech, Sweden.

Bofors SUTECH Double Eagle ROV

Double Eagle is fitted with powerful high-speed thrusters for use in currents up to at least 3 knots, the eight thrusters giving over 5 knots forward, 3 knots astern, 3 knots lateral and 1 knot vertical movement. The ROV is fitted with a computerised stabilisation control system and is extremely manoeuvrable, exhibiting unlimited movement in six degrees of freedom (pitch ±180°, roll ±180°).

There are two monitors, one displaying the picture from a colour TV camera, the other the picture from a monochrome TV camera mounted at the tip of a telescopic arm. Digital data such as heading, depth, pitch and roll angle, cable twist, leakage warnings, real-time clock with date and time and diagnostics are superimposed on the TV monitor. High-quality video is available using the fibre optic link in the umbilical cable. The standard umbilical is 600 m (1,968 ft) long, but there is

also an optional 1,000 m (3,280 ft) cable. The vehicle is fitted with one colour CCD camera as standard, and tilt arrangement with colour and SIT camera is available as an optional extra. Optional sensors include echo-sounder, and electronic scanning or conventional sonar.

The vehicle uses a unique precision charge placement technique using a small mine disposal charge which also features several advantages. The vehicle can also carry a heavy standard NATO mine disposal charge as well as cable cutters.

Specifications
(Double Eagle)
Length: 1.90 m (6.23 ft)
Width: 1.30 m (4.26 ft)
Height: 0.80 m (2.62 ft)
Weight: 400 kg (882 lb)
Payload: 80 kg (176 lb)
Speed: 5 kts
Service depth: 500 m (1,640 ft)

Manufacturer/Contractor
Bofors Underwater Systems, Sweden.

MINEHUNTING SONARS

Thomson-CSF TSM 2022
TSM 2022 is a hull-mounted high-frequency minehunting sonar, which can also be used for mine avoidance on minesweepers. It is based largely on experience gained with the French DUBM 21B in the field of high-resolution beam-forming techniques. It is a hull-mounted equipment intended also for use in conjunction with precision display and navigation equipment and a mine countermeasures system.

The main feature of the TSM 2022 is its small-size retractable single array assembly, used for both detection and classification, which enables easy installation and maintenance. The high-resolution features of the DUBM 21 are maintained and improvements are mainly in the field of digital processing technology. The main functions of the sonar are: detection and classification of moored and bottom mines, detection at distances up to 600 m (1,968 ft), and classification of targets by analysis of the shape of their echo or shadow at distances up to 250 m (820 ft). In the classification mode, horizontal beamwidth is 7°; in detection mode either 14° or 28° beamwidth can be selected. In both modes the vertical beamwidth is 15°. In the Mk II configuration the TSM 2022 is equipped with a 19 in high-resolution colour console and specific sonar processing such as computer-aided detection (CAD), computer-aided classification (CAC) and performance indicator (PI).

Manufacturers/Contractors
Thoray, US/Thomson Sintra ASM, France.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/70 SAK 48
Not *Vinga* (M 75). The SAK 48 is a manually laid mounting in which the cupola-covered gun platform is on a pedestal. The mounting has a protective shield and includes ammunition racks for 96 rounds.

Specifications
Traverse: 360° (nominal) at 30°/s
Elevation: −3 to +85° at 24°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Manufacturer/Contractor
Bofors Weapon Systems, Sweden.

Bofors Sea Trinity CIWS
Vinga (M 75) only. The trials of the new Bofors Sea Trinity mount are being carried out aboard *Vinga* (M 75), in which it replaces the Bofors SAK 40 mm/70.

Specifications
(Sea Trinity)
Calibre: 40 mm
Length of barrel: 70 calibres
Traverse: 360° at 90°/s
Elevation: −20 to +80° at 55°/s
Firing dispersion: 0.7 mrad
Crew: 1
Range:
anti-surface: 1.61 n miles (3 km)
anti-air: 6,000 m (19,685 ft)
Rate of fire: 330 rds/min
Ammunition: 2.8 kg (6.1 lb) (3P)

Manufacturer/Contractor
Bofors Ordnance, Sweden.

7.62 mm MGs
Two per ship; model unknown

ANTI-SUBMARINE MORTARS

Elma ASW grenade-launching system
The ship system comprises four Saab nine-tube LLS-920 launchers, control electronics and a power supply. The tubes and support structure are of non-magnetic stainless steel, and the launchers are mounted on deck with a tube elevation of 30°. Tubes are loaded from the muzzle with the grenades, and from the rear with the propulsive charges. Grenade firing is initiated from the combat information centre in a programmable pattern when a submarine target has been identified and located. A carpet of 9, 18, 27 or 36 grenades can be laid over a pinpointed submarine within a range of 350 m (1,148 ft). The Elma grenade carries a shaped charge specially designed for good submarine hull penetration qualities. The blast jet makes a hole in a boat's pressure hull after passing through the water-filled superstructure. The grenade has a patented feature that prevents it bouncing or tumbling when striking a hard surface moving through the water.

Specifications
Launcher weight: 103 kg (227 lb)
Tube calibre: 100 mm (4.0 in)
Grenade weight: 4.35 kg (9.58 lb)
System range: 250-350 m (820-1,148 ft) (adjustable)

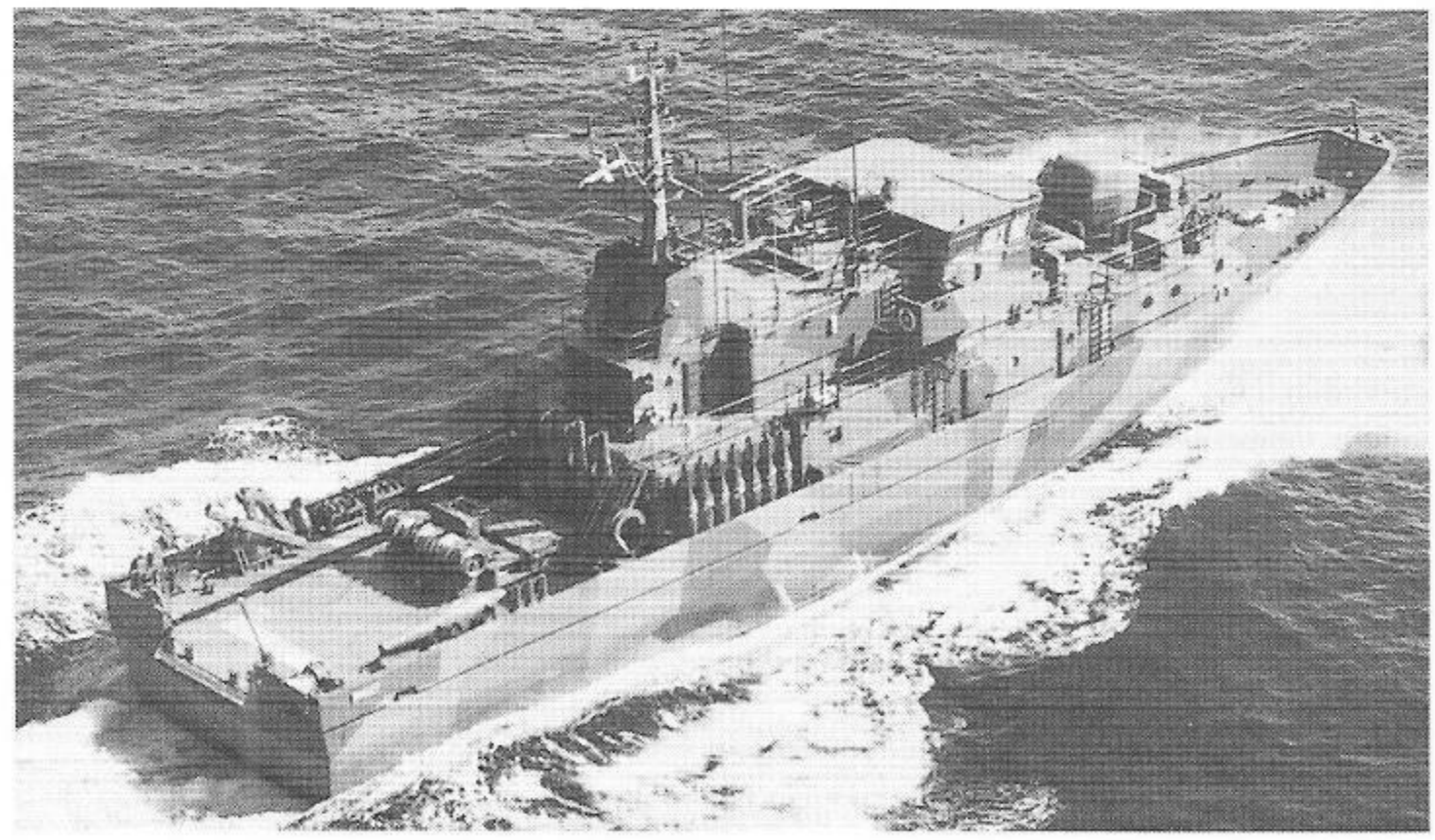
Manufacturers/Contractors
Saab Missiles (launchers).
FFV Ordnance (grenades).

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES

Thorn EMI MATILDA radar threat warning receiver.
MATILDA (Microwave Analysis Threat Indication and Launch Direction Apparatus) (known as Outfit UAR in the UK Royal Navy) covers the frequency range 7.5 to 18 GHz, and is intended to act primarily as a trigger for short-range chaff systems. It detects and recognises the threat, indicates bearing and, if required, activates chaff launchers. There are three elements: a small, lightweight antenna covering 360° in azimuth; a processing unit; and a display. The antenna unit consists of four antenna horns which are circularly polarised for the detection of vertical, horizontal and circular polarised signals. The warning unit consists of a small indicator panel designed to be located at any convenient position in the operations room. On detecting a threat, the unit sounds an audio warning and provides an indication of the threat and bearing sector channel. Total processing/warning time is claimed to be under one second.

Specifications
(MATILDA)
Frequency range: 7.5-18 GHz
Frequency resolution: 1.5 GHz
Pulsewidth range: 100 ns-6.4 µs
Pulsewidth resolution: 200 ns
Bearing coverage: 360°
Bearing resolution: 45°
Sensitivity (referred to isotropic): −30 dBm
Dynamic range: 40 dB



An aerial picuture of a 'Landsort' class MCMV showing the general layout and the large, uncluttered sweep deck aft (Karlskronavarvet)

Antenna gain: 6-8 dB
Voice module: Programmable to any warning required in any language

Manufacturer/Contractor
Thorn EMI Electronics Ltd, Sensors Group, Crawley, West Sussex, UK

DECOYS

Philax (Protean) 9CM/100 decoy launchers
The 9CM system is based upon the Philax fixed launcher which consists of four magazines similar to those used in DAGAIE and also uses Lacroix munitions. Usually the magazines contain chaff munitions but one

may be replaced by an infra-red (IR) munitions magazine. The munitions are fired by a single cartridge in each of the four chaff groups or each of the three to six IR containers. Each chaff magazine has 36 × 40 mm grenades which are fired at an interval of 0.1 second per group and within 1 second begin to create a cloud with a 1,000 m² (3,280 sq ft) radar cross-section which is complete within <5 seconds at a height of 40-60 m (131-196 ft). The IR container is 131 × 468 × 357 mm (5 × 18 × 14 in) and weighs 28.5 kg (62.8 lb), the munitions covering the 3 to 5 and 8 to 14 µm bands.

The 9CM100 system in the 'Landsort' class MCMVs controls two fixed launchers and is integrated with the MATILDA radar threat warning receiver.

Specification
(Philax)
Length: 87.5 cm (34.4 in)
Height: 72 cm (28 in)
Width: 95 cm (37 in)
Weight (unloaded): 180 kg (397 lb)

Manufacturer/Contractor
CelsiusTech, Sweden.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Philips 9LV 100
Optronic director. The system is intended to control medium-calibre guns against air and surface targets as well as surface-to-surface missiles. It can track up to two air or surface targets and can receive designation from search and navigation radars or designators as well as being capable of being slaved to other types of directors.

The main elements of the 9LV 100 are an electro-optic director weighing 140 kg (308 lb) with Saab TV camera and Ericsson 1.06 µm laser with optional infra-red tracker, a control and display console with a 41 cm (16 in) screen, gun and director controls, two bridge pointers for designation, and the fire-control computer.

Specifications
(9 LV 100)
Director
Azimuth: 360° at 85°/s
Elevation: −25 to + 80°
Angular acceleration: 400°/s²

TV camera
Type: Vidicon
Field of view: 32 × 42 mrad
Scanning: 625 lines, 25 frames/s

IR camera
Wavelength: 8-12 µm
Field of view: 52 × 35 mrad; 157 × 105 mrad
Cooling: Stirling closed cycle
Detector: Cadmium Mercury Telluride

Laser rangefinder
Type: Nd:YAG
Wavelength: 1.06 µm
Peak power: 4 MW
Pulse repetition frequency: 10 Hz

Manufacturer/Contractor
CelsiusTech, Sweden.

RADARS

Terma Skanter
I-band navigation radar.

Manufacturer/Contractor
Terma, Denmark.

PROPULSION

Specifications
System: Diesel
Main machinery: 4 Saab-Scania DSI 14 diesels; 1.17 MW (1,592 hp(m)) sustained
Propellers: The four diesels are coupled in pairs to two Voith Schneider props
Ships services: 2—225 kVA diesel-generator sets; 1—135 kVA emergency diesel generator set

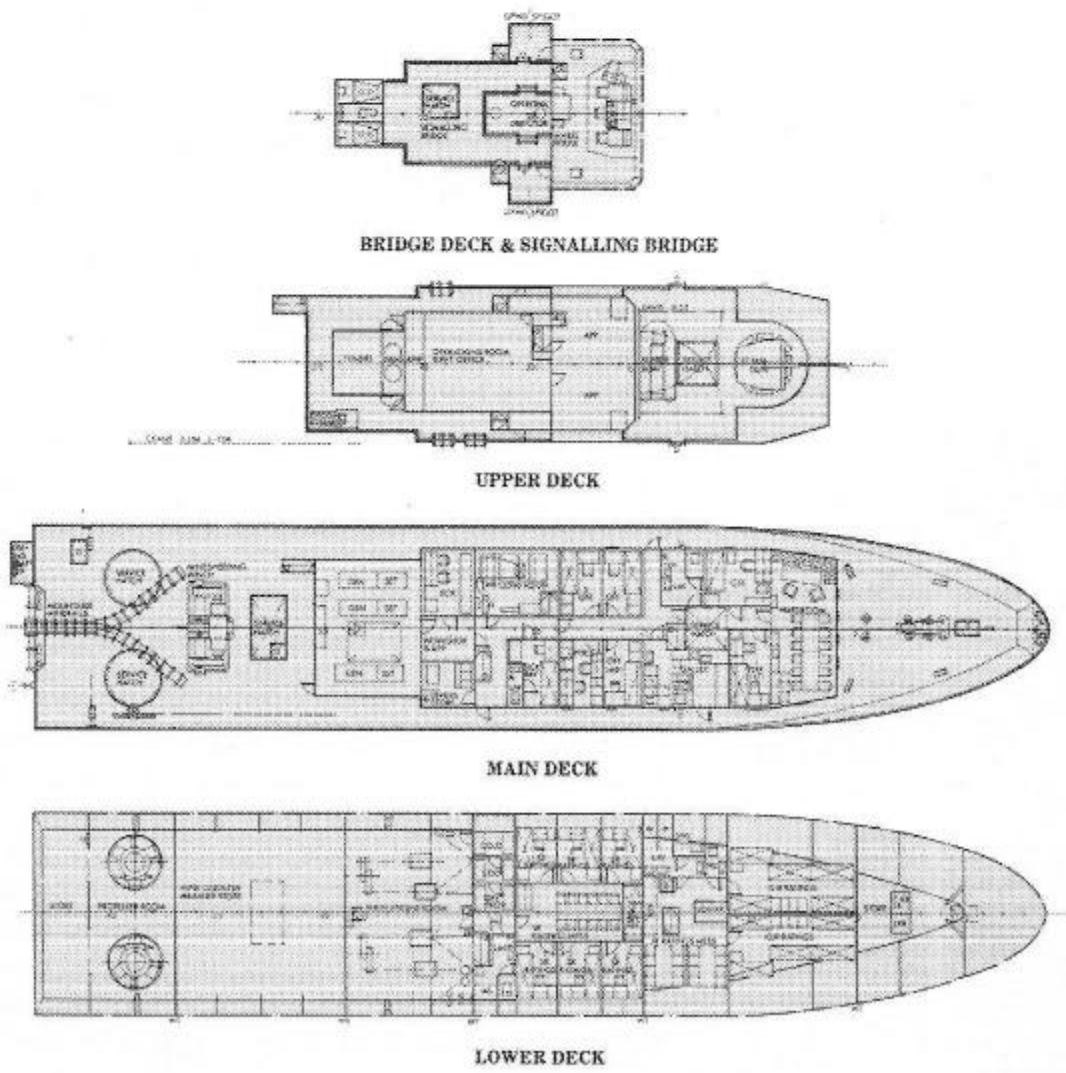
FURTHER INFORMATION

PROGRAMME

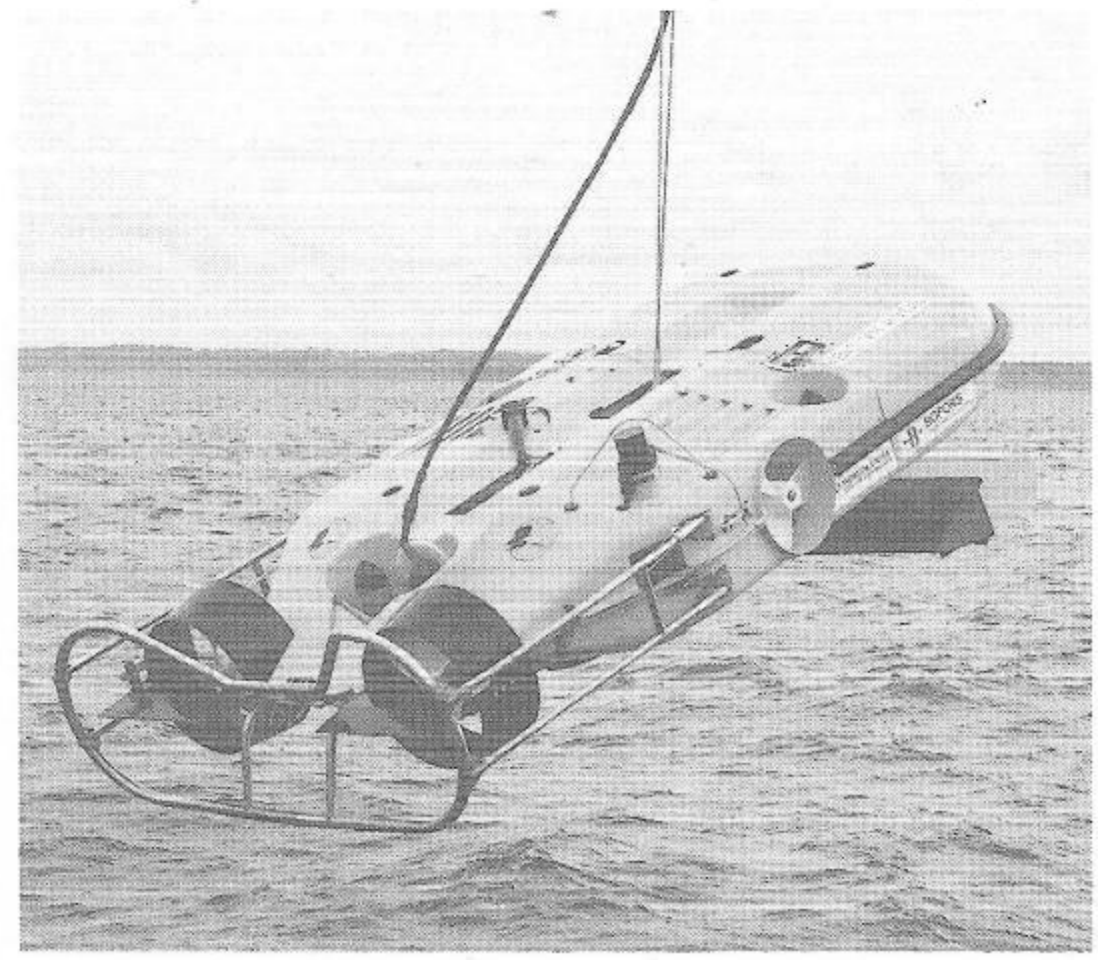
The orders for this class were placed: two in early 1981; four in 1984; and one in 1989. A projected eighth of the class was cancelled. Four, to the same design, have been built in Singapore.

DESIGN

The hull is constructed of double-skinned GRP sandwich. The face material is made of E-type glass fibre woven with an isophthalic polyester resin, while the core is a rigid PVC foam. The hull is of conventional design and is fabricated on a wooden, frame; this is coated with the GRP sandwich and, on completion, the mould is inverted and removed, leaving the hull to receive its internal lamination and have the bulkheads fitted. This hull mould has also been used for the Swedish coastguard's KBV 171 class.



Views of the decks of the export version of the 'Landsort'. The version for the Royal Swedish Navy is slightly different (Karlskronavarret)



Sutech Double Eagle ROV has eight thrusters giving unlimited movement in six degrees of freedom (pitch ±180°; roll ±180°) (Jane's/David Miller)

BEDOK (LANDSORT)

GENERAL SPECIFICATIONS

Country of origin: Sweden
Operator: Singapore
Type: Landsort (Minehunter)

Class: BEDOK

Built: 4
Active: 4

Displacement:
Standard: 270 t
Full load: 360 t

Dimensions
Length: 47.5 m (155.8 ft)
Beam: 9.6 m (31.5 ft)
Draught: 2.2 m (7.3 ft)

Speed: 15 kts
Range: 2,000 n miles at 12 kts

Complement: 38 (8 officers)

SHIPS

BEDOK (M 105)
Builder Karlskronavarvet, Karlskrona, Sweden
Launched 24 Jun 1993
Commissioned 7 Oct 1995

KALLANG (M 106)
Builder Singapore Shipbuilding, Jurong, Singapore
Launched 29 Jan 1994
Commissioned 7 Oct 1995

KATONG (M 107)
Builder Singapore Shipbuilding, Jurong, Singapore
Launched 8 Apr 1994
Commissioned 7 Oct 1995

PUNGGOL (M 108)
Builder Singapore Shipbuilding, Jurong, Singapore
Launched 16 Jul 1994
Commissioned 7 Oct 1995

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

The Landsort MCMVs are fitted for:

- Mechanical sweeps for moored mines
- Magnetic sweeps
- Acoustic sweeps
- It is also possible to operate two SAM drones for remotely controlled preliminary sweeps.

MINEHUNTING

Thomson-CSF TSM 2061 Mk II

TSM 2061 Mk II is a minehunting and mine disposal system, which includes on board, real-time analysis.

PAP Mk 5 ROV

The Singaporean MCMs will carry two PAP Mk 5 (PAP = *poisson auto-propulsé*) ROVs, which have the capability simultaneously to hunt and destroy ground mines and tethered mines either by placing and remotely detonating a charge or by cutting the mooring rope of tethered mines. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via either a tether, which can be either a 2,000 m (6,562 ft) fibre optic cable or a 1,000 m (3,280 ft) coaxial cable. It is horizontally propelled by means of two side thrusters.

In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide-rope'. The winch in the PAP is instructed to deploy a selected length of rope and the operator then uses return signals from the vehicle to maintain the vehicle at the desired selected height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP Mk 5 is able to carry the 126 kg (278 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution nearfield sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

Specifications
PAP Mk 5
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.2 ft)
Performance
Max vehicle velocity:
mid-water transit: 6 kts (3 m/s)
bottom-following mode: 5.5 kts (2.75 m/s)
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s
Ascent velocity (charge released): 1.5 m/s
Payload:
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Horizontal range:
with fibre optic cable: 2,000 m (6,560 ft)
with coaxial cable: 1,000 m (3,280 ft)
Max continuous endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bars

Manufacturer/Contractor
Societé ECA, 92707 Colombes, France.

SAM remote-control minesweeping drone

The RSN has bought SAMs for use with its 'Bedok' class MCMVs. The remote-control SAM uses a diesel-powered rudder propeller to drive the GRP catamaran hull. The craft is fully equipped for power supply, sweeping of acoustic and magnetic mines, navigation and remote control from a 'Landsort' class MCMV, which can control a number of the unmanned sweeps, providing remote control of the diesel engine, steering, minesweeping equipment, control and monitoring. The hull of the SAM is fitted with a number of coils which are used for sweeping magnetic mines, and a towed acoustic transmitter is used to counter acoustic mines. A number of buoys is carried to mark the swept passage. A digital GPS and microplotter is also installed to monitor the sweeping track.

Onboard power is provided by a Volvo Penta TAMD 70D diesel engine with a continuous output of about 159 kW at 2,200 rpm, to give the craft a speed of 8 knots. Power is fed to a Schottel-type propeller unit via reversing gear couplings and a shaft. The diesel and reversing gear are mounted on a girder framework which is shockmounted in an aluminium structure onto the main platform. Although the machinery is normally remotely controlled from the MCMV, it can also be controlled at the engine or from the operating platform. Remote-control functions include diesel engine control, steering control, minesweeping equipment control and monitoring.

Bedok *(M 105), the first of four 'Landsort' class MCMVs for Singapore was completely built in Sweden*
(H & L van Ginderen Collection)

Specifications
Length: 18.2 m (59.7 ft)
Beam: 6.2 m (20.3 ft)
Draught: 1.6 m (5.2 ft)
Displacement: 27 m³ (953 ft³)
Speed: 8 kts
Range: 330 n miles at 7 kts
Engine: Volvo Penta TAMD 70D diesel engine, 159 kW at 2,200 rpm

Manufacturer/Contractor
Karlskronavarvet, Karlskrona.

MINEHUNTING SONAR

Thomson-CSF TSM 2022

TSM 2022 is a hull-mounted high-frequency minehunting sonar, which can also be used for mine avoidance on minesweepers. It is based largely on experience gained with the French DUBM 21B in the field of high-resolution beam-forming techniques. It is a hull-mounted equipment intended also for use in conjunction with precision display and navigation equipment and a mine countermeasures system.

The main feature of the TSM 2022 is its small-size retractable single array assembly, used for both detection and classification, which enables easy installation and maintenance. The high-resolution features of the DUBM 21 are maintained and improvements are mainly in the field of digital processing technology. The main functions of the sonar are: detection and classification of moored and bottom mines, detection at distances up to 600 m (1,968 ft), and classification of targets by analysis of the shape of their echo or shadow at distances up to 250 m (820 ft). In the classification mode, horizontal beamwidth is 7°; in detection mode either 14° or 28° beamwidth can be selected. In both modes the vertical beamwidth is 15°. In the Mk II configuration the TSM 2022 is equipped with a 19 in high-resolution colour console and specific sonar processing such as computer-aided detection (CAD), computer-aided classification (CAC) and performance indicator (PI).

Manufacturers/Contractors
Thoray, US.
Thomson Sintra ASM, France.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/70

The SAK 40L/70-315 is a manually laid mounting in which the gun platform is on a pedestal. The total height to the centre of the barrel from the deck when the gun is horizontal is 1.36 m (4.5 ft). The mounting weighs 2.87 t unloaded, is 1.83 m (6.00 ft) long and has a training radius of 3.31 m (10.9 ft). The mounting has a protective shield and includes ammunition racks for 96 rounds.

Specifications
Traverse: 360° (nominal) at 30°/s
Elevation: −3 to +85° at 24°/s
Rate of fire: 300 rds/min
Muzzle velocity: 1,005-1,025 m/s (3,297-3,363 ft/s)
Max range:
anti-surface: 6.5 n miles (12 km)
anti-air: 2.2 n miles (4,000 m)
Ammunition weight: 2.4 kg (5.29 lb)
Projectile weight: 0.96 kg (2.11 lb)
Crew: 4

Manufacturer/Contractor
Bofors Weapon Systems, Sweden.

12.7 mm machine guns

Each ship carries four 12.7 mm machine guns; model not known.

MINES

There are two mine rails.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Signaal WM20 director

WM20 is designed to control two to three light or medium calibre guns and can engage one air and/or one surface target simultaneously while the torpedo control system can engage two targets simultaneously. The optional third gun can be used to engage a second surface target. The radar can track one air and three surface targets simultaneously and there is input from a ×8 magnification optical sight with 8° field of view.

Manufacturer/Contractor
Signaal, Hengelo, The Netherlands.

RADARS

Navigation

There is one I-band navigation radar.

Signaal WM20

Specifications
Role: Surface search/fire control
Frequency: I/J-band
Range: 25 n miles (46 km)
Beam:
search: 1.5 × 4/7°
track: 2.4°
Peak power: 200 kW
Gain: 33.5 dB
Pulsewidth: 0.22/4.5 µs
PRF: 3,600/1,800 pps
Scan rate: 60 rpm

Manufacturer/Contractor
Signaal, Hengelo, The Netherlands.

PROPULSION

Specifications
System: Diesel
Main machinery: 4 Saab Scania diesels; 1.17 MW (1,592 hp(m))

Propellers: The 4 diesels are coupled in pairs to 2 Voith Schneider props
Ships services: 2—225 kVA diesel-generator sets; one 123 kVA emergency diesel generator set

FURTHER INFORMATION

PROGRAMME

The Republic of Singapore Navy (RSN) ordered this design from Karlskrona in February 1991. The first ship, *Bedok* (M 105) was built at Karlskrona and started trials in Sweden in December 1993; it was then shipped to Singapore in early 1994 for completion. Prefabrication work for the other three was done in Sweden with assembly and fitting out in Singapore at Benoi Basin.

DESIGN

The hull is constructed of double-skinned GRP sandwich. The face material is made of E-type glass fibre woven with an isophthalic polyester resin, while the core is a rigid PVC foam. The hull is of conventional design and is fabricated on a wooden frame; this is coated with the GRP sandwich and, on completion, the mould is inverted and removed, leaving the hull to receive its internal lamination and have the bulkheads fitted.

Katong *(M 107). Note that in the Singapore version the superstructure extends further aft than the Swedish version (resulting in a much smaller sweep deck) and there is also a large rectangular recess in the port side of the transom* (H & L van Ginderen Collection)

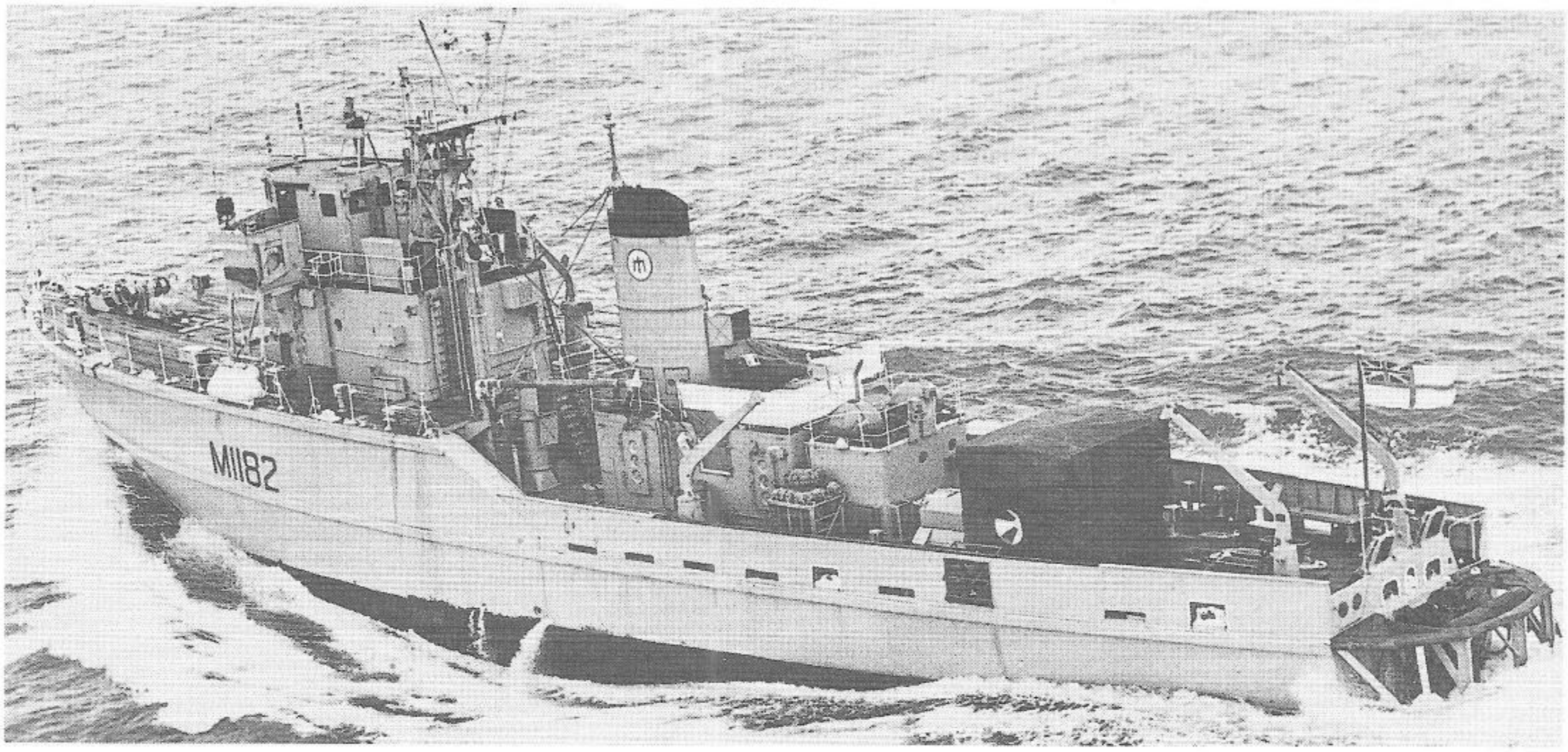
OPERATIONAL

Based at Tuas.

TON

OVERVIEW

The 'Ton' class was a direct outcome of the threat posed to NATO shipping by the Soviet magnetic influence mine, which was perceived to pose a major threat to European ports and coastal waters. NATO nations co-operated to modernise their MCM fleets to meet this new threat and one of the types produced in large numbers was the British 'Ton' class, the first of which was launched in 1952. A number of those built in the UK were exported, either as direct sales or at the completion of their service with the UK Royal Navy. As part of the NATO programme, however, the drawings were provided to Canada, France and The Netherlands.



Ton Class (Ton Association)

Country of production	Class name	Number built	Years	Operators	Operational 1997	Fate
Canada	Gaspe (Bay)	20	1951-57	Canada — 10	—	Stricken 1994
				Turkey — 4 — 1958	—	Reroled 1991-92
				France — 6 — 1954	—	Stricken 1976-87
France	Sirius	37	1952-57	France — 32	—	Stricken 1972-81
				Seychelles — 1 — 1979	1	Used as PC
				Morocco — 1— 1974	—	Stricken 1986
				Yugoslavia — 3 —1957	2	
Netherlands	Dokkum	32	1954-56	Netherlands	2	
				Oman — 2 — 1974	—	Stricken 1981
				Ethiopia — 1— 1971	—	Stricken 1990
Portugal	Sao Roque	4	1954-57	Portugal — 4	1	Used as PC
UK	Ton	115	1952-58	UK	—	All disposed of
				Argentina — 6	6	
				Australia — 6	—	Stricken
				Ghana — 1	—	Discarded 1979
				India — 4	—	Stricken 1980s
				Ireland — 3	—	Stricken 1980s
				Malaysia — 6	—	Stricken 1980s
				South Africa — 10	4	6 stricken
Yugoslavia	Sirius	1	1958	Yugoslavia — 1	—	Stricken 1993
TOTALS		**209**			**16**	

NEUQUEN (TON)

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: Argentina
Type: Ton (Minesweeper)

Class: NEUQUEN

Purchased: 6
Active: 6

Displacement:
standard: 360
full load: 440 t

Dimensions
Length: 46.4 m (153 ft)
Beam: 8.8 m (28.9 ft)
Draught: 2.5 m (8.2 ft)

Speed: 15 kts
Range: 2,500 n miles at 12 kts

Complement: Minesweepers 27; Minehunters 36

SHIPS

NEUQUEN (M 1)
Builder Thornycroft, Woolston, Hampshire, UK
Launched 26 Jan 1955 (*Hickleton* (M 1132))
Sold (Argentina) 1968

RIO NEGRO (M 2)
Builder Doig
Launched 10 Nov 1954 (*Tarlton* (M 1186))
Sold (Argentina) 1968

CHUBUT (M 3)
Builder Fleetlands
Launched 18 Aug 1955 (*Santon* (M 1178))
Sold (Argentina) 1968

TIERRA DEL FUEGO (M 4)
Builder Whites, Cowes, Isle of Wight, UK
Launched 17 Mar 1953 (*Bevington* (M 1108))
Sold (Argentina) 1968

CHACO (M 5)
Builder Richards, Cowes, Isle of Wight
Launched 27 Nov 1958 (*Rennington* (M 1176))
Sold (Argentina) 1968
Converted to minehunter 1968

FORMOSA (M 6)
Builder Camper & Nicholson, Southampton, UK
Launched 8 Mar 1954 (*Ilmington* (M 1148))
Sold (Argentina) 1968
Converted to minehunter 1968

MINE COUNTERMEASURES

MINESWEEPING

Oropesa Sweep, Mk 3 Mod 2
The Mk 3 Mod 2 Oropesa is a conventional wire sweeping system designed to cut the wires on buoyant mines, thus releasing them so that they return to the surface where they can be destroyed. The system can be configured with either one or two Oropesa floats, using kite and otters to maintain the depth and direction.

Magnetic Sweep LL Mk 2 Mod 3
The LL Mk 2 Mod 3 (LL = double longitudinal) consists of two cables streamed side by side. The cables are of differing lengths and currents are passed between them to create a magnetic field.

AD Mk 3 acoustic
The AD Mk 3 (AD = Acoustic Displacer) is a large device which is slung beneath the ship, which contains a simple electrically powered noise-maker vibrating at very low frequencies, typically between 10 and 30 Hz.

MINEHUNTING SONAR

GEC-Marconi Type 193
Chaco and *Formosa* only. Type 193 is installed in the two minehunters. It is a British hull-mounted, short-range, high-definition, sector-scanning sonar, operating at two frequencies, providing detection and classification of both moored and ground mines. The sonar provides both bearing and range data; the fine range and bearing resolution enable the operator to assess accurately the shape of a target and hence its nature. Since the resolution depends both on operating frequency and pulse length, two selectable frequencies are provided, with a choice of pulse lengths in the classification mode.

Range and bearing data appear on two displays: in the search mode one display shows the total range covered; in the classification mode, a 27 m (30 yd) section of the search display is expanded to fill the second display screen and permit close examination of the target. Two frequencies are employed by the 193M sonar: 100 kHz for long-range search and 300 kHz for short-range search and classification. The transducers

Neuquen *(M 1). The Argentine Navy has six of these vessels which were bought from the UK in 1968. All are active* (Argentine Navy)

for these signals are carried beneath the ship on a stabilised, steerable mounting, the whole assembly contained within a dome.

Manufacturer/Contractor
GEC-Marconi Sonar Systems, UK.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60 (UK Mk 7 mount)
1 or 2 mounts per vessel in some.

Specifications
Weight: 1.42 t
Traverse: Nominal 360° at 35°/s
Elevation: −5 to +90° at 45°/s
Crew: 3

COMMAND AND CONTROL SYSTEMS

RADARS

Decca 45
Decca 45 is an old type of I-band navigation radar.

IFF
Type 955

PROPULSION

Specifications
System: Diesel
Main machinery: 2 × Paxman Deltic/Mirrlees JVSS-12 diesels; 2.24 MW (3,000 hp)
Shafts: 2

FURTHER INFORMATION

DESIGN

These ships are of composite wooden and non-magnetic metal construction. Shortly after being taken over by the Argentine Navy, *Chaco* and *Formosa* were converted into minehunters in HM Dockyard, Portsmouth, while the other four were refitted and modernised as minesweepers by the Vosper Thornycroft Group, the work including installing Vosper activated roll damping equipment.

OPERATIONAL

All are active in spite of reports that they had been paid off.

KIMBERLEY (TON)

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: South Africa
Type: Ton (Minesweepers)

Class: KIMBERLEY

Purchased: 10
Active: 4

Displacement:
standard: 360 t
full load: 440 t

Dimensions
Length: 46.6 m (153 ft)
Beam: 8.8 m (28.9 ft)
Draught: 2.5 m (8.2 ft)

Speed: 15 kts
Range: 2,300 n miles at 13 kts

Complement: 27

SHIPS

See 'Further Information'

KIMBERLEY (M 1210)
Builder Dorset Yacht Co, Poole, Dorset, UK
Commissioned (UK RN) 5 Jun 1959 (*Stratton* (M 1210))
Sold (South Africa) 1959

WALVISBAAI (M 1214)
Builder Harland & Wolff, Belfast, UK
Commissioned (UK RN) 20 Sep 1959 (*Packington* (M 1214))
Sold (South Africa) 1959

EAST LONDON (M 1215)
Builder Cook, Welton and Gemmell, Beverley, Yorkshire, UK
Commissioned (UK RN) 28 Oct 1958 (*Chilton* (M 1215))
Sold (South Africa): 1958

WINDHOEK (M 1498)
Builder Jl Thornycroft, Southampton, Hampshire, UK
Commissioned (RSAN) 17 Apr 1958

MINE COUNTERMEASURES

MINESWEEPING

Oropesa Sweep, Mk 3 Mod 2

The Mk 3 Mod 2 Oropesa is a conventional wire sweeping system designed to cut the wires on buoyant mines, thus releasing them so that they return to the surface where they can be destroyed. The system can be configured with either one or two Oropesa floats, using kite and otters to maintain the depth and direction.

Magnetic Sweep LL Mk 2 Mod 3

The LL Mk 2 Mod 3 (LL = double longitudinal) consists of two cables streamed side by side. The cables are of differing lengths and currents are passed between them to create a magnetic field.

AD Mk 3 acoustic

The AD Mk 3 (AD = Acoustic Displacer) is a large device which is slung beneath the ship, which contains a simple electrically powered noise-maker. It is vibrated at very low frequencies, typically between 10 and 30 Hz.

MINEHUNTING SONAR

GEC-Marconi Type 193

***Chaco* and *Formosa* only.** Type 193 is installed in the two minehunters. It is a British hull-mounted, short-range, high-definition, sector-scanning sonar, operating at two frequencies, providing detection and classification of both moored and ground mines. The sonar provides both bearing and range data; the fine range and bearing resolution enable the operator to assess accurately the shape of a target and hence its nature. Since the resolution depends both on operating frequency and pulse length, two selectable frequencies are provided, with a choice of pulse lengths in the classification mode.

Range and bearing data appear on two displays: in the search mode one display shows the total range covered; in the classification mode, a 27 m (30 yd) section of the search display is expanded to fill the second display screen and permit close examination of the target. Two frequencies are employed by the 193M sonar: 100 kHz for long-range search and 300 kHz for short-range search and classification. The transducers for these signals are carried beneath the ship on a stabilised, steerable mounting, the whole assembly contained within a dome.

Manufacturer/Contractor
GEC-Marconi Sonar Systems, UK.

WEAPONS SYSTEMS

GUNS

Bofors 40 mm/60 (UK Mk 3)

One Bofors 40 mm/60 in a UK Mk 3 mount is mounted on the foredeck.

Specifications
Weight: 1.22 t
Traverse: Nominal 360°
Elevation: −5 to +90°
Training speed: 25°/s
Elevation speed: 26°/s
Crew: 3

7.62 mm machine guns

Two per ship.

Walvisbaai *(M 1214). All four remaining South African 'Ton' class MCMVs are being totally reconstructed at the RSAN's repair yard at Simon's Town*

COMMAND AND CONTROL SYSTEMS

RADAR

Raca-Decca

I-band navigation radar (possibly now replaced by equipment of South African design).

PROPULSION

Specifications
System: Diesel
Main machinery: Two Paxman Deltic-7A diesels; 2.24 MW (3,000 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The Republic of South Africa Navy purchased ten 'Ton' class minesweepers from the UK. Of these, two (*Windhoek* (M 1214) and *Durban* (M 1499)) were built for and commissioned directly into the RSAN, and were given both South African names and pennant numbers. The other eight were all originally bought by and spent some time serving with, the UK Royal Navy before being sold to the RSAN. On transfer, they were given new South African names but six retained the same pennant numbers that they had carried in the UK Royal Navy, while two were given both South African names and South African pennant numbers. The reason for these anomalies is not known.

Two of the ten were converted into minehunters: *Kimberley* (M 1210) in 1977-78, and *Port Elizabeth* (M 1212) in 1979-80.

Six were paid off in 1987, primarily because of a shortage of trained South African Navy personnel to man them.

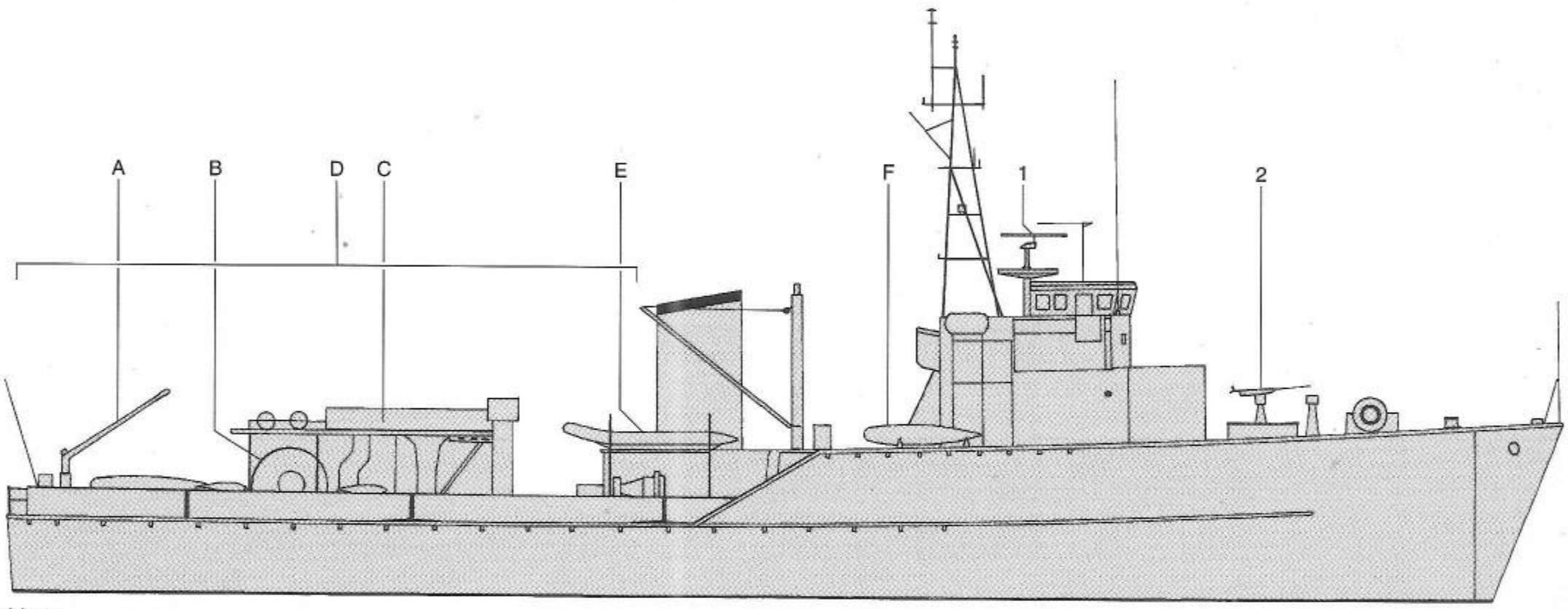
Four now survive, of which one, *Kimberley* (M 1210), was one of those converted to a minehunter, but has now reverted to minesweeping configuration.

MODERNISATION

A two year major modernisation programme started in 1991 at the RSAN's base at Simon's Town. The first ship, *Walvisbaai* completed this process on 13 April 1993 and is now considered to be good for another 20 years. The second of class started modernisation in mid-1993.

The work started with stripping down the wooden-hulled ship, where it was found that the ship's condition was worse than had been expected, particularly in the accumulation of hydrated aluminium oxide between the aluminium hull frames and the wooden planking. The work involved stripping out the internal equipment and removing items such as the keel, connecting rivets and the plate work. The ship then received a new upper deck, new aluminium plating, new hull and deck planking (6,000 m (19,685 ft) in overall length), and all rivets and plank fastening bolts. Much electronic equipment was replaced by new equipment of South African design and manufacture. Total cost was $7 million.

DOKKUM (TON)



Dokkum
MCM A *Crane* **B** *Sweep winch* **C** *Shelter deck* **D** *Sweep deck* **E** *Combat diver's dinghy* **F** *Float*

General 1 *Racal-Decca TM 1229C navigation radar* **2** *Oerlikon 20 mm cannon*

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: The Netherlands
Type: Ton (Coastal minesweeper)

Class: DOKKUM

Built: 32
Active: 2

Displacement:
standard: 378 t
full load: 460 t

Dimensions
Length: 46.6 m (152.9 ft)
Beam: 8.8 m (28.9 ft)
Draught: 2.3 m (7.5 ft)

Speed: 16 kts
Range: 2,500 n miles at 10 kts

Complement: 27-36 depending on task

SHIPS

NAARDEN (M 823)
Builder Wilton-Fijenoord Niestern Shipbuilders, Schiedam, Netherlands
Commissioned 18 May 1956

SITTARD (M 830)
Builder Wilton-Fijenoord Niestern Shipbuilders, Schiedam, Netherlands
Commissioned 19 Dec 1956

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm/70 cannon
These ships have one 20 mm Oerlikon cannon in a single mounting; either or both may also have a second mounting.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,773 ft)

Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca TM 1229C

The navigation radar is the Racal-Decca Type 1229, with an output of 20 kW. It is equipped with a 2.7 m (8.9 ft) antenna and operates in the I/J band.

Specifications
Role: Navigation
Frequency: I/J-band
Beam: 1.3 × 30°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
PRF: 1,300/650 pps
Scan rate: 25 rpm

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 × Fijenoord MAN V64 diesels; 1.84 MW (2,500 hp(m))
Shafts: 2

FURTHER INFORMATION

PROGRAMME

32 'Western Union'-type coastal minesweepers were built in the Netherlands, being launched in 1954-56. They were based closely on the British 'Ton' class design , but with certain Dutch equipment, including the diesel engines. Eighteen of these ships, known as the 'Dokkum' class, were procured using Mutual Defense Aid Pact (MDAP) funds and were powered by Fijenoord diesels. A further 14 ships, known as the 'Wilderwank' class, were procured under Dutch Government funding and were essentially identical to the MDAP group, except that they were powered by Werkspoor diesels.

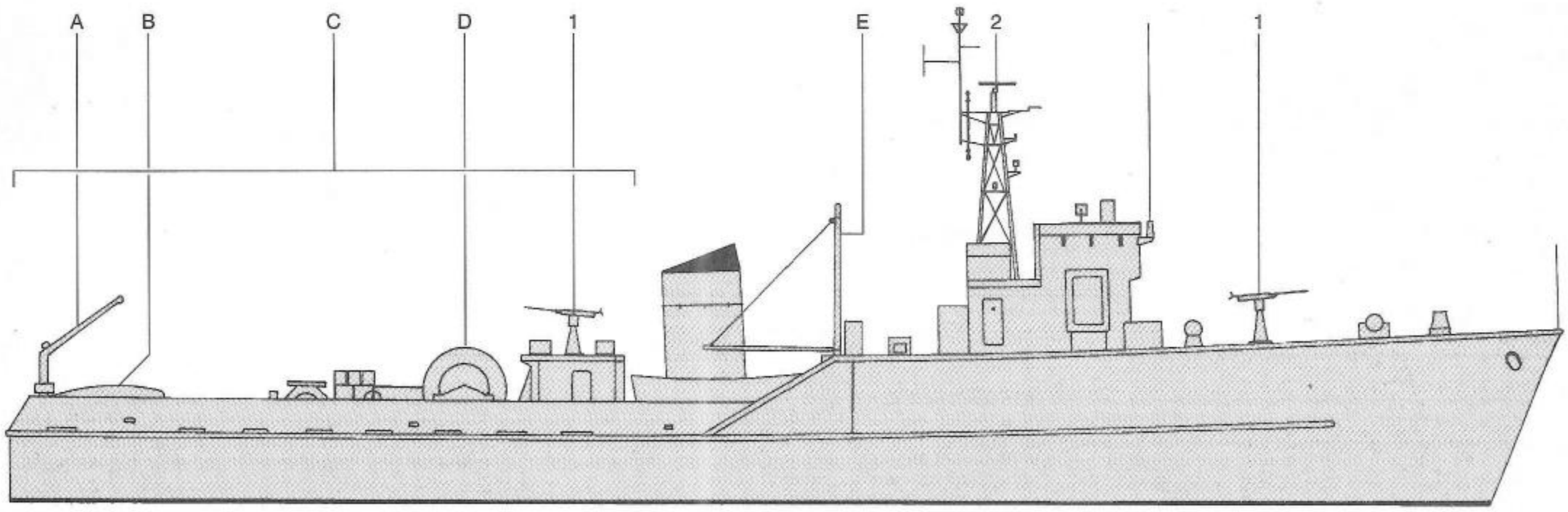
Two of the 'Dokkum' class remain in service.

MODERNISATION

The entire 'Dokkum' class was subject to a fleet rehabilitation and modernisation (FRAM) programme, which was completed in 1977. Six ships underwent a 'life prolonging' refit between the mid-1980s and 1991, which included updating equipment and the installation of a deckhouse to provide additional accommodation.

Naarden *(M 823) is one of two 'Dokkum' class MCMVs still in service with the RNethN. The deckhouse forward of the bridge was fitted as part of 1970s 'Fleet Rehabilitation and Modernisation' (FRAM) programme* (Audio Visual Dienst, MoD Netherlands)

VUKOV KLANAC (TON)



Podgora
MCM A *Crane* **B** *Oropesa float* **C** *Sweep deck* **D** *Sweep winch* **E** *Derrick*

General 1 *Oerlikon 20 mm cannon* **2** *DRBN-32 navigation radar*

GENERAL SPECIFICATIONS

Country of origin: UK (France - see Futher Information)
Operator: Yugoslavia
Type: Ton (Minesweepers)

Class: VUKOV KLANAC

Purchased: 3
Built: 1
Active: 2

Displacement:
standard: 365 t
full load: 424 t

Dimensions
Length: 46.4 m (152 ft)
Beam: 8.6 m (28.0 ft)
Draught: 2.5 m (8.2 ft)

Speed: 15 kts
Range: 3,000 n miles at 10 kts

Complement: 40

SHIPS

PODGORA (M 152)
Builder A Normand, France
Commissioned Sep 1957

BLITVENICA (M 153)
Builder A Normand, France
Commissioned Sep 1957

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

Oropesa Sweep, Mk 3

The Mk 3 Oropesa is a conventional wire sweeping system designed to cut the wires on buoyant mines, thus releasing them so that they return to the surface where they can be destroyed. The system can be configured with either one or two Oropesa floats, using kite and otters to maintain the depth.

Magnetic Sweep LL Mk 2

The LL Mk 2 (LL = double longitudinal) consists of two cables streamed side by side. The cables are of differing lengths and currents are passed between them to create a magnetic field.

AD Mk 3 acoustic

The AD Mk 3 (AD = Acoustic Displacer) is a large device which is slung beneath the ship, which contains a simple electrically powered noise-maker which is vibrated at very low frequencies, typically between 10 and 30 Hz.

MINEHUNTING

Thomson-CSF TSM 2022

***Blitvenica* only.** TSM 2022 is a hull-mounted high-frequency minehunting sonar which can also be used for mine avoidance on minesweepers. It is based largely on experience gained with the French DUBM 21B in the field of high-resolution beam-forming techniques. It is a hull-mounted equipment intended also for use in conjunction with precision display and navigation equipment and a mine countermeasures system.

The main feature of the TSM 2022 is its small-size retractable single array assembly, used for both detection and classification, which enables easy installation and maintenance. The high-resolution features of the DUBM 21 are maintained and improvements are mainly in the field of digital processing technology. The main functions of the sonar are: detection and classification of moored and bottom mines, detection at distances up to 600 m (1,968 ft), and classification of targets by analysis of the shape of their echo or shadow at distances up to 250 m (820 ft). In the classification mode, horizontal beamwidth is 7°; in detection mode either 14° or 28° beamwidth can be selected. In both modes the vertical beamwidth is 15°. In the Mk II configuration the TSM 2022 is equipped with a 19 in high-resolution colour console and specific sonar processing such as computer-aided detection (CAD), computer-aided classification (CAC) and performance indicator (PI).

Manufacturers/Contractors
Thoray, US.
Thomson Sintra ASM, France.

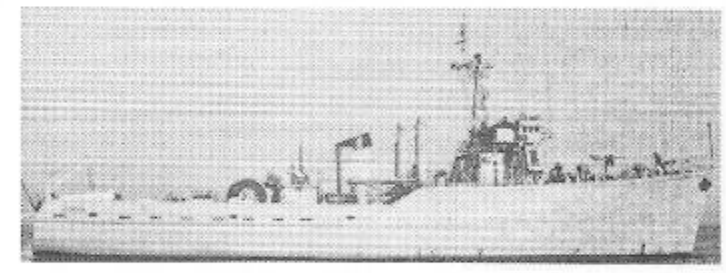
WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm (US Mk 10)

There are two mounts: one on the foredeck, the second abaft the stack.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range:
anti-surface: 1.5 km
anti-air: 1,150 m (3,773 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g



Blitvenica (M153) has been modified as a minehunter (Yugoslav Navy)

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca DRBN-32

DRBN-32 is the French designation for the Racal-Decca Type 1226 navigation radar.

Specifications
(DRBN 32/Type 1226)
Role: Navigation
Band: I
Beam: 1.2°
Peak Power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
PRF: N/A
Scan rate: 28 rpm
Typical range: 48 n miles

Manufacturer/Contractor
Racal-Decca, UK.

PROPULSION

Specifications
Main machinery: 2 SEMT=Pielstick PA1 175 diesel; 1.9 MW (1,620 hp(m))
Shafts: 2

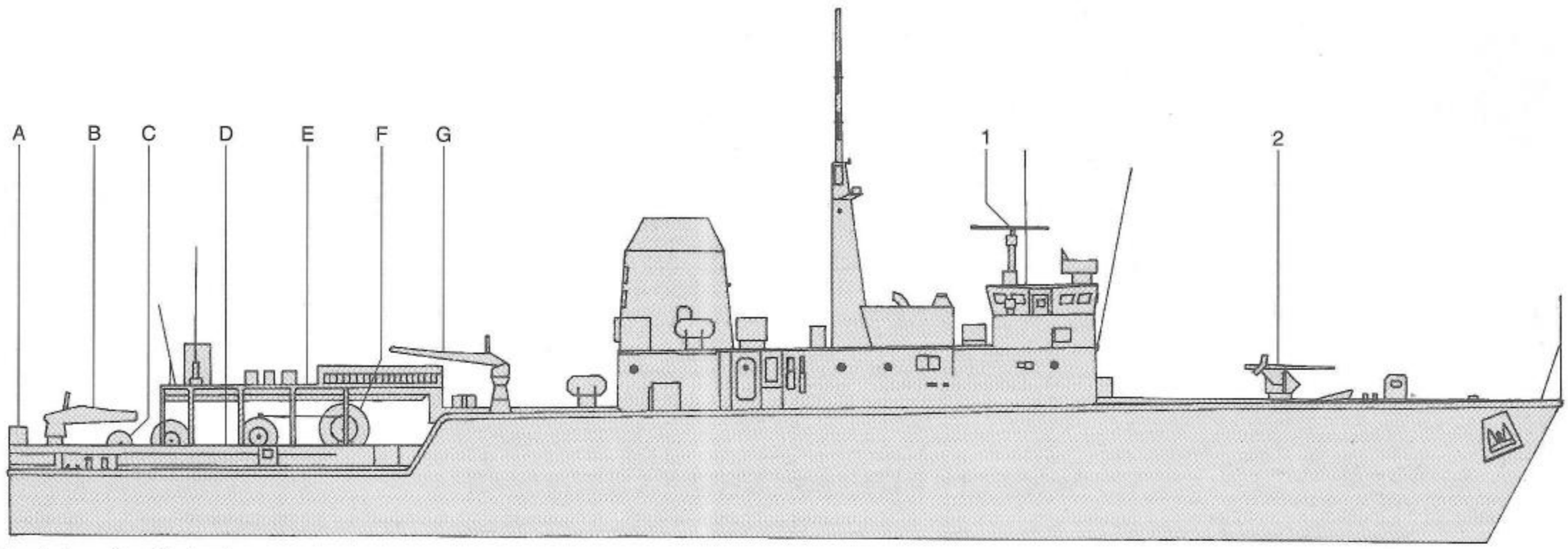
FURTHER INFORMATION

PROGRAMME

The Yugoslav Navy acquired three 'Sirius' class MCMVs in 1957, which were a French version of the British 'Ton' class design. These were paid for by the USA using 'offshore' funds and built in France to the 'Sirius' class design but, in addition, a fourth ship was then built in a Yugoslav yard to the same design, with French technical assistance.

One ship, *Blitvenica* was converted to a minehunter in 1981. Of the four ships, one was taken over by Croatia in 1991 and has since been scrapped, while three remain with the Yugoslav Navy. One of the three is being cannibalised for spares, but the other two are believed to be in service, based at Tivat.

HUNT



Hunt class (Ian Sturton)
MCM A *Fairleads* **B** *Derricks (two)* **C** *Towed Acoustic Generator (TAG)* **D** *Main sweep deck* **E** *Shelter deck* **F** *Main winch* **G** *Derricks (2)*

General 1 *Kelvin Hughes Type 1006 navigation radar* **2** *Oerlikon 30 mm/75DS 30B*

GENERAL SPECIFICATIONS

Operator: United Kingdom
Type: Coastal minehunter/sweeper

Class: HUNT

Built: 13
Active: 13

Displacement:
light: 615 t
full load: 750 t

Dimensions
Length: 60 m (197 ft)(oa), 57 m (187 ft) (wl)
Beam: 10 m (32.8 ft)
Draught: 3.4 m (9.5 ft)

Speed: 15 kts (diesels), 8 kts (hydraulic drive)
Range: 1,500 n miles at 12 kts

Complement: 45 (5 officers)

SHIPS

BRECON (M 29)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 21 Jun 1978
Commissioned 21 Mar 1980

LEDBURY (M 30)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 5 Dec 1979
Commissioned 11 Jun 1981

CATTISTOCK (M 31)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 22 Jan 1981
Commissioned 16 Jun 1982

COTTESMORE (M 32)
Builder Yarrow Shipbuilders, Glasgow, UK
Launched 9 Feb 1982
Commissioned 24 Jun 1983

BROCKLESBY (M 33)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 12 Jan 1982
Commissioned 3 Feb 1983

MIDDLETON (M 34)
Builder Yarrow Shipbuilders, Glasgow, UK
Launched 27 Apr 1983
Commissioned 15 Aug 1984

DULVERTON (M 35)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 3 Nov 1982
Commissioned 4 Nov 1983

BICESTER (M 36)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 4 Jun 1985
Commissioned 20 Mar 1986

CHIDDINGFOLD (M 37)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 6 Oct 1983
Commissioned 10 Aug 1984

ATHERSTONE (M 38)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 1 Mar 1986
Commissioned 30 Jan 1987

HURWORTH (M39)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 25 Sep 1984
Commissioned 2 Jul 1985

BERKELEY (M 40)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 3 Dec 1986
Commissioned 14 Jan 1988

QUORN (M 41)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 23 Jan 1988
Commissioned 21 Apr 1989

MINE COUNTERMEASURES SYSTEMS

MINEHUNTING SYSTEMS

Combat Divers

Normal complement is five to seven combat divers.

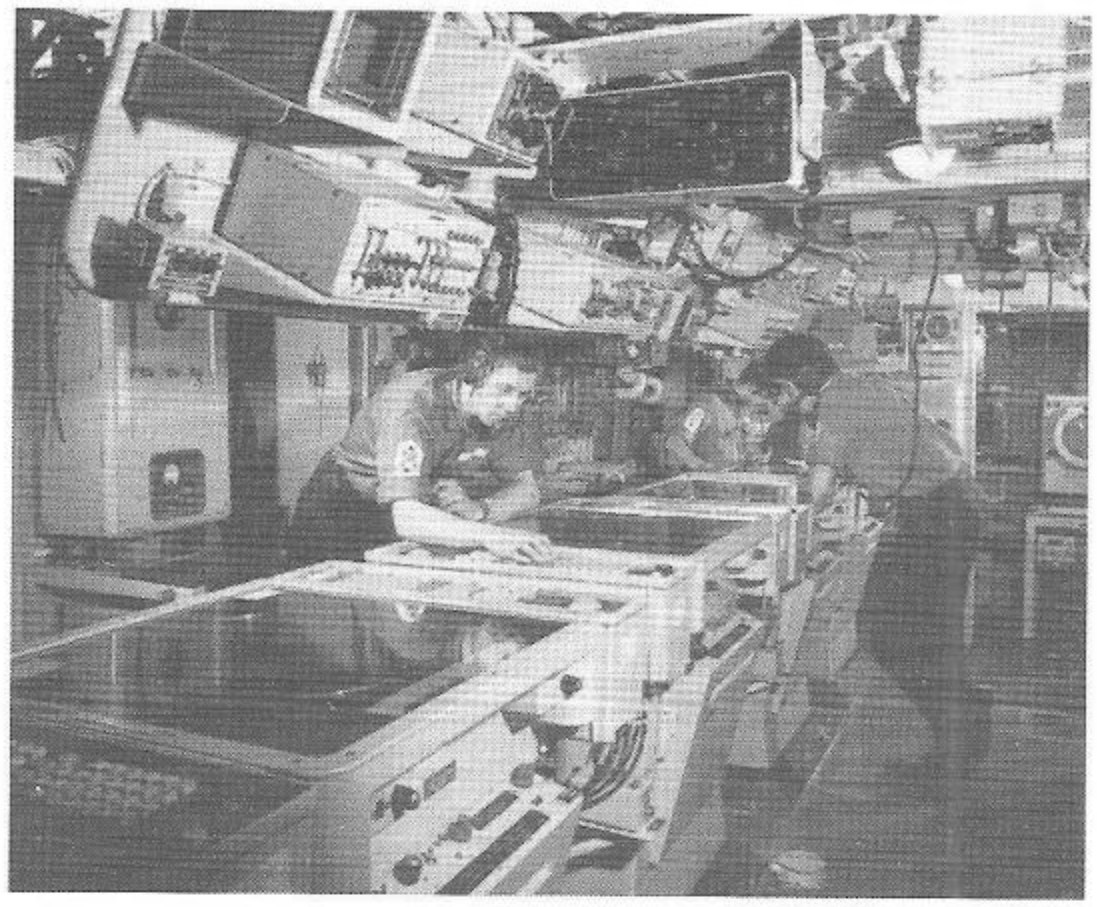
PAP 104/105 ROV

'Hunt' class MCMVs carry two PAP Mk 5 (PAP = *poisson auto-propulsé)* ROVs, which have the capability simultaneously to hunt and destroy ground mines and tethered mines either by placing and remotely detonating a charge or by cutting the mooring rope of tethered mines. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via a tether, which can be either a 2,000 m (6,562 ft) fibre optic cable or a 1,000 m (3,281 ft) coaxial cable. It is horizontally propelled by means of two side thrusters.

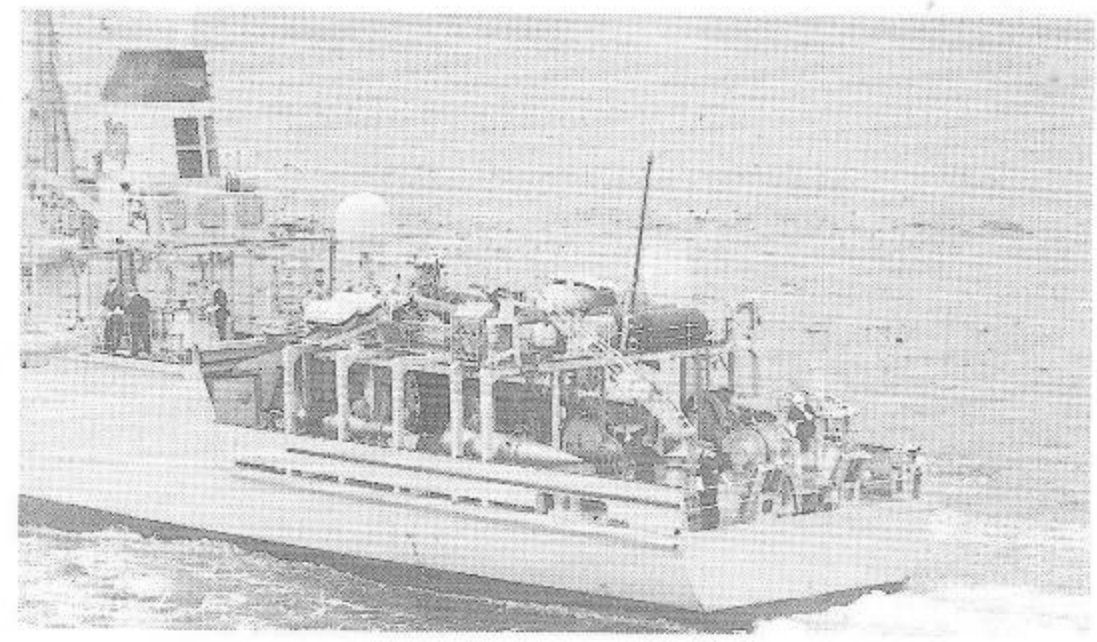
In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide-rope'. The winch in the PAP then lowers a selected length of rope and the operator uses return signals from the vehicle to maintain the vehicle at the desired selected height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP Mk 5 is able to carry the 126 kg (277 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution nearfield sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

The PAPs are stored in two large garages on the afterdeck when not in use.



A CAAIS (Outfit DBA) combat information centre



The sweep deck of a 'Hunt' class MCMV showing the wide variety of equipment carried by these relatively small ships. At the left of the picture is a PAP Mk 5 ROV. On the stern are five fairleads for the various sweeps, with two davits and, below the starboard davit, a Towed Acoustic Generator (TAG). Also at the main deck level are a number of floats and a wide variety of winches and cables. On the shutter above are a second PAP Mk 5 ROV, a dinghy for the combat divers, floats, buoys, fenders and Satcom antenna (Jane's/David Miller)

Specifications
PAP Mk 5
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.2 ft)
Performance:
Max vehicle velocity
mid-water transit: 6 kts (3 m/s)
bottom-following mode: 5.5 kts (2.75 m/s)
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s
Ascent velocity (charge released): 1.5 m/s
Payload:
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Horizontal range:
with fibre optic cable: 2,000 m (6,561 ft)
with coaxial cable: 1,000 m (3,280 ft)
Max continuous endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bars

Manufacturer/Contractor
Societé ECA, 92707 Colombes, France.

MINESWEEPING SYSTEMS

Magnetic Sweep Mk 14 (MS Mk 14)
MS Mk 14 is designed to counter magnetic influence mines and consists of two longitudinal electrodes of unequal lengths, their outer ends being connected by a non-conducting loop. the MS Mk 14 can be used on its own, or in combination with MSSA Mk 1 to form a Combined Influence Sweep (CIS).

Manufacturer/Contractor
BAeSEMA, Bristol, UK.

Mine Sweeping System Acoustic Mk 1 (MSSA Mk 1)
MSSA Mk 1 (originally known as 'Osborn') uses a controllable, broadband noise generator to simulate any desired ship's acoustic signature. A monitor near the noise generator senses the noise level and, in conjunction with the shipboard control unit, optimises the signal output for sweeping a wide variety of mines, ensuring that the required amplitude at seabed level is maintained, regardless of variations in acoustic propagation conditions. It is used to activate all acoustic mines, including those with frequency-selective triggering characteristics, which are designed to be actuated only by certain types or classes of vessels. The system comprises a Towed Acoustic Generator (TAG), a Towed Acoustic Monitor (TAM) with a towed hydrophone array, and a shipboard control console. The system has been specially designed to withstand the repeated levels of explosive shock likely to be experienced in operation, and is normally deployed in association with a magnetic sweep.

Manufacturer/Contractor
BAeSEMA Marine Division, Bristol, UK.

Combined Influence Sweep (CIS)
The MS Mk 14 and MSSA Mk 1 can be combined to form a Combined Influence Sweep as shown in the accompanying diagram.

Wire Sweep Mk 8 (WS Mk 8)
Wire Sweep Mk 8 (WS Mk 8) is a low-magnetic signature wire sweep system, which was developed for the 'Hunt' class from the Mk 3 Mod 2 used on the 'Ton' class minesweepers. It has a low-magnetic signature in order to be compatible with the overall low-magnetic characteristics of modern mine countermeasure vessels and, for example, has floats, kites and otters made from Cellobond® GRP rather than aluminium. It will sweep most types of buoyant mines that are moored to the seabed with sinkers by severing the mine mooring chain or wires with explosive cutters fitted to the sweep wires. The Mk 8 can be deployed in three configurations: Single Oropesa, Double Oropesa and Team Sweep.

Manufacturer/Contractor
BAJ Limited, Weston-super-Mare.

GEC-Marconi Minehunting Performance Prediction System
The Minehunting Performance and Prediction System (MPPS) was developed to gather data on underwater environmental and operating conditions to enable sonar operators to select the optimum operating parameters and to derive a probability factor for detection and classification of perceived mines using those parameters. MPPS is a self-contained, computer-based system consisting of a variable depth sound velocity measuring probe which is lowered and raised by an outboard winch and jib assembly sited on the upper deck, and which is controlled either remotely from the operations room or from a local control panel on the winch. The computer, plotter and electronic panel and rack are located below deck in the operations room.

The probe measures the velocity of sound, pressure (indicating the depth) and temperature at intervals of time as the probe is raised from the operator-selected depth. An optional lightweight probe is available which can replace the winch and probe assembly.

Using these data, together with data keyed in by the operator and data received from minehunting sonar, the computer applies programmed algorithms to produce recommendations for the sonar parameters to be used, together with predictions of the classification and detection performance which can be obtained. The operator interacts with the menu-driven program software in the computer using a keyboard and screen displays to insert parameters, select options, deploy the probe and request recommendations and graphical and tabulated information.

In computing the recommended sonar parameters and performance predictions, the system takes account of the ship's sonar characteristics (frequency, pulse length and so on); underwater environment (reverberation, ambient noise, sound profile and so on); ship characteristics (flow/propulsion noise levels and so on); detection, classification and operator performance models; and specific mission inputs (that is, ship speed, sonar operating mode, target characteristics and deployment). The system computes and displays detection range and depth characteristics (detection contour); probability of detection against range; probability of classification against range for moored and ground mines; real-time monitoring of sonar conditions; performance summary; velocity of sound versus depth; ray trace display; optimum towed body height for the variable depth sonar; and data for mission planning, allowing selection of optimum operating modes.

Manufacturer/Contractor
GEC-Marconi Naval Systems, Templecombe, Somerset, UK.

SCARAB
Some Hunts carry the SCARAB remote control, floating mine-towing device to enable them to destroy mines safely once they have been cut from their moorings. It is a catamaran consisting of two pontoons and driven by a standard yacht engine, which is steered by remote control using closed-circuit television. Once near the floating mine, it is secured using a hydraulic grab, and then towed away to a safe distance, where it can be detonated or otherwise disposed of.

MINEHUNTING SONARS

Type 193M Mod 1
The 193M is a short-range, high-definition sector scanning sonar, operating at two frequencies, providing detection and classification of both moored and ground mines. The sonar provides both bearing and range data; the fine range and bearing resolution enables the operator to assess accurately the shape of a target and hence its nature. Since the resolution depends both on operating frequency and pulse length, two selectable frequencies are provided, with a choice of pulse lengths in the classification mode.

Range and bearing data appear on two displays: in the search mode one display shows the total range covered; in the classification mode, a 27 m (30 yd) section of the search display is expanded to fill the second display screen and permit close examination of the target.

Two frequencies are employed by the 193M sonar: 100 kHz for long-range search and 300 kHz for short-range search and classification. The transducers for these signals are carried beneath the ship on a stabilised, steerable mounting, the whole assembly contained within a dome.

Type 193M Mod 1 enhancements have been retrofitted as a modification to the 'Hunt' class.

Manufacturer/Contractor
GEC-Marconi Sonar Systems, UK.

Type 2059
Type 2059 is a special high-frequency (HF) sonar, which is used to track up to five underwater vehicles such as PAPs and submarine rescue vehicles. There are five discrete transmit frequencies (22 kHz, 23.5 kHz, 25 kHz, 26 kHz, and 28 kHz) which activate a transponder aboard each vehicle to respond at 30 kHz. Aboard the MCMV a computer uses the return signal to establish the precise position of each vehicle, which is then fed into the MCMV's command system.

Manufacturer/Contractor
EDO, USA.

WEAPONS SYSTEMS

GUNS

Oerlikon 30 mm/75 DS 30B
The DS 30B uses the Astra/Oerlikon KCB gun and has the UK Ministry of Defence designation 'Single 30 mm Gun Mounting Mk 1.' It has replaced the Bofors 40 mm previously mounted in the 'Hunt' class.

Specifications
Gun
KCB
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Rate of fire: 650 rds/min
Ammunition: 870 g

Mounting
DS 30B
Traverse: 230° at 55°/s
Elevation: −25 to +70° at 55°/s
Mounting weight (loaded): 1,463 kg (3,225 lb)
Crew: 1
Power requirement: 440/415/380 V, 50-60 Hz, three phase (4 kVA)

Manufacturer/Contractor
MSI Defence Systems Ltd.

Oerlikon 20mm GAM-CO1
The GAM-CO1 mount features the KAD gun and has an elevation of −15 to +60°.

Specifications
Calibre: 85
Muzzle velocity: 1,040-1,100 m/s (3,412-3,609 ft/s)
Range:
anti-surface: 1.7 km
anti-air: 1,700 m (5,577 ft)
Rate of fire: 950 rds/min
Round weight: 306-321 g
Projectile: 110-125 g

Manufacturer/Contractor
Royal Ordnance, UK.

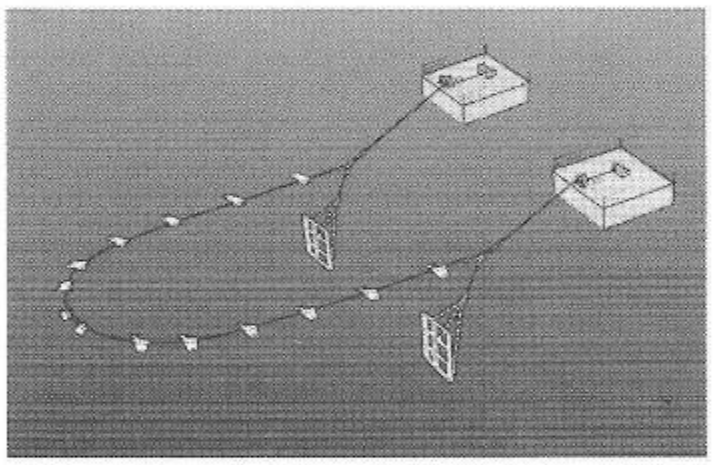
ELECTRONIC WARFARE SYSTEMS

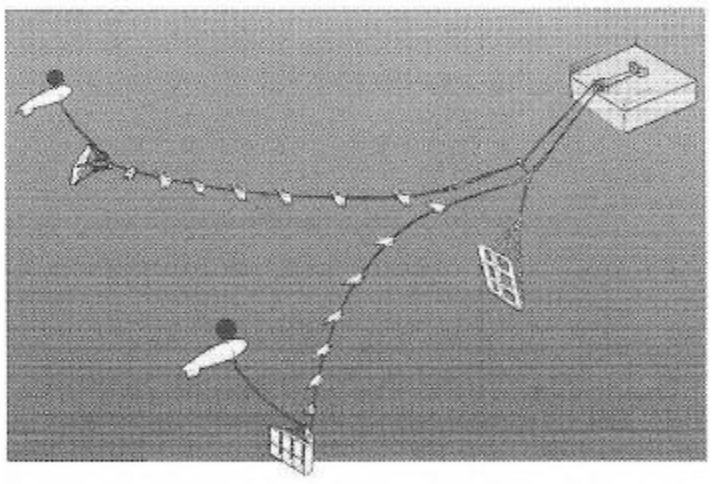
ELECTRONIC SUPPORT MEASURES

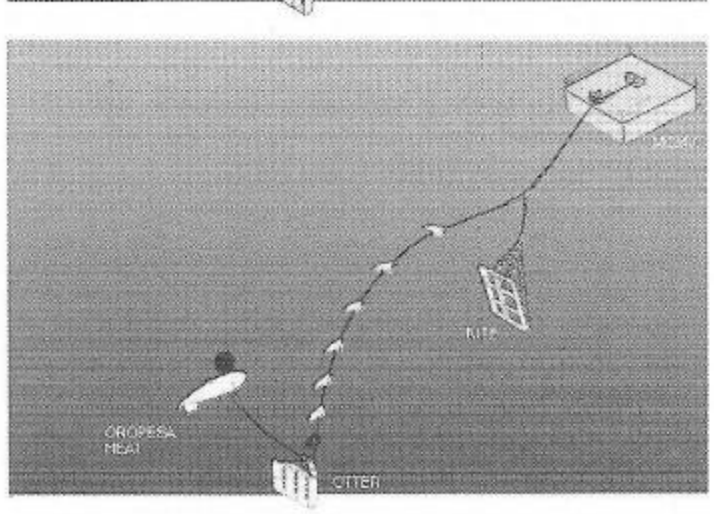
Outfit UAR radar threat warning receiver.
Outfit UAR, also known as MATILDA (Microwave Analysis Threat Indication and Launch Direction Apparatus) covers the frequency range 7.5 to 18 GHz, and is intended to act primarily as a trigger for short-range chaff systems. It detects and recognises the threat, indicates bearing and, if required, activates chaff launchers. There are three elements: a small, lightweight antenna covering 360° in azimuth; a processing unit; and a display. The antenna unit consists of four antenna horns which are circularly polarised for the detection of vertical, horizontal and circular polarised signals. The warning unit consists of a small indicator panel designed to be located at any convenient position in the operations room. On detecting a threat, the unit sounds an audio warning and provides an indication of the threat and bearing sector channel. Total processing/warning time is claimed to be under one second.

Specifications
Frequency range: 7.5-18 GHz
Frequency resolution: 1.5 GHz
Pulsewidth range: 100 ns-6.4 µs
Pulsewidth resolution: 200 ns
Bearing coverage: 360°
Bearing resolution: 45°
Sensitivity (referred to isotropic): −30 dBm
Dynamic range: 40 dB
Antenna gain: 6-8 dB
Voice module: Programmable to any warning required in any language

Manufacturer/Contractor
Thorn EMI Electronics Ltd, Sensors Group, Crawley, West Sussex, UK.







The Wire Sweep Mk 8 (WS Mk 8) was developed specifically for the 'Hunt' class MCMVs. It uses low-magnetic materials and the floats, kites and otters are all made from Cellobond® GRP rather than aluminium. There are three configurations: Team Sweep (top); Double Oropesa (centre); and Single Oropesa (bottom) (BAeSEMA)

Mentor A
In some ships only. Some, but not all, 'Hunt' class MCMVs are equipped with the GEC-Marconi Mentor A ESM system. Mentor is designed around a 32-bit signal processor with software written in Ada and can operate in either automatic or manual modes. The display shows raw and synthetic formats on a dynamic cartesian display, using colour coding to differentiate between friendly, neutral, unknown or hostile emitters. Details of new emitters are shown in tabular form, while areas of particular interest can be expanded for detailed viewing. The simultaneous tracking capability is 200 emitters. Mentor provides immediate warning of missile attacks, with radars being detected, analysed and full information displayed in less than one second, with both audible and visual warnings given. Mentor also triggers the deployment of offboard countermeasures.

Specifications
Mentor
Frequency range: D-J bands
Bearing accuracy: 3-6°
Channels: 6
Sensitivity: −60 dBm
Dynamic range: 60 dB
Emitter library: 3,000
Response time: 1 s
Scan types: Circular, sector, steady, conscan, raster, complex
Track file: >200
Pulsewidth range: <100 ns to 100 µs/CW
PRF range: 100-130 kHz
Elevation coverage: −10 to +50°
Azimuth coverage: 360°

Manufacturer/Contractor
GEC-Marconi Defence Systems, Stanmore, Middlesex, UK.

DECOYS

Barricade (Outfit DLK)
The 'Hunt' class has two Barricade launchers per ship. Barricade (designated Outfit DLK in the UK Royal Navy) is designed to provide ships with an effective and lightweight means of deploying chaff and infra-red decoys as countermeasures to missile attack. The system gives a layered defence against the various phases and types of anti-ship missile attack, ranging from the long-range confusion mode, through medium-range distraction and dump modes to the close in centroid mode. It was originally produced by Wallop Systems (and now by ML Aviation).

The complete system consists of port and starboard launchers, safety switches, a control unit, ready-use ammunition lockers (27 rockets) and rockets. The launcher consists of six sets of triple cells, the outer three sets being angled 60° from the next in bearing so that the launchers provide all-round coverage. The inner three sets are preset to point to the same bearing, as required but in different elevations. The inner three sets fire short-range Palisade rockets in centroid mode, while the outer barrels fire medium- and long-range Stockade rockets in dump, distraction and confusion modes.

Manufacturer/Contractor
M L Aviation, UK.

Irvin Replica chaff buoys
Replica (also known as Rubber Duck) is a rapidly deployed, passive naval decoy which presents a ship-like image to the radar seeker of an incoming anti-ship missile. The equipment consists of a launcher and a pair of liferaft-type containers, each housing one octahedral-shaped radar reflector. The two reflecting bodies start to inflate as they leave the ship and, once in the water, they are linked to each other by a 5 m (16 ft) line with one of the container lids acting as a sea-anchor to ensure that they remain apart. The distance between the opposite tips of the decoy is approximately 2.5 m (8.2 ft) and it contains metal-coated nylon mesh curtains, which are suspended from aluminium alloy tubes.

Manufacturer/Contractor
Irvin, Letchworth, UK.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

CAAIS (Outfit DBA (4))

CAAIS (Computer Assisted Action Information System) is a British-developed system in service in a variety of RN ships as Outfit DBA; Outfit DBA (4) (known colloquially as 'CAAIS for MCMV') is the version developed specifically for the 'Hunt' class MCMVs. CAAIS is a mainframe system using the FM1600B computer and Coral 66 software language. The hardware includes a three-cabinet digital suite which houses a 24-bit computer, operating at 200 Kips and with a 780 k memory, as well as a datalink terminal. In addition there are peripheral control units which include radar extraction units, encoder/decoders, display drive unit and the MMI control units. The last two elements support the display system which, in the CAAIS 400 series, can include up to six CA 1600 horizontal displays.

The search radars have two methods of tracking, LAX (Limited Area automatic eXtraction) and LFX (Limited output Full area automatic eXtraction), either of which involves tracking up to 20 air and surface targets. LAX exploits the capabilities of E/F- and I/J-band radars to produce a combined tracking capability but it is normally used in conjunction with surface search radars. Tracks are initiated manually and the area around the target is highlighted. Where several targets overlap, this limits the data rate of position extraction. LFX is similar but is usually used with air search radars and initially merely indicates the presence of such targets. Location data is not automatically provided to the computer until the operator requests it to form a track.

Manual rate-aided tracking is also available in severe clutter or ECM conditions. Automatic tracking may also be transferred by manual order from one radar to another as well as between manual and LAX. The displays may also accept inputs from ESM and optical/electro-optical systems.

Data from up to three sonars may be accepted by a CAAIS system with data fed to the computer semi-automatically by means of synchro-resolvers at the sonar operator's controls. Initially they are displayed as unassociated points which are 'rippled' in time sequence to assess the tactical position. When a submarine is believed to be in the area an automatic investigation is initiated by the operator around its suspected location. The computer then checks records to see if a track can be initiated and monitored by the sonars. There is provision for the 'rippled' display of up to 16 unassociated points, 32 associated detections shared by up to four tracks.

The CAAIS hardware had to be re-engineered to meet the low-magnetic signature requirements of MCMVs.This involved replacing mild steel components with similar items made of stainless steel, while the power supply units had to be totally redesigned.

Manufacturer/Contractor

Ferranti Naval Systems, UK.

COMMUNICATIONS AND DATALINKS

Satcom
Inmarsat

RADARS

Type 1006 or Type 1007.

Specifications

Type 1006
Role: Navigation
Frequency: I-band
Beam: 1 × 18°/0.75 × 18°
Peak power: 25 kW
Gain: 31 dB/34 dB
Pulsewidth: 0.8 or 0.25 µs/0.75 µs
PRF: 1,600/800 pps
Scan rate: 24 rpm
Typical range: 64 n miles

Manufacturer/Contractor

Kelvin Hughes, UK.

PROPULSION

Specifications

System: Diesel
Main machinery: 2 Ruston-Paxman 9-59K Deltic diesels; 1.42 MW (1,900 hp)
Shafts: 2
Thruster: 1 APE-Allen bow thruster
Pulse generator/auxiliary power: 1 Ruston-Paxman Deltic Type 9-55B diesel, 582 kW (780 hp)
Auxiliary power: 3—200 kW Foden FD 12 Mk 7 amagnetic diesel generators; APE-Allen 60 kW emergency generator (with Lucas gas turbine)

FURTHER INFORMATION

PROGRAMME

The first 11 ships were ordered on 19 June 1980, entering service between 1980 and 1985. A further two were ordered on 4 June 1985 and were commissioned in 1988 and 1989. All were built by Vosper Thornycroft except for two of the first batch, which were built by Yarrow.

DESIGN

The hull and superstructure were fabricated from layers of 800 g/m² Tyglas woven glass roving, bonded with BP Chemicals Cellebond® isophthalic-polyester resin. External surfaces were given a high-grade silane finish, while internal non-structural bulkheads are made of sandwich construction using end-grain balsa cores and thin-glass, phenolic-resin veneered cases. Exhaust uptakes are made from titanium, while the rudder frames are made from GRP-coated phosphor bronze.

Main power is provided by two Ruston-Paxman diesels, while a third diesel set (Ruston-Paxman Deltic Type 9-55B) is used for:

- Four Dowty hydraulic swash pumps which power hydraulic motors to drive propellers at 'creep' speeds of up to 8 kts during minehunting operations
- Seawater pump to drive bow thruster.
- Sweep winches
- Magnetic sweep current alternator (480 kW)
- Sweep cable winch

MODERNISATION

The ships were originally equipped with PAP Mk 4, but these have been replaced by ten PAP 104 Mk 5, acquired in 1988-89. The ships have also received a 30 mm gun in place of the Bofors 40 mm and the Racal Mk 53 navigation system has recently been installed.

A mid-life update was planned, which was to have included VDS sonar, NAUTIS-M command system and a replacement PAP or mine disposal UUV, but this has been cancelled in favour of a less wide-ranging modernisation, which, it is reported, may include the Australian ADI AMASS influence sweep.

Quorn *(M 41) final MCMV of the 'Hunt' class* (Jane's/H M Steele)

SANDOWN

GENERAL SPECIFICATIONS

Operator: UK
Type: Single-role minehunter

Class: SANDOWN

Active: 5
Building: 7

Displacement:
standard: 450 t
full load: 484 t

Dimensions
Length: 52.5 m (172.2 ft)
Beam: 10.5 m (34.4 ft)
Draught: 2.3 m (7.5 ft)

Speed: 14 kts diesels; 6.5 kts electric drive
Range: 3,000 n miles at 12 kts

Complement: 34 (5 officers) plus 6 spare berths

SHIPS

SANDOWN (M 101)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 16 Apr 1988
Commissioned 9 Jun 1989

INVERNESS (M 102)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 27 Feb 1990
Commissioned 24 Jan 1991

CROMER (M 103)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 6 Oct 1990
Commissioned 7 Apr 1992

WALNEY (M 104)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 25 Nov 1991
Commissioned 20 Feb 1993

BRIDPORT (M 105)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 30 Jul 1992
Commissioned 6 Nov 1993

PENZANCE (M 106)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched Mar 1997
Commissioned Dec 1997

PEMBROKE (M 107)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched Dec 1997
Commissioned Sep 1998

GRIMSBY (M 108)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched Jul 1998
Commissioned May 1999

BANGOR (M 109)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched Mar 1999
Commissioned Jan 2000

RAMSEY (M 110)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched Oct 1999
Commissioned Jul 2000

BLYTHE (M 111)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched May 2000
Commissioned Feb 2001

SHOREHAM (M 112)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched Feb 2001
Commissioned Nov 2001

MINE COUNTERMEASURE SYSTEMS

MINEHUNTING SONAR

GEC-Marconi Type 2093

The Type 2093 sonar is designed to operate in either hull-mount or variable depth mode, deployed through the ship's centre well, and will detect, localise and classify all current and future mine threats. Total system weight is 13,000 kg (28,660 lb). The variable depth, dual-frequency search and dual-frequency classification capability provides a sonar able to operate under all bottom and sea conditions at a range claimed to be twice that of hull-mounted sonar and with an increase of three times detection depth.

The towed body of the 2093 is cylindrical with hemispherical ends. The sonar arrays within the body consist of two 360° rings for LF and VLF operation, hydrophones for HF and VHF reception, and separate HF and VHF projectors. Below is a cylindrical VLF projector and finally a VLF depth sounder. LF and VLF are used for search, survey and moored mine classification; HF and VHF for classification and survey.

Sonar 2093 employs multiple operating modes which offer the MCM commander a choice of operational configurations to match the prevailing threat and environment. These multiple operating modes comprise VLF and LF search and moored mine classification, VLF and LF search, search and ground mine classification, also search and route survey. Sonar 2093 can combine these modes to enable concurrent operation.

Manufacturer/Contractor

GEC-Marconi, UK.

Other MCM features

Racal Hyperfix.
Decca Navigation Mk 21.
Kelvin Hughes NAVPAC system integrates all navigational aids to give an accuracy of 9 m (29.5 ft).

REMOTE CONTROL MINE DISPOSAL

PAP Mk 5 ROV

The 'Sandown' class carries two PAP Mk 5 (PAP = poisson auto-propulsé) ROVs, which have the capability simultaneously to hunt and destroy ground mines and tethered mines either by placing and remotely detonating a charge or by cutting the mooring rope of tethered mines. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via either a tether, which can be either a 2,000 m (6,562 ft) fibre optic cable or a 1,000 m (3,281 ft) coaxial cable. It is horizontally propelled by means of two side thrusters.

In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide rope'. The winch in the PAP is instructed to deploy a selected length of rope and the operator then uses return signals from the vehicle to maintain the vehicle at the desired selected height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP Mk 5 is able to carry the 126 kg (277 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution nearfield sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

Specifications

PAP Mk 5
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.2 ft)
Performance:
Max vehicle velocity
mid-water transit: 6 kts (3 m/s)
bottom-following mode: 5.5 kts (2.75 m/s)
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s
Ascent velocity (charge released): 1.5 m/s
Payload:
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Horizontal range:
with fibreoptic cable: 2,000 m (6,561 ft)
with coaxial cable: 1,000 m (3,281 ft)
Max continuos endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bars

Manufacturer/Contractor

Societé ECA, 92707 Colombes, France.

WEAPONS SYSTEMS

GUNS

Oerlikon/DES 30 mm/75 DS 30B

The DS 30B uses the Astra/Oerlikon KCB gun.

Specifications
DS 30B
Gun
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Mounting weight (loaded): 1,463 kg (3,225 lb)
Rate of fire: 650 rds/min
Ammunition: 870 g

Mounting
Traverse (operational): 230° at 55°/s
Elevation: −25 to +70° at 55°/s
Crew: 1

Manufacturer/Contractor
MSI Defence Systems Ltd, UK.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC COUNTERMEASURES

Outfit DLK (Barricade)

The 'Sandown' class carries two Barricade launchers per ship on operational deployments. Outfit DLK (designated Barricade for export) is designed to provide ships with an effective and lightweight means of deploying chaff and infra-red decoys as countermeasures to missile attack. The system gives a layered defence against the various phases and types of anti-ship missile attack, ranging from the long-range confusion mode, through medium-range distraction and dump modes to the close in centroid mode. It was originally produced by Wallop Systems (and now by ML Aviation).

The complete system consists of port and starboard launchers, safety switches, a control unit, ready-use ammunition lockers (27 rockets) and rockets. The launcher consists of six sets of triple cells, the outer three sets being angled 60° from the next in bearing so that the launchers provide all-round coverage. The inner three sets are preset to point to the same bearing, as required but in different elevations. The inner three sets fire short-range Palisade rockets in centroid mode, while the outer barrels fire medium- and long-range Stockade rockets in dump, distraction and confusion modes.

Manufacturer/Contractor
M L Aviation.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

GEC-Marconi NAUTIS M

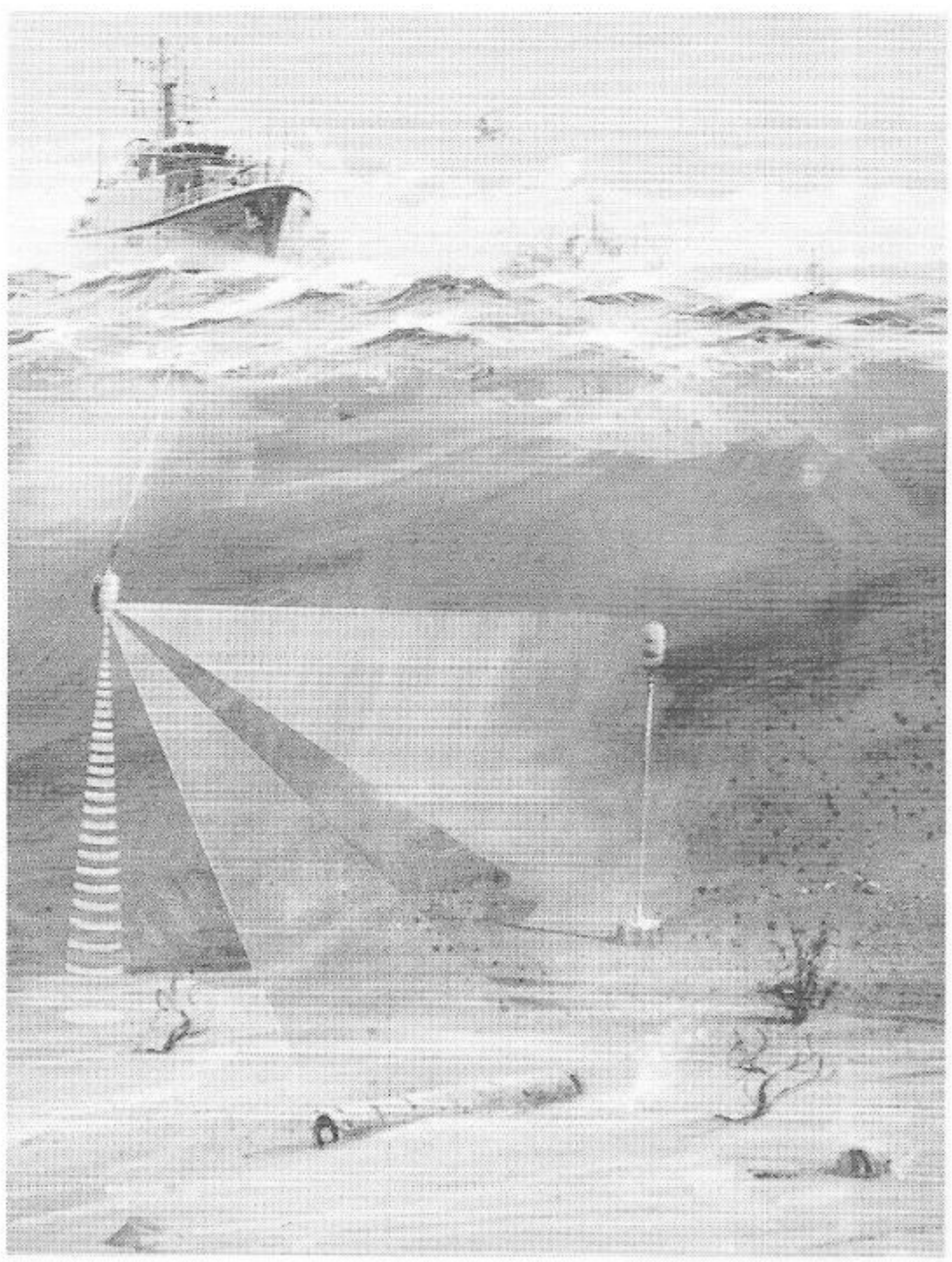
The NAUTIS-M system is based upon the NAUTIC (Naval AUTonomous Intelligent Console) multifunction intelligent workstation.

The NAUTIC itself uses the Intel iAPX-86 processor with 3 Mbyte RAM together with 2 Mbyte non-volatile magnetic bubble memory. Dual iAPX-286 microprocessors are used in Multibus configurates, while iAPX-186 microprocessors are used for intelligent interfaces. The system capacity is 200 air, surface and submarine tracks and reference points with integral radar autotracking for up to 80 air and surface targets. The HCI consists of 32 software-defined function keys with a separate numeric keypad and a rollerball. A dual-redundant MIL-STD-1553B highway links the workstations, each of which uses some 150,000 lines of Ada-language software code to support NAUTIS.

The monochrome system used in the 'Sandown' class features a 4,096 pixel monochrome 40 cm (16 in) System 90 screen and displays raw radar, graphics, alphanumeric totes and an interactive menu. Display scales are from 0.25 to 1,000 n miles (1,852 km) and six labelled electronic range and bearing lines can be attached to moving tracks. An extensive system database, replicated in each console, can typically cover an area of 2,000 × 2,000 n miles (3,704 km) and can include radar and sonar tracks, route/search plans, user-designated tactical maps and synthetic charts. Manually initiated automatic radar tracking is possible for a minimum of 20 tracks.

The NAUTICs are networked into a system designed to meet customer requirements with the workstations configured to meet specific tasks such as radar displays, automatic target tracking, tactical picture compilation, weapon direction and navigation. These roles are software driven and the workstations may be easily reconfigured in the event, for example, of damage or breakdown. Such reconfiguration is based upon a priority decided by the customer. The Military Standard-1553B 1 MHz bandwidth (of which 300 kHz is used) data highway system consoles can interface directly with one or more radars, IFF, navigation sensors, electro-optic and electronic warfare systems but may also be used with Ethernet standard local area networks. Optional facilities include an interactive chart table, automatic tactical plotter/printer as well as data storage and retrieval using magnetic tape cartridges.

NAUTIS-M mine countermeasures (MCM) system provides support for operational planning, ship control guidance, underwater and surface picture compilation, command and control for mine disposal, together with a real-time MCM database. The three-console (minehunting, operations, bridge) monochrome system has been purchased for the Royal Navy and the Royal Saudi Arabian Navy for use with 'Sandown' minehunters. The



Sandown *(M 101) showing the twin hangars and two PAP Mk 5 ROVs. One is strung out ready for launch the other is on its chocks* (Jane's/David Miller)

Sonar 2093 is the first variable depth, multimode minehunting sonar in any navy and is deployed through the ship's central sonar trunk
(Vosper Thornycroft)

'Sandown' class has the Type 1007 navigation radar, Type 2093 variable depth sonar and PAP 104 Mk 5 remotely operated vehicles.

Manufacturer/Contractor

GEC-Marconi Naval Systems, Combat Systems Division.

RADAR

Kelvin Hughes Type 1007

Navigation radar is the Kelvin Hughes Type 1007.

Specification

Type 1007
Role: Navigation
Frequency: H/I-band (9,410 MHz)
Beam: 1.0 × 18°/0.75 × 18°
Peak power: 25 kW
Pulsewidth: 0.08/0.3/0.8 µs
PRF: 1,600/800/400 pps
Scan rate: 26 rpm

Manufacturer/Contractor

Kelvin Hughes Ltd, Hainault, Essex, UK.

Nautis-M command system aboard a 'Sandown' class SRMH (Vosper Thornycroft)

PROPULSION

Specifications

System: Diesel
Main machinery: 2 × Paxman Valenta 6RP200m diesels; 1.12 MW (1,500 hp) sustained

Propellers: 2 Voith-Schneider cycloidal units
Thrusters: 2 Schottel bow thrusters
Auxiliary power: 3 Perkins V8-250G diesels (335 bhp) plus Maudsley generator sets

FURTHER INFORMATION

PROGRAMME

The 'Sandown' class is designated the Single-Role Minehunter (SRMH) in the UK Royal Navy and is designed to hunt and destroy mines and for operations in deep and exposed waters. Thus, in the UK Royal Navy it complements the 'Hunt' class MCMVs. The Vosper Thornycroft design for this class was approved on 9 January 1984 and the first one was ordered in August 1985, followed by an order for four more on 23 July 1987.

This should have been followed by a contract for a second batch in 1990, but this was deferred twice, until an order for seven more was finally placed in July 1994, with the first Batch 2 ship, *Penzance,* being laid down on 25 September 1995.

DESIGN

The Sandown hull uses a unidirectionally stiffened, single skin GRP structure, which is claimed to be lighter and more cost-effective than previous methods, particularly sandwich. The Batch 2 ships will incorporate a number of modifications, including larger diameter (1.8 m (5.9 ft)) Voith Schneider units, a two-man decompression chamber and a different stern davit.

Numerous MCMV designs use the Voith-Schneider cycloidal propulsion system, which is capable of both propelling and manoeuvring a ship in any chosen direction. The Sandown design is unique in combining the Voith-Schneider units with twin bow-mounted thrusters. The Voith-Schneider units are used for normal passage, but in the minehunting mode the ship is required to manoeuvre regardless of wind and tidal conditions in order to detect, classify and dispose of mines.

The Ship Positioning and Control System (SPCS) is computer-controlled and has two modes of automatic hover:

Dynamic Positioning (DP) uses the bow thrusters and the Voith-Schneider units to manoeuvre the ship towards the hover position and then to maintain it in these low environmental conditions.

Position Control Management (PCM) uses the Voith-Schneider units alone to orientate the ship so that the resultant effect of wind and tide produces the necessary forces to maintain the ship in the required position. Using the environment in this way requires less power and thus reduces the acoustic signature.

Bridport *(M 105) one of the five Sandown Batch 1 single-role minehunters serving with the UK Royal Navy* (Jane's/H M Steele)

DEPLOYMENT

All current Batch 1 'Sandown' class MCMVs are in service with 3rd MCM Squadron.

AL JAWF (SANDOWN)

GENERAL SPECIFICATIONS

Country of origin: UK
Operator: Saudi Arabia
Type: Sandown (Minehunter)

Class: AL JAWF

Purchased: 3
Active: 3
Proposed: 3

Displacement:
standard: 450 t
full load: 480 t

Dimensions
Length: 52.7m (172.9 ft)
Beam: 10.5 m (34.4 ft)
Draught: 2.1 m (6.9 ft)

Speed: 13 kts diesels; 6 kts electric drive
Range: 3,000 n miles at 12 kts

Complement: 34 (7 officers) plus 6 spare berths

SHIPS

AL JAWF (420)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 2 Aug 1989
Commissioned 12 Dec 1991

SHAQRA (422)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 15 May 1991
Commissioned 7 Feb 1993

AL KHARJ (424)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched 8 Feb 1993
Commissioned Apr 1996

ONAIZAH (426)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched —
Commissioned —

AL RAAS (428)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched —
Commissioned —

AL BAHAN (430)
Builder Vosper Thornycroft, Woolston, Hampshire, UK
Launched —
Commissioned —

MINE COUNTERMEASURE SYSTEMS

MINEHUNTING SONAR

GEC-Marconi Type 2093

The Type 2093 sonar is designed to operate in either hull-mount or variable depth mode, deployed through the ship's centre well, and will detect, localise and classify all current and future mine threats. Total system weight is 13,000 kg (28,659 lb). The variable depth, dual-frequency search and dual-frequency classification capability provides a sonar able to operate under all bottom and sea conditions at a range claimed to be twice that of hull-mounted sonar and with an increase of three times detection depth.

The towed body of the 2093 is cylindrical with hemispherical ends. The sonar arrays within the body consist of two 360° rings for LF and VLF operation, hydrophones for HF and VHF reception, and separate HF and VHF projectors. Below is a cylindrical VLF projector and finally a VLF depth sounder. LF and VLF are used for search, survey and moored mine classification; HF and VHF for classification and survey.

Sonar 2093 employs multiple operating modes which offer the MCM commander a choice of operational configurations to match the prevailing threat

Shaqra *(422). Apart from the armament, these Saudi ships are virtually identical with the UK Royal Navy 'Sandown' class (*Vosper Thornycroft)

and environment. These multiple operating modes comprise VLF and LF search and moored mine classification, VLF and LF search, search and ground mine classification, also search and route survey. Sonar 2093 can combine these modes to enable concurrent operation.

Manufacturer/Contractor
GEC-Marconi, UK.

Other MCM features
Racal Hyperfix.
Decca Navigation Mk 21.
Kelvin Hughes NAVPAC system integrates all navigational aids to give an accuracy of 9 m (29.5 ft).

REMOTE CONTROL MINE DISPOSAL

PAP Mk 5 ROV
The 'Sandown' class carries two PAP Mk 5 (PAP = poisson auto-propulsé) ROVs, which have the capability simultaneously to hunt and destroy ground mines and tethered mines either by placing and remotely detonating a charge or by cutting the mooring rope of tethered mines. The vehicle is powered by onboard batteries, but is guided from a control console in the operations centre, with signals being passed via either a tether, which can be either a 2,000 m (6,562 ft) fibre optic cable or a 1,000 m (3,281 ft) coaxial cable. It is horizontally propelled by means of two side thrusters.

In the bottom-following mode a constant altitude can be achieved by instructing the vehicle to deploy a 'guide rope'. The winch in the PAP is instructed to deploy a selected length of rope and the operator then uses return signals from the vehicle to maintain the vehicle at the desired selected height; limits are 2 m (6.56 ft) minimum and 8 m (25.25 ft) maximum.

The PAP Mk 5 is able to carry the 126 kg (277 lb) charge necessary to ensure the total destruction of a mine. Cutters can be carried with the charge. The front section of the vehicle carries a sonar, either a high-resolution nearfield sonar or a mid-range relocation sonar. Identification is carried out by a tiltable low-light TV camera and/or by a tiltable colour TV camera. Vertical thrusters are used to achieve mid-water navigation. Alternative payloads include: explosive charges, cutters (frontal, lateral mechanical and lateral explosive) and a manipulator with a variety of tools.

Specifications
PAP Mk 5
Length: 3 m (9.8 ft)
Diameter: 1.2 m (3.9 ft)
Height: 1.3 m (4.2 ft)
Performance:
Max vehicle velocity
mid-water transit: 6 kts (3 m/s)
bottom-following mode: 5.5 kts (2.75 m/s)
Vehicle incidence: ±20° (max)
Vertical velocity with charge: 0.7 m/s
Ascent velocity (charge released): 1.5 m/s
Payload:
NATO charge: 100 kg (220 lb)
Small charge: 30 kg (66 lb)
Horizontal range:
with fibreoptic cable: 2,000 m (6,561 ft)
with coaxial cable: 1,000 m (3,281 ft)
Max continuos endurance: 2 h (depending on type of mission)
Max operating depth: 300 m (984 ft)
Watertight integrity: 36 bars

Manufacturer/Contractor
Societé ECA, 92707 Colombes, France.

WEAPONS SYSTEMS

GUNS

ESCO 30 twin 30 mm mounting
There are one twin ESCO (formerly Emerson) 30, 30 mm cannon on the foredeck. The ESCO 30 is a twin 30 mm, 70 calibre weapon designed for air defence, surface engagement and anti-missile operations, using either local or remote control. The ESCO 30 employs two Oerlikon KCB positively locked, gas-operated cannon with the gunner's cabin between them, and forward of the elevating mass. Behind the cabin, and in a sealed compartment, are the elevating and training drives together with flexible chutes to channel ammunition from the magazine. The gunner's cabin is equipped with a daylight reflex, or an image intensifier sight, together with gyro-assisted line of sight stabilisation. Ready-use ammunition is stored in an integral, below-deck, drum magazine with a capacity of 985 rounds for each barrel in a continuous, disintegrating- link belt. These are transferred to the guns through separate chutes by means of electrically operated drives which automatically respond to the individual demand for ammunition supply. Normally, the mount uses ship's power supplies, but this is backed up by an on-mount battery, providing sufficient power to fire a full complement of ammunition and, finally, there is the traditional hand-crank mechanism operated by the gunner.

Specifications
Calibre: 30 mm
Length of barrel: 75 calibres
Muzzle velocity: 1,080 m/s (3,543 ft/s)
Traverse: 360° at 80°/s
Elevation: −15 to +80° at 80°/s
Crew: 1
Range: 3.25 n miles (6 km) (anti-surface) (max)
Rate of fire: 600 rds/min/barrel (nominal) or 140 rds/min/barrel (nominal)
Ammunition: 870 g (31 oz) (HEI/HEI-T, SAPHEI, TP/TP-T)

Manufacturer/Contractor
Electronics & Space Corporation (ESCO), St Louis, Missouri, USA.

ELECTRONIC WARFARE SYSTEMS

ELECTRONIC SUPPORT MEASURES

Thomson-CSF Shiploc radar warning receiver
Shiploc is a shipborne Radar Warning Receiver (RWR) which covers D to J frequency bands to provide warning against threat radar systems, and is designed for smaller vessels such as FACs and MCMVs. It has a very high sensitivity and provides instantaneous and accurate threat identification. Software-controlled Shiploc is fully reprogrammable during the mission and will carry out target designation for countermeasures equipment such as chaff launchers. Display of threat information can be either on a CRT or LED display or a combined CRT/LED display giving the direction, type and level of threat.

Manufacturer/Contractor
Thomson-CSF, Radio and Countermeasures Division, Elancourt, France.

DECOYS

Loral Hycor SRBOC Mk 36 6-barrelled Chaff Launcher
There are four Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) units, two mounted on either side of the forward Vulcan Phalanx CIWS.

Specifications
Launcher
Dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Weight: 173 kg (381.4 lb)
Range: 2.2 n miles (4 km)

Rounds
Diameter: 130 mm (5.1 in)
Length, weight:
Mk 182: 1,209 mm; 22.7 kg
Super Chaffstar: 1,209 mm; 20.9 kg
Super Gemini: 451 mm; 5.5 kg
Super Hiram III: 1,220 mm; 13.6 kg
Super Hiram IV: 467 mm; 3.8 kg
Super Loroc: 734 mm; 13.2 kg

Manufacturers/Contractors
Loral Hycor Inc, Woburn, Maryland, USA.
Tracor Aerospace Inc (SCIP), Austin, Texas, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

GEC-Marconi NAUTIS M
The NAUTIS-M system is based upon the NAUTIC (Naval AUTonomous Intelligent Console) multifunction intelligent workstation.

The NAUTIC itself uses the Intel iAPX-86 processor with 3 Mbyte RAM together with 2 Mbyte non-volatile magnetic bubble memory. Dual iAPX-286 microprocessors are used in Multibus configurates, while iAPX-186 microprocessors are used for intelligent interfaces. The system capacity is 200 air, surface and submarine tracks and reference points with integral radar autotracking for up to 80 air and surface targets. The HCI consists of 32 software-defined function keys with a separate numeric keypad and a rollerball. A dual-redundant MIL-STD-1553B highway links the workstations, each of which uses some 150,000 lines of Ada-language software code to support NAUTIS.

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NAUTIS-M mine countermeasures (MCM) system provides support for operational planning, ship control

guidance, underwater and surface picture compilation, command and control for mine disposal, together with a real-time MCM database. The three-console (mine-hunting, operations, bridge) monochrome system has been purchased for the Royal Navy and the Royal Saudi Arabian Navy for use with 'Sandown' minehunters. The 'Sandown' class has the Type 1007 navigation radar, Type 2093 variable depth sonar and PAP 104 Mk 5 remotely operated vehicles.

Manufacturer/Contractor
GEC-Marconi Naval Systems, Combat Systems Division.

COMMAND AND CONTROL SYSTEMS

WEAPONS CONTROL

Sea Hawk Mk II

Sea Hawk Mk II is a lightweight electro-optical fire-control/surveillance system consisting of an electro-optical director, an operator control console (OCC), a weapon control module (WCM) and a pedestal electronics cabinet (PEC). The director has three sensors:

An Nd-YAG laser with a 1 mrad 10 Hz pulsed beam and a measuring range of between 280 m and 20.5 km.

A ruggedised, high-resolution vidicon TV camera with a focal length of 32 to 320 mm (1.2 to 12.5 in) and a CCIR output, housed in an environmental protection container with its own washer/wiper mechanism for the window.

A FLIR dual field of view unit (12 × 8° and 3.16 × 2.1°), operating in the 8-12 µm wavelength, with the same environmental protection as the TV camera and cooled by a split Stirling engine.

The PEC has a 16- or 32-bit microcomputer and supports the pedestal electronics. The OCC is used to monitor the system and to insert data on calibration and ammunition. The WCM houses a 32-bit processor and interfaces with the director and the weapon or weapons. The WCM filters engagement data and also provides trajectory prediction, aiming point calculation and fire restriction data.

The Sea Hawk can designate its own targets through automatic horizon/sector scans or by manual input using the MMI. Alternatively targets may be designated either by the ship's radar through a tactical data handling system or by a bridge target indicator system. With radar designation the Sea Hawk conducts a search by means of an elevation scan while, with a target indicator system, the search is conducted in elevation and azimuth. There are four tracking modes; two for air targets, one each for surface targets and auto-track. Air targets may be tracked either with the full range of electro-optics (3D tracking) or by using the TV and FLIR sensors (2D tracking). The latter is also used for surface target tracking although this may also be performed manually with the aid of the joystick. The auto-track mode, using the TV sensor, is used against both air and surface targets.

Manufacturer/Contractor
Contraves Corp, USA.

RADARS

Kelvin Hughes Type 1007

Navigation radar is the Kelvin Hughes Type 1007.

Specification
Type 1007
Role: Navigation
Frequency: H/I-band (9,410 MHz)
Beam: 1.0 × 18°/0.75 × 18°
Peak power: 25 kW
Pulsewidth: 0.08/0.3/0.8 µs
PRF: 1,600/800/400 pps
Scan rate: 26 rpm

Manufacturer/Contractor
Kelvin Hughes Ltd, Hainault, Essex, UK.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 × Paxman Valenta 6RP200E diesels; 1.12 MW (1,500 hp) sustained

Propellers: 2 Voith-Schneider cycloidal units
Thrusters: 2 Schottel bow thrusters
Auxiliary power: 3 Perkins V8-250G diesels (335 bhp) plus Maudsley generator sets

FURTHER INFORMATION

Three were ordered on 2 November 1988 from Vosper Thornycroft, with an option for three more. The names of the second group have been announced, but no firm order has yet been placed.

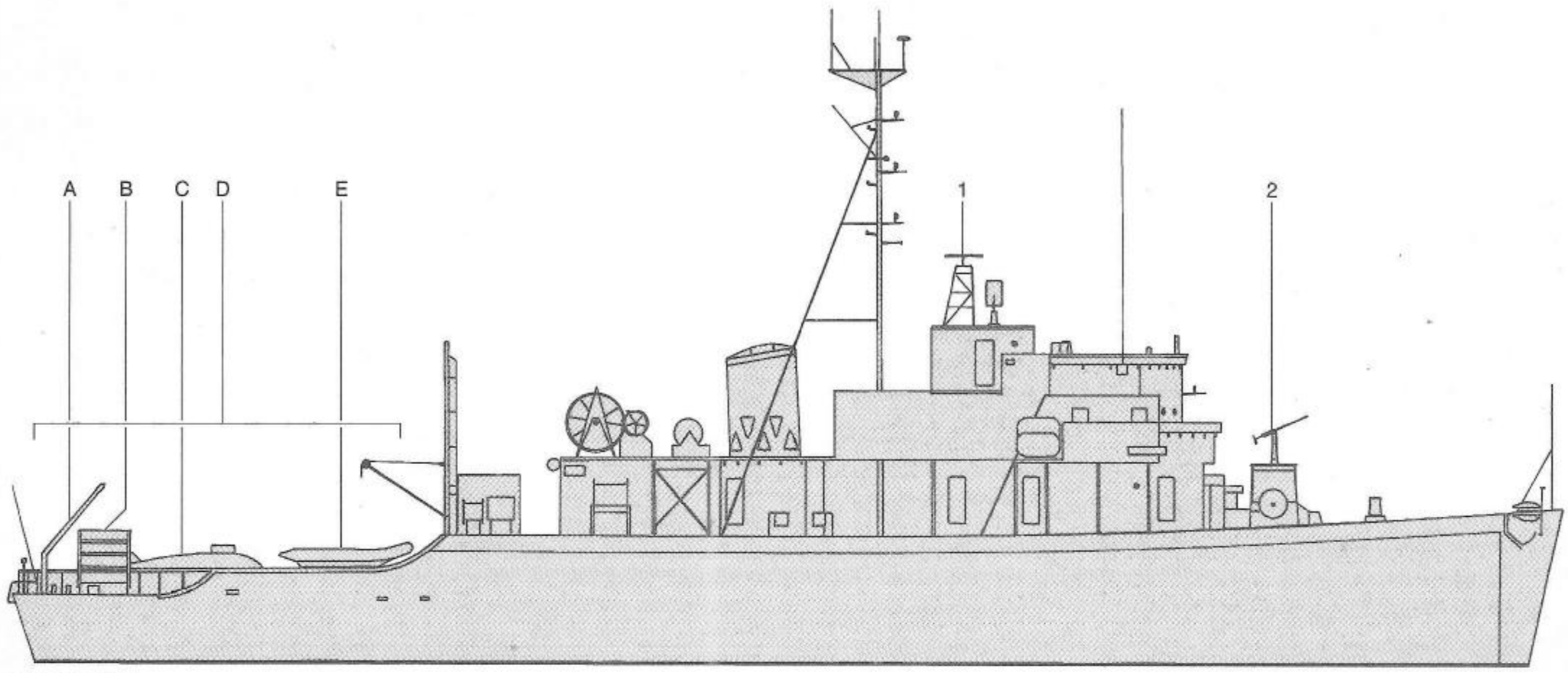
Al Jawf sailed for Saudi Arabia in November 1995, followed by the second and third in 1996.

The MCMV features of these ships are identical to those in the UK Royal Navy ships, but the weapons, fire-control system and countermeasure are different.

Al Jawf *(420) of the Royal Saudi Navy. Note the Esco twin 30 mm mounting on the foredeck with the Contraves Sea Hawk fire-control director behind it* (Jane's/H M Steele)

AGGRESSIVE

OVERVIEW



Agressive-USA
MCM A *Derrick* **B** *Kite* **C** *Float* **D** *Sweep deck* **E** *Combat diver's dinghy*

General 1 *Racal-Decca 1229 navigation radar* **2** *Twin 12.7 mm machine guns*

The 'Aggressive' class was constructed in the United States between 1952 and 1956 as part of the NATO response to the mining threat posed by the (then) Soviet Union. 62 were for the US Navy, but 26 went to NATO allies under the Mutual Defense Aid Pact (MDAP): Belgium — 4; France — 8; Italy — 2; Netherlands — 6; Norway — 2; Portugal — 4. They were built of wood, with fittings of either bronze or non-magnetic stainless steel, and were fitted with an automatic degaussing system. The diesel engines were made of non-magnetic stainless steel alloy and drove LIPS controllable-pitch propellers.

As built, they carried a new mine locating sonar, AN/UQS-1, although this was eventually replaced by another new system, AN/SQQ-14. The 'Aggressive' class remained in service with the US Navy for a remarkably long time, although many were stricken in the 1970s (some of which were transferred abroad), but the last few remained in service until replaced by the 'Avenger' class in the early 1990s. They were capable of sweeping mines of all types.

DUFOUR (AGGRESSIVE)

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Belgium
Type: Aggressive (Ocean minesweepers)

Class: DUFOUR

Acquired: 7
Active: 2

Displacement:
standard: 731 t
full load: 792 t

Dimensions
Length: 52.6 m (172.5 ft)
Beam: 10.7 m (32.1 ft)
Draught: 4.3 m (14.1 ft)

Speed: 14 kts
Range: 3,000 n miles at 10 kts

Complement: 40 (3 officers)

SHIPS

A F DUFOUR (M 903)

Builder	Bellingham Shipyard, Washington, USA
Launched (US Navy)	27 Sep 1955 (MSO 498)
Transferred (Norway)	27 Sep 1955 (*Lagen* (M 950))
Transferred (Belgium)	14 Apr 1966

GEORGES TRUFFAUT (M 908)

Builder	Tampa Marine, Tampa, Florida, USA
Commissioned (Belgium)	21 Sep 1956 *(G Truffaut)*

MINE COUNTERMEASURE SYSTEMS

MINEHUNTING SONAR

Lockheed Martin AN/SQQ-14 (IT)
Variable depth sonar. The AN/SQQ-14 system is essentially a variable depth, dual-frequency sonar for detecting and classifying bottom mines in shallow water. It utilises a towed body in the shape of an elongated sphere towed through a centre well on a mine countermeasures vessel.

The AN/SQQ-14 can operate down to 45 m (148 ft). It transmits at 80 kHz and 350 kHz respectively for search and classification, scanning over azimuths of 100° and 18°, and through an elevation of 10° in each case. Azimuth and range resolutions are 1.5° and 1 m (3.28 ft) for search, and 0.3° and 8 cm (3.1 in) for classification. Under the SQQ-14 IT programme FIAR has produced new dry and wet end electronics for the SQQ-14 for the Belgian and Italian navies.

Manufacturers/Contractors
Lockheed Martin, US/FIAR Italy.

WEAPONS SYSTEMS

GUNS

M2HB 12.7 mm machine guns

Two M2HB are carried on a twin mount forward of the bridge. This is a selective short recoil automatic operation weapon with a 1,143 mm (45 in) long barrel.

Specifications

Gun

Weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

Truffaut *(M 908) one of two 'Aggressive' class MCMVs still in service with the Belgian Navy*
(H & L van Ginderen Collection)

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca 1229

The navigation radar is the Racal-Decca Type 1229, with an output of 20 kW. It is equipped with a 2.7 m (8.9 ft) antenna and operates in the I/J band.

Specifications

Role: Navigation
Band: I/J
Beam: 1.3 × 30°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0 µs
PRF: 1,300/650 pps
Scan rate: 25 rpm

Manufacturer/Contractor

Racal-Decca, UK.

PROPULSION

Specifications

System: Diesel
Main machinery: 4 × GM 8-268A diesels; 1.3 MW (1,760 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

M 908 was one of four supplied new to the Belgian Navy in 1955-56. M 903, however, was one of a pair supplied at the same time to the Royal Norwegian Navy, but in 1966 the Norwegians exchanged their two 'Aggressive' class ocean minesweepers for three Belgian 'Adjutant' class inshore minesweepers.

DEPLOYMENT

Both these ships are based at Zeebrugge and are to be kept operational for the foreseeable future. There are two other survivors of this class in the Belgian Navy: M 902 is used as a base ship for divers and M 909 is cocooned in reserve.

GUADALETE (AGGRESSIVE)

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Spain
Type: Aggressive (Ocean minesweepers)

Class: GUADALETE

Acquired: 4
Active: 4

Displacement:
full load: 817-853 t

Dimensions
Length: 52.6 m (172.5 ft)
Beam: 10.7 m (32.1 ft)
Draught: 4.3 m (14.1 ft)

Speed: 14 kts
Range: 3,000 n miles at 10 kts

Complement: 74 (6 officers)

SHIPS

GUADALETE (M 41)
Builder Colbert, Stockton, California, USA
Commissioned (US Navy) 15 Dec 1953 (*Dynamic* (MSO 432))
Transferred (Spain) (MDAP) 1 Jul 1971
Purchased (Spain) 1974

GUADALMEDINA (M 42)
Builder Wilmington BW, California, USA
Commissioned (US Navy) 12 Jul 1954 (*Pivot* (MSO 463))
Transferred (Spain) (MDAP) 1 Jul 1971
Purchased (Spain) 1974

GUADALQUIVIR (M 43)
Builder Tacoma, Seattle, Washington, USA
Commissioned 3 Feb 1956 (*Persistant* (MSO 491))
Transferred (Spain) (MDAP) 1 Jul 1971
Purchased (Spain) 1974

GUADIANA (M 44)
Builder Burgess Boat Co, Manitowoc
Commissioned (US Navy) 8 Nov 1954 (*Vigor* (MSO 473))
Transferred (Spain) (MDAP) 4 Apr 1971
Purchased (Spain) 1974

MINE COUNTERMEASURES SYSTEMS

Gaymarine Pluto ROV

Fitted in some. Pluto is available in three configurations: battery-powered with a 6 mm, 500 m (1,640 ft) long umbilical cable; battery-powered with a 3 mm, 2,000 m (6,561 ft) long fibre optic umbilical cable; or remotely powered, unlimited endurance with 8 mm, 500 m (1,640 ft) long umbilical cable. The vehicle is powered by five thrusters: two horizontal for forward/reverse, two vertical for vertical and lateral shift, and a transversal thruster. The thrusters are controlled by two joysticks. The vehicle can maintain automatic depth control within ±10 cm (4 in). Maximum speed forwards is 4 knots and vertical speed 1 knot. Sensors are mounted in the forward tiltable section of the vehicle. Optional equipment includes black and white LLTV, colour TV or still camera, search or scanning sonar, acoustic pinger, strobe flash, measuring instruments, manipulators and so on. There are 10 free channels for remote control and two four-digit telemetry channels for measurements. The console incorporates a 9 in TV monitor for display of information showing TV image, depth, compass, head tilt angle, elapsed time and sonar diagram. All displayed data can be video recorded.

Specifications

Length: 1,680 mm (66 in)
Width: 600 mm (24 in)
Height: 630 mm (25 in)
Weight: 160 kg (353 lb)
Service depth: 400 m (1,312 ft)
Payload: 15 kg (33 lb)

Manufacturer/Contractor

Gaymarine, Italy.

MINEHUNTING SONAR

Lockheed Martin AN/SQQ-14

Variable depth sonar. The AN/SQQ-14 system is essentially a variable depth, dual-frequency sonar for detecting and classifying bottom mines in shallow water. It utilises a towed body in the shape of an elongated sphere towed through a centre well on a mine countermeasures vessel. The AN/SQQ-14 can operate down to 45 m (148 ft). It transmits at 80 kHz and 350 kHz for search and classification respectively, scanning over azimuths of 100° and 18°, and through an elevation of 10° in each case. Azimuth and range resolutions are 1.5° and 1 m (3.28 ft) for search, and 0.3° and 8 cm (3.1 in) for classification.

Manufacturer/Contractor

Lockheed Martin, USA.

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm twin mounting

The Spanish ships are armed with one twin Oerlikon mounting. The Mk 24 20 mm mounting was designed primarily for air defence and features two Mk 2 or Mk 4 guns which are 165 mm (6.5 in) apart. The muzzle arc clearance is 138 cm (54 in) and the working circle is 141 to 152 cm (55.5 to 60 in). The mounting has a crew of three. Elevation of −15 to +90°.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range
anti-surface: 1.5 km
anti-air: 1,150 m (3,773 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca 1226

The Type 1226 radar is used for surface search. This model is part of the Solid State series with a maximum power output of 25 kW. They have 30 cm (11.8 in) PPI (Plan Position Indicator) displays and come with 1.83 m (6.0 ft) antennas.

Specifications

Type 1226
Role: Navigation
Frequency: I-band
Range: 48 n miles (81 km)
Beam: 1.2°
Peak power: 25 kW
Gain: 30 dB
Pulsewidth: 0.05/0.25/1.0µs
Scan rate: 28 rpm

Manufacturer/Contractor

Racal-Decca, UK.

Racal-Decca 626

Navigation radar is Racal-Decca, I-band, Model 626.

PROPULSION

Specifications

System: Diesel
Main machinery: 4 Packard ID-1700 diesels; 1.7 MW (2,280 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

The first three were transferred from the USA under the MDAP and commissioned on 1 July 1971, followed by the fourth ship on 4 April 1972. All were purchased outright in August 1974. Modernisation was completed in 1984-86 to extend their service lives. At least two Pluto ROVs were acquired in 1989 in order to gain experience while the new MCMVs are being built.

DEPLOYMENT

All four ships are based at Cartagena.

THE FUTURE

These four MCMVs, plus a number of smaller but equally old vessels, will be replaced by four new Spanish GRP minehunters in 1997-98, which will be built in Spain by Bazan. The Spanish Navy hopes to order a further four of the same type (see CME).

YUNG YANG (AGGRESSIVE)

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Republic of China, Taiwan
Type: Agressive (Ocean minesweepers)

Class: YUNG YANG

Purchased: 4
Active: 4

Displacement:
standard: 720 t
full load: 780 t

Dimensions
Length: 52.6 m (172.5 ft)
Beam: 10.7 m (32.1 ft)
Draught: 4.3 m (14.1 ft)

Speed: 14 kts
Range: 3,000 n miles at 10 kts

Complement: 86 (7 officers)

SHIPS

YUNG YANG (1306)
Builder Wilmington Boat, USA
Commissioned (US Navy) 10 Mar 1954 (*Implicit* (MSO 455))
Transferred (Taiwan) 3 Aug 1994
Recommissioned 1 Mar 1995

YUNG TZU (1307)
Builder Martenac, Tacoma, Washington, USA
Commissioned (US Navy) 20 Jul 1955 (*Conquest* (MSO 488))
Transferred (Taiwan) 3 Aug 1994
Recommissioned 1 Mar 1995

YUNG KU (1308)
Builder Martenac, Tacoma, Washington, USA
Commissioned (US Navy) 14 Sep 1955 (*Gallant* (MSO 489))
Transferred (Taiwan) 30 Sep 1994
Recommissioned 1 Mar 1995

YUNG TEH (1309)
Builder Martenac, Tacoma, Washington, USA
Commissioned 20 Apr 1956 (*Pledge* (MSO 492))
Transferred (Taiwan) 30 Sep 1994
Recommissioned 1 Mar 1995

MINE COUNTERMEASURE SYSTEMS

MINEHUNTING SONAR

Lockheed Martin AN/SQQ-14

Variable depth sonar. The AN/SQQ-14 system is essentially a variable depth, dual-frequency sonar for detecting and classifying bottom mines in shallow water. It utilises a towed body in the shape of an elongated sphere towed through a centre well on a mine countermeasures vessel.

The AN/SQQ-14 can operate down to 45 m (148 ft). It transmits at 80 kHz and 350 kHz respectively for search and classification, scanning over azimuths of 100° and 18°, and through an elevation of 10° in each case. Azimuth and range resolutions are 1.5° and 1 m (3.28 ft) for search, and 0.3° and 8 cm (3.1 in) for classification.

Manufacturer/Contractor
Lockheed Martin, USA.

WEAPONS SYSTEMS

GUNS

M2HB 12.7 mm machine guns

Two M2HB are carried. This is a selective short recoil automatic operation weapon with a 1,143 mm (45 in) long barrel.

Specifications
Gun
Weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

RADAR

Sperry AN/SPS-53L

AN/SPS-53 is a Raytheon, I-/low J-band, high resolution search radar which employs a 1.5 m slotted array antenna. SPS-53 radars are now to be found only in a few, mainly elderly, warships.

Specifications
AN/SPS-53L
Role: Surface search
Frequency: I-band
Beam: 1.6 × 20°
Peak power: 40 kW
Gain: 30 dB
Pulsewidth: 0.5/1.0 µs
PRF: 750/1,500 pps
Scan rate: 15 rpm
Maker: Raytheon

PROPULSION

Specifications
System: Diesel
Main machinery: 4 × Packard ID-1700 or Waukesha diesels; 1.7 MW (2,280 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These four ships were transferred by sale to Taiwan from the US Navy on 3 August and 30 September 1994, although actual delivery was delayed into 1995 while replanking work was carried out in the USA. All were recommissioned on 1 March 1995. All are fitted with SLQ-37 mechanical acoustic and magnetic sweeps and can carry an ROV.

These ships represent a substantial addition to the 'Adjutant' class which forms the backbone of the Taiwanese MCM flotilla, although it was reported that the RoCN was not best pleased to receive such elderly boats at a time when the rest of the navy is receiving modern ships at last.

SWIFTSHIPS CMH

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Egypt
Type: Coastal minehunters

Class: SWIFTSHIPS CMH

Acquired: 3
Active: 3

Displacement:
full load: 203 t

Dimensions
Length: 33.8 m (111 ft)
Beam: 8.2 m (27 ft)
Draught: 2.3 m (8 ft)

Speed: 12.4 kts
Range: 2,000 n miles at 10 kts

Complement: 25 (5 officers)

SHIPS

CMH 1		CMH 2		CMH 3	
Builder	Swiftships, Morgan City, Louisiana, USA	**Builder**	Swiftships, Morgan City, Louisiana, USA	**Builder**	Swiftships, Morgan City, Louisiana, USA
Launched	25 Apr 1994	**Launched**	20 Jun 1994	**Launched**	30 Jul 1994

MINE COUNTERMEASURES SYSTEMS

UniSys Command System

These ships are fitted with a Unisys minehunting command data handling system, which is an improved version of AN/SYQ-12.

General facilities

- GPS
- Line of sight navigation system.
- Dynamic positioning.
- Side-scan sonar body and the Pluto ROV can be streamed from a deck crane.
- Portable decompression chamber.

Gaymarine Pluto ROV

The Pluto ROV is available in three configurations: battery-powered with a 6 mm, 500 m (1,640 ft) long umbilical cable; battery-powered with a 3 mm, 2,000 m (6,561 ft) long fibre optic umbilical cable; or remotely powered with an 8 mm, 500 m (1,640 ft) long umbilical cable, giving virtually unlimited endurance. There are five thrusters: two horizontal for forward/reverse, two vertical for vertical and lateral shift, and a transverse thruster. The thrusters are controlled by two joysticks. The vehicle can maintain automatic depth control within ±10 cm (4 in). Forward maximum speed is 4 knots and vertical speed 1 knot.

Sensors are mounted in the forward tiltable section of the vehicle. Optional equipment includes black and white LLTV, colour TV or still camera, search or scanning sonar, acoustic pinger, strobe flash, measuring instruments, manipulators and so on. There are ten free channels for remote control and two four-digit telemetry channels for measurements.

The console incorporates a 9 in TV monitor for display of information showing TV image, depth, compass, head tilt angle, elapsed time and sonar diagram. All displayed data can be video recorded.

Specifications

Pluto ROV
Length: 1,680 mm (66 in)
Width: 600 mm (23.6 in)
Height: 630 mm (24.8 in)
Weight: 160 kg (353 lb)
Service depth: 400 m (1,312 ft)
Payload: 15 kg (33 lb)

Manufacturer/Contractor

Gaymarine, Italy.

MINEHUNTING SONAR

Thomson-CSF TSM 2022

TSM 2022 is a hull-mounted high-frequency minehunting sonar, which can also be used for mine avoidance on minesweepers. It is based largely on experience gained with the French DUBM 21B in the field of high-resolution beam-forming techniques. It is a hull-

The Egyptian coastal minehunter is based on a US commercial fishing boat (Swiftships)

mounted equipment intended also for use in conjunction with precision display and navigation equipment and a mine countermeasures system.

The main feature of the TSM 2022 is its small-size retractable single array assembly, used for both detection and classification, which enables easy installation and maintenance. The high-resolution features of the DUBM 21 are maintained and improvements are mainly in the field of digital processing technology. The main functions of the sonar are: detection and classification of moored and bottom mines, detection at distances up to 600 m (1,968 ft), and classification of targets by analysis of the shape of their echo or shadow at distances up to 250 m (492 ft). In the classification mode, horizontal beamwidth is 7°; in detection mode either 14° or 28° beamwidth can be selected. In both modes the vertical beamwidth is 15°. In the Mk II configuration the TSM 2022 is equipped with a 19 in high-resolution colour console and specific sonar processing such as computer-aided detection (CAD), computer-aided classification (CAC) and performance indicator (PI).

Manufacturers/Contractors

Thoray.
US/Thomson Sintra ASM, France.

WEAPONS SYSTEMS

GUNS

M2HB 12.7 mm machine gun

Two M2HB 12.7 mm (0.50 in) machine guns are carried in each ship. The M2HB is a selective short recoil automatic operation weapon using 110-round belts.

Specifications
M2HB
Calibre: 12.7 mm
Barrel: 90 calibres
Gun weight: 38.1 kg (84.0 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

RADAR

Sperry

One Sperry I-band navigation radar is mounted.

PROPULSION

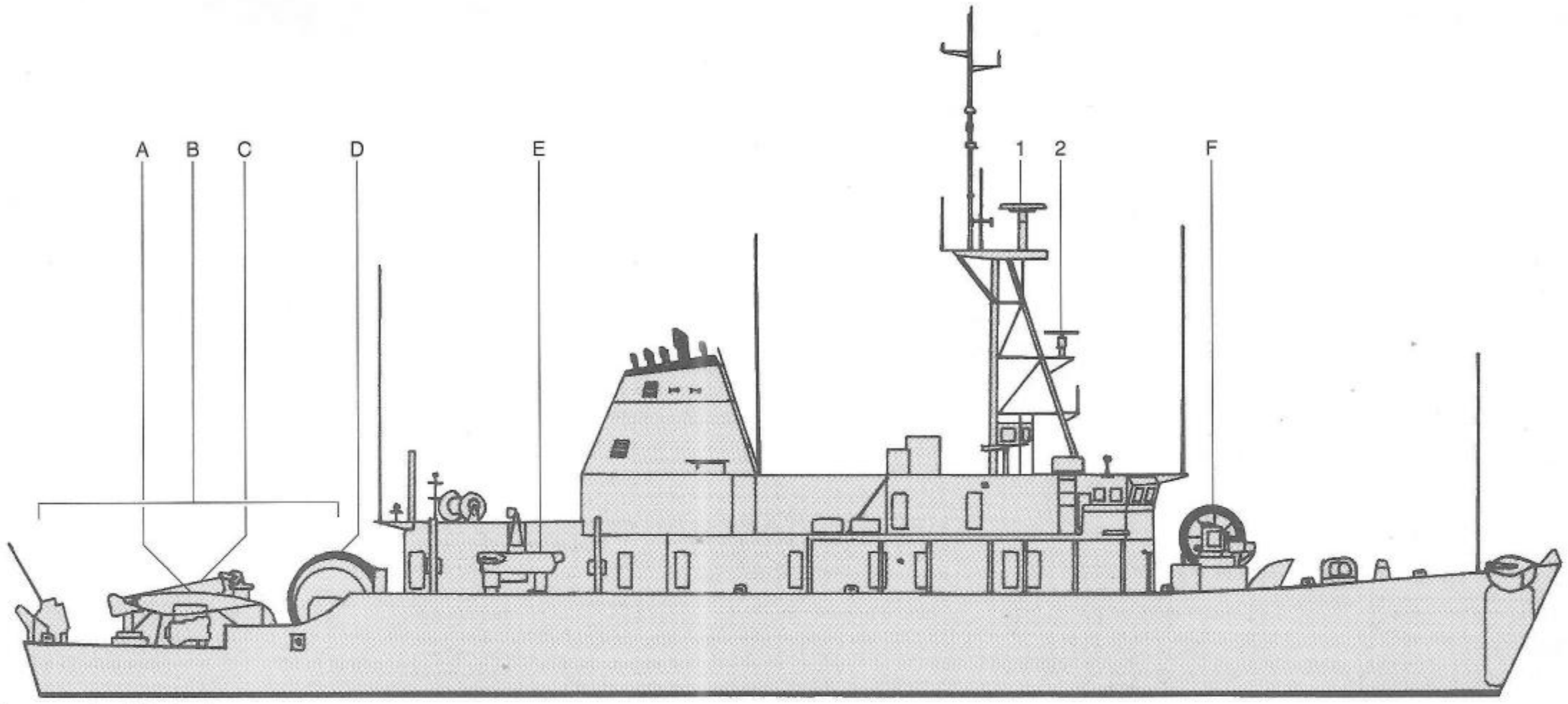
Specifications
System: Diesel
Main machinery: 2 MTU 12V 183 TE61 diesels; 786 kW (1,068 hp(m))
Shafts: 2
Propellers: 2 Schottel steerable propellers
Thruster: 1 White Gill thruster, 224 kW (300 hp)

FURTHER INFORMATION

PROGRAMME

These MCMVs were ordered from Swiftships in the USA in December 1990, using FMS (Foreign Military Sales) funding. The first of class passed its acceptance trials in June 1994 and was completed in August 1994. The other two followed in November 1995 and February 1996, respectively.

AVENGER



Avenger (Ian Sturton)
MCM A *Oropesa float* **B** *Sweep deck* **C** *Folding crane* **D** *Main winch* **E** *AN/SLQ-48 ROV* **F** *Winch for AN/SQQ-30 or -32 sonar*

General 1 *ISC Cardion AN/SPS-55 surface search radar* **2** *Raytheon AN/SPS-64(V)9*

GENERAL SPECIFICATIONS

Operator: USA
Type: Mine countermeasures vessel

Class: AVENGER

Built: 14
Active: 14

Displacement:
light: 1,195 t
full load: 1,312 t

Dimensions
Length: 68.3 m (224 ft)
Beam: 11.9 m (39 ft)
Draught: 3.7 m (12.2 ft)

Speed: 13.5 kts

Complement: 81 (7 officers)

SHIPS

AVENGER (MCM 1)
Builder Peterson Builders Inc, Sturgeon Bay, Wisconsin, USA
Laid down 3 Jun 1983
Launched 15 Jun 1985
Commissioned 12 Sep 1987

DEFENDER (MCM 2)
Builder Marinette Marine Corp, Marinette, Wisconsin, USA
Laid down 1 Dec 1983
Launched 4 Apr 1987
Commissioned 30 Sep 1989

SENTRY (MCM 3)
Builder Peterson Builders Inc, Sturgeon Bay, Wisconsin, USA
Laid down 8 Oct 1984
Launched 20 Sep 1986
Commissioned 2 Sep 1989

CHAMPION (MCM 4)
Builder Marinette Marine Corp, Marinette, Wisconsin, USA
Laid down 28 Jun 1984
Launched 15 Apr 1989
Commissioned 31 Jan 1991

GUARDIAN (MCM 5)
Builder Peterson Builders Inc, Sturgeon Bay, Wisconsin, USA
Laid down 8 May 1985
Launched 20 Jun 1987
Commissioned 16 Dec 1989

DEVASTATOR (MCM 6)
Builder Peterson Builders Inc, Sturgeon Bay, Wisconsin, USA
Laid down 9 Feb 1987
Launched 11 Jun 1988
Commissioned 6 Oct 1990

PATRIOT (MCM 7)
Builder Marinette Marine Corp, Marinette, Wisconsin, USA
Laid down 31 Mar 1987
Launched 15 May 1990
Commissioned 18 Oct 1991

SCOUT (MCM 8)
Builder Peterson Builders Inc, Sturgeon Bay, Wisconsin, USA
Laid down 8 Jun 1987
Launched 20 May 1989
Commissioned 15 Dec 1990

PIONEER (MCM 9)
Builder Peterson Builders Inc, Sturgeon Bay, Wisconsin, USA
Laid down 5 Jun 1989
Launched 25 Aug 1990
Commissioned 7 Dec 1992

WARRIOR (MCM 10)
Builder Peterson Builders Inc, Sturgeon Bay, Wisconsin, USA
Laid down 25 Sep 1989
Launched 8 Dec 1990
Commissioned 3 Apr 1993

GLADIATOR (MCM 11)
Builder Peterson Builders Inc, Sturgeon Bay, Wisconsin, USA
Laid down 7 Jul 1990
Launched 29 Jun 1991
Commissioned 18 Sep 1993

ARDENT (MCM 12)
Builder Peterson Builders Inc, Sturgeon Bay, Wisconsin, USA
Laid down 22 Oct 1990
Launched 16 Nov 1991
Commissioned 18 Feb 1994

DEXTROUS (MCM 13)
Builder Peterson Builders Inc, Sturgeon Bay, Wisconsin, USA
Laid down 11 Mar 1991
Launched 20 Jun 1992
Commissioned 8 Jul 1994

CHIEF (MCM 14)
Builder Peterson Builders Inc, Sturgeon Bay, Wisconsin, USA
Laid down 19 Aug 1991
Launched 12 Jun 1993
Commissioned 5 Nov 1994

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING GEAR

AN/SLQ-37(V)3

A modular magnetic/acoustic influence sweep equipment developed specifically for the 'Avenger' class. Modules include:

- Acoustic (A) sweeps:
  - A Mk 2. An acoustic noise-maker.
  - A Mk4(V). A towed, hydraulically operated hammer device transmitting at 60-600 Hz.
  - A Mk 6B. A towed device, which uses a diaphragm driven by pistons, operated by an electric motor.
- Magnetic (M) sweeps:
  - M Mk 5. Two-legged sweep of uneven lengths.
  - M Mk 6. Two-legged sweep in which the end of the longer leg is diverted inwards towards the shorter leg.
  - M Mk 7.
  - Two MagneTek solid-state 2,500 amp magnetic-pulse sweep generators.

AN/SLQ-38 Oropesa sweep Type O Size 1

A standard mechanical sweep, this is the largest in the US Navy inventory. It is streamed with 550 m (300 fathom) wires at about 8.5 kts. The swept path is roughly 230 m (250 yd) wide for a side-sweep, and 460 m (500 yd) for a double sweep.

MINEHUNTING SONARS

AN/SQQ-30

AN/SQQ-30 is the successor to the AN/SQQ-14 system and consists of two sonars: a search sonar for initial detection; and a high-frequency, high-resolution sonar for classification of targets. The two sonars are separated to give the area coverage needed. They are housed in a hydrodynamically shaped vehicle and towed at various speeds by the minehunter. The towed body is streamed from a well in the forward part of the ship, using a winch driving a 3 m (9.8 ft) diameter cable drum on the foredeck. Two display consoles are provided for the search and classification sonars, which have ranges of 600 m (1,968 ft) and 200 m (656 ft), respectively.

Manufacturer/Contractor

Lockheed Martin.

AN/SQQ-32

The AN/SQQ-32 was fitted in MCM 10 onwards and is being retrofitted to the rest. SQQ-32 consists of two separate sonars: a search sonar for initial detection; and a high-frequency, high-resolution sonar for classification of the targets. The detection sonar, designed and manufactured by Raytheon, detects mines over a wide range of distances and bottom conditions. This system incorporates a computer-aided detection facility which is designed to help the sonar operator to discard non-mine objects detected by the sonar. Raytheon is also providing the computer facilities and display consoles and is responsible for overall system integration. The classification sonar, designed and fabricated by Thomson Sintra ASM, is based on its experience with the DUBM 21 and TSM 2022 minehunting sonars. The classification sonar provides very high-resolution transmission and reception of underwater signals to enable targets to be identified with near-picture quality. The AN/SQQ-32 has two identical operator consoles with high-resolution displays. Search and classification data can be displayed simultaneously or independently. Automated detection and control functions are performed by two AN/UYK-44 computers.

Manufacturers/Contractors

Raytheon Company, US.
Thomson Sintra Activités Sous-Marines, France.

ROV

Alliant Techsystems AN/SLQ-48 ROV

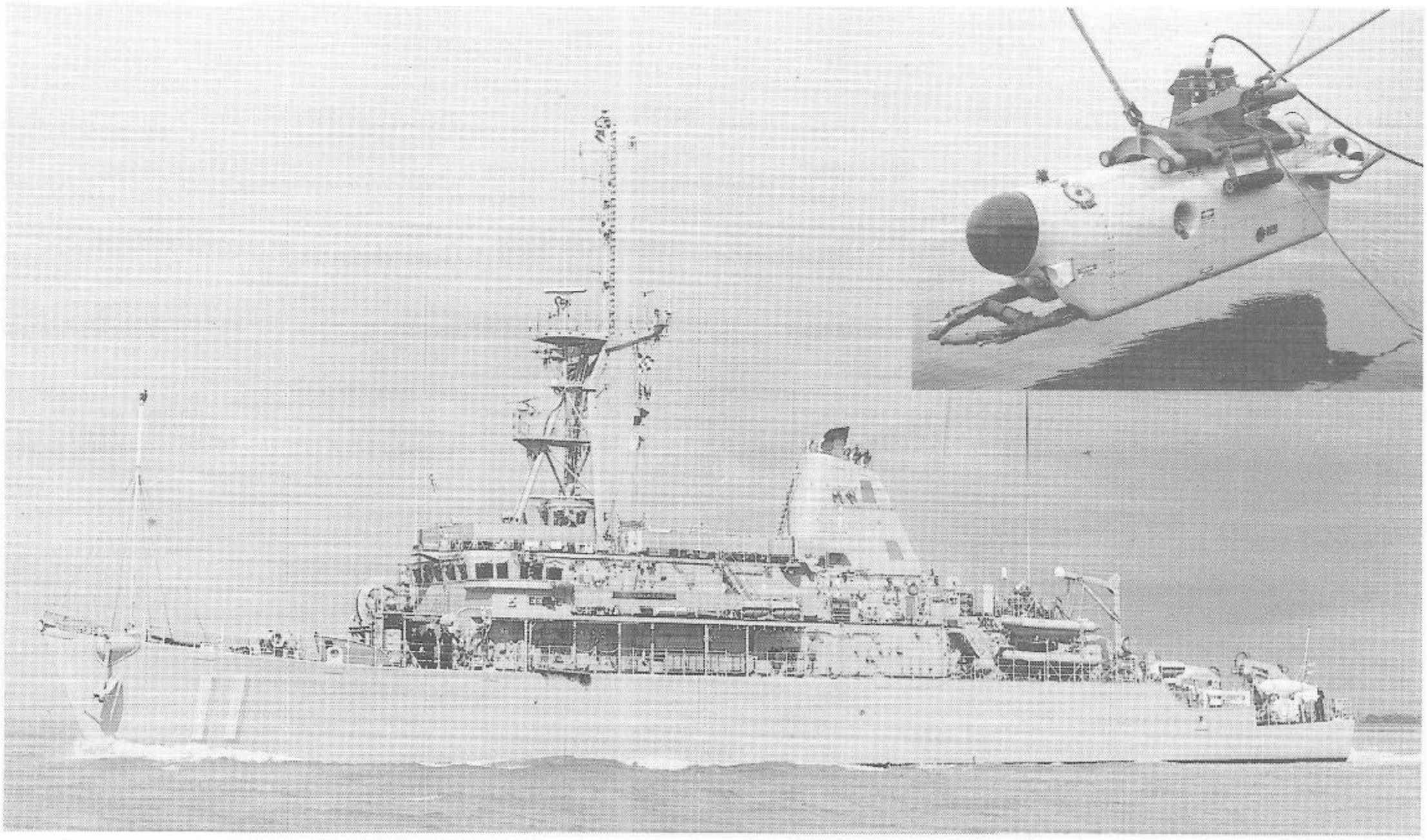
There are two AN/SLQ-48 ROV (remotely operated vehicle) or mine neutralisation systems (MNS), which are designed to detect, locate, classify and neutralise moored and bottom mines, using high-resolution sonar, low-light level TV, cable cutters and mine destruction charges. The tethered underwater vehicle carries these sensors and countermeasures and is controlled from the parent vessel. Initial target detection and vehicle guidance information is provided by the ship's sonar. Initial vehicle navigation is plotted and monitored within the MNS acoustic tracking system. Vehicle sonar is used during the mid-course search and final homing phases, and high resolution enables operations in poor visibility by sonar guidance alone. Low-light TV is used in conjunction with sonar during the precision guidance phase near the target.

Specifications

Length: 3.8 m (12.4 ft)
Width: 0.9 m (3.0 ft)
Height: 1.2 m (3.9 ft)
Speed: 6 kts
Vehicle weight: 1,247 kg (2,749 lb) (in air)
Propulsion: Hydraulic, twin 15 hp
Thrusters: Horizontal/vertical/lateral
Cable length: 1,070 m (3,510 ft)
Power requirements: 43 kVA

Manufacturer/Contractor

Alliant Techsystems, USA.



Gladiator *(MCM 11). All metallic elements in the ship are made from stainless steel, aluminium, copper, brass, or bronze. The large winch before the bridge is for lowering and raising the AN/SQQ-32 variable depth sonar* (H & L van Ginderen Collection)

WEAPONS SYSTEMS

GUNS

Mk 26 Mod 17 12.7 mm machine guns

Two Mk 26 Mod 17 machine guns are carried. This is a selective-fire, short-recoil, automatic weapon with a 1,143 mm (45 in) long barrel.

Specifications

Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

GEC-Marconi AN/SYQ-15 NAUTIS-M

Fitted in last two ships (and to be fitted in all), NAUTIS-M is a one, two or three console system to provide support for operational planning, ship control guidance, underwater and surface picture compilation, command and control for mine disposal, together with a real-time MCM database. The three-console (minehunting, operations, bridge) monochrome system is the version purchased for the US Navy for the 'Avenger' class MCM ships. In the 'Avenger' class, the AN/SYQ-15 integrates the outputs from the AN/SPS-55 search radar; either AN/SQQ-30 (MCM 1-9) or AN/SQQ-32 (MCM 10-14) variable depth sonar; and the AN/SLQ-48 remotely operated vehicle.

Manufacturer/Contractor
GEC-Marconi, UK.

COMMUNICATIONS AND DATALINKS

Satellite Communications
AN/SRR-1
AN/WSC-3 (UHF)

RADARS

ISC Cardion AN/SPS-55

Specifications
Role: Surface search
Frequency: I/J-band
Beam: 1.5 × 20°
Peak power: 130 kW
Gain: 31 dB
Pulsewidth: 0.12/1.0 µs
PRF: 2,250/750 pps
Scan rate: 16 rpm

Manufacturer/Contractor
ISC Cardion, USA.

Raytheon AN/SPS-64(V)9

Specifications
Role: Navigation
Frequency: I-band
Beam: 1.9 × 22°
Peak power: 20 kW
Gain: 28 dB
Pulsewidth: 0.06/0.5/1.0 µs
PRF: 3,600/1,800/900 pps
Scan rate: 33 rpm

Manufacturer/Contractor
Raytheon, USA.

PROPULSION

Specifications
System: Diesel/electric motors
Main machinery: MCM 1-2. Four Waukesha L-1616 diesels, 1.76 MW (2,400 hp(m)) sustained; MCM 3-14. Four Isotta-Fraschini ID 36 SS 6V AM diesels, 1.76 MW (2,400 hp(m)) sustained
Electric motors: 2 Hansome Electric motors; 294 kW (400 hp(m)) for hovering
Thruster: 1 Omnithruster hydrojet; 257 kW (350 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These ships are the result of a protracted programme, which had more than its fair share of problems. A programme for a new class of 19 MCMVs was approved in 1976, the ships being mainly intended to counter new Soviet deep-water mines, but the programme was cancelled on the grounds of cost. Subsequently, another programme was started which led to the 'Avenger' class, with the contract for the prototype MCM being awarded in June 1982, followed by contracts for MCM 2 in May 1983; MCM 3-5 in December 1983 and MCM 6-8 in August 1986. MCM 9 was funded in the FY85 programme and MCM 10-11 in the FY86 programme, but contracts for their construction were not awarded until January 1989. The last three were funded in FY90.

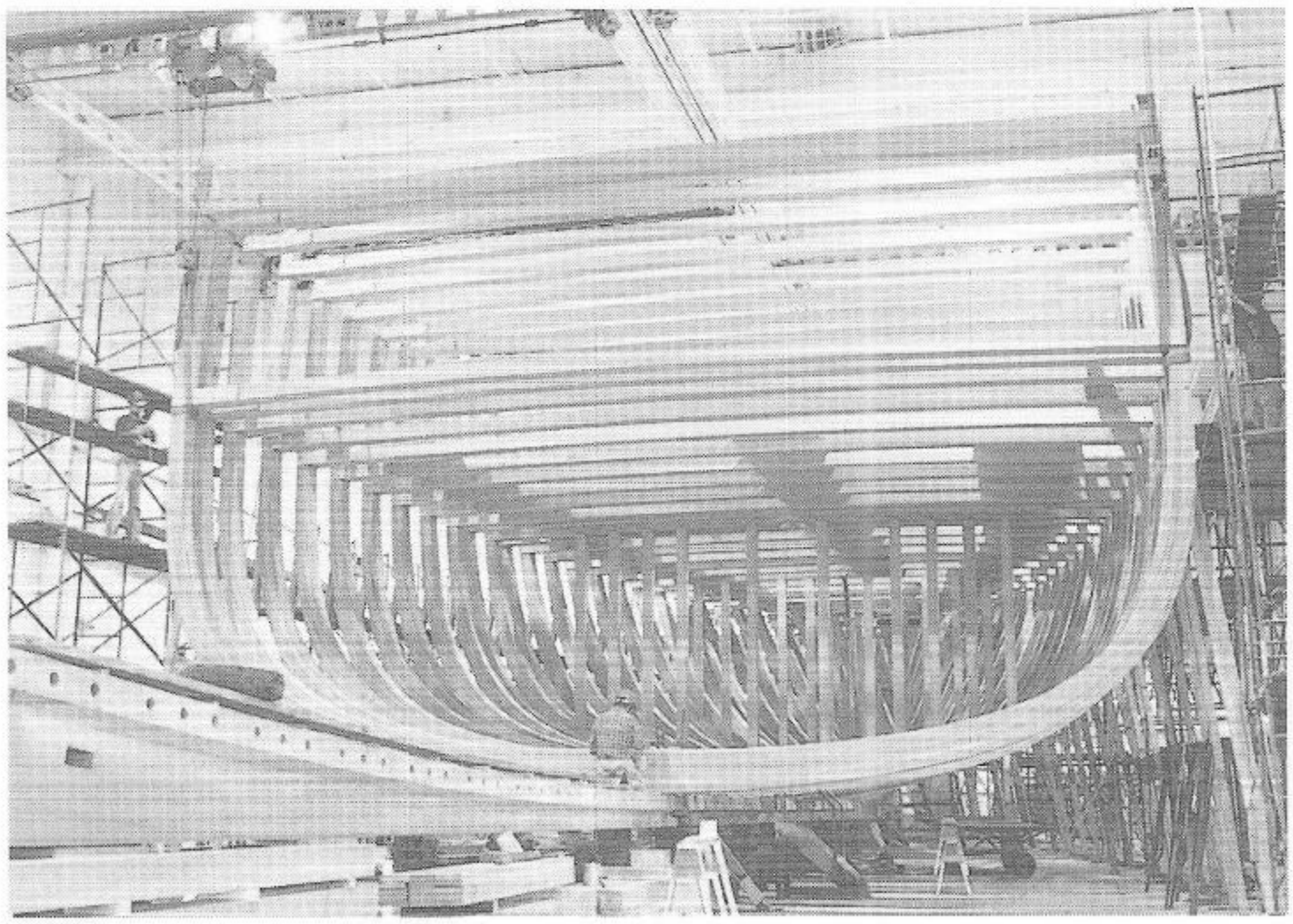
DESIGN

These are the most sophisticated wooden ships ever built, constructed for strategic reasons entirely from North American timbers. The single-piece keel is fabricated from laminated Douglas fir, upon which transverse 254 × 457 mm laminated white oak frames are laid at 1.07 m intervals, followed by longitudinal girders of laminated Douglas fir. The hull structure is then covered with three inner layers of 127 mm thick, diagonally laid, Alaskan cedar planking, followed by an outer, longitudinally laid layer, also 127 mm thick, of Douglas fir planking. Phenol/resorcinol glue is used throughout.

The main deck and 01 level planking are constructed from tongued-and-grooved, laminated Douglas fir and sheathed with Douglas fir plywood. The superstructure is constructed from a mix of laminated and solid woods, with plywood sheathing. Finally, the entire exterior surface is covered with GRP to give environmental protection.

There was a problem of engine rotation on the Waukesha diesels fitted in MCM 1-2. This has been resolved, but those engines have been replaced in the rest of the class by low-magnetic engines manufactured by Isotta-Fraschini of Milan, Italy (despite instructions from Congress that the last five were to be powered by US-made engines).

Another problem with MCM 1 occurred when it was discovered that the entire class needed to be lengthened by 1.8 m (5.9 ft) to overcome potential stability problems. MCM 1 was already under construction and the hull had to be lengthened before work could continue.



These are the most sophisticated wooden ships ever built. The single-piece keel is made from Douglas fir, the frames are of white oak and the girders of Douglas fir. The hull is then covered with three layers of diagonally laid Alaskan cedar planking with an outer layer of 127 mm thick Douglas fir planking (Peterson Builders Inc.)

DEPLOYMENT

Avenger (MCM 1) was fitted with the AN/SQQ-32 for Gulf operations in 1991 and all others in the class are being retrofitted.

Avenger (MCM 1) and *Defender* (MCM 2) were transferred to the Naval Reserve Force in 1995 and two more were scheduled to join them in 1996.

Ardent (MCM 12) and *Dextrous* (MCM 13) have been permanently stationed in the Gulf since March 1996 with crew rotation. *Guardian* (MCM 5) and *Patriot* (MCM 7) are homeported at Sasebo, Japan. The remainder is based at Ingleside, Texas.

BLUEBIRD/ADJUTANT

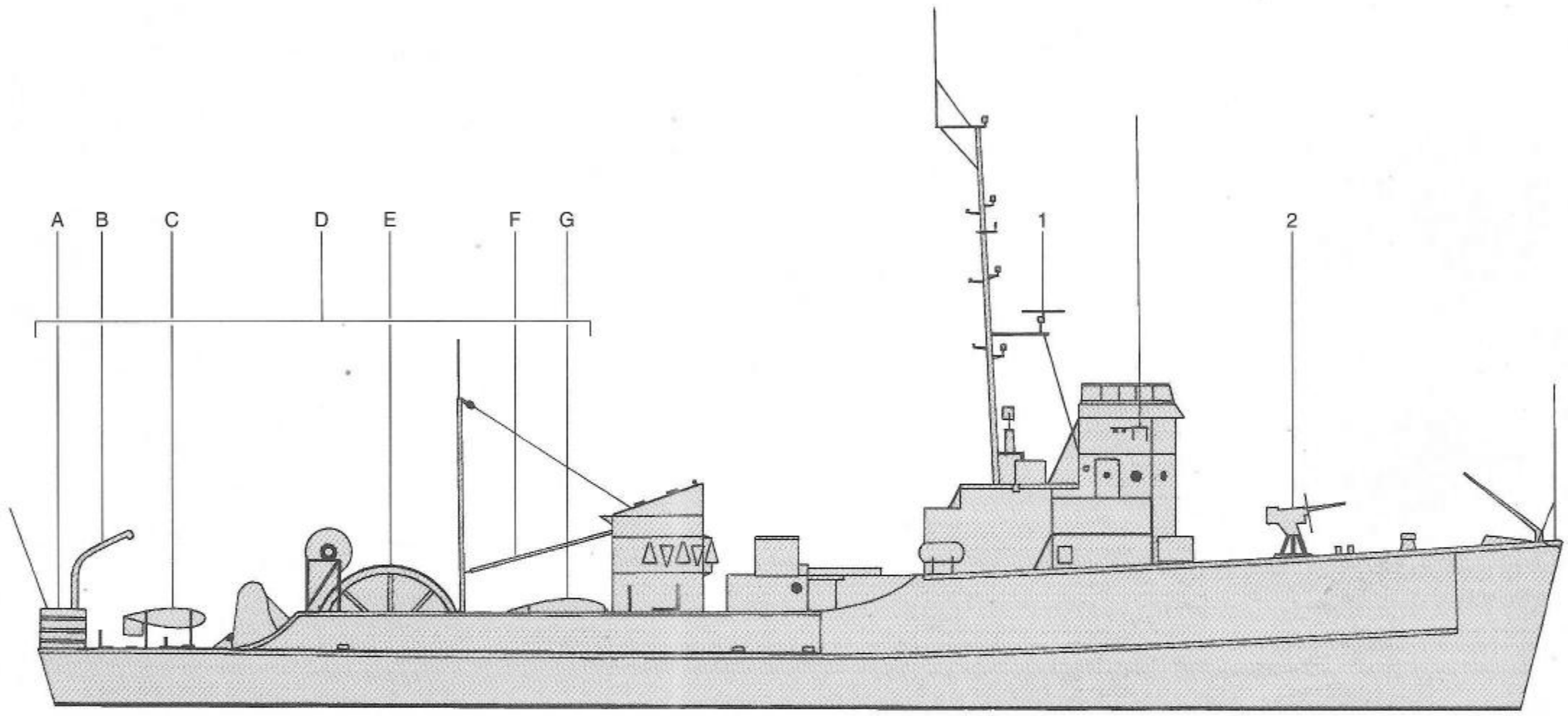
OVERVIEW

Frequent references have been made elsewhere in this book to the NATO reaction in the 1950s to the threat posed by Soviet minelaying capabilities, which was first properly appreciated during the Korean War. As has frequently happened in the MCM field, there was a sudden burst of activity and numerous MCMVs were designed and constructed, before the threat was once again allowed to recede into the background.

One of the designs produced during the mid-1950s was the US Navy wooden-hulled coastal minesweeper. Some of these served in the US Navy and were later sold abroad, while others were either constructed in the USA for direct export under the Mutual Defense Aid Pact (MDAP), or were constructed abroad, but with MDAP funding. These were originally designated AMS (auxiliary minesweepers), but this was later changed to the current designation: MSC (minesweeper, coastal).

There were a number of minor variations on the original design and a variety of designations are used for them, including 'Bluebird', 'Redwing', 'Adjutant', MSC 268, MSC 292 and MSC 294. In this book it is intended to use the designation 'Bluebird/Adjutant' class to cover all these types.

GRØNSUND (BLUEBIRD/ADJUTANT)



Adjutant (Ian Sturton)
MCM A *Kite* **B** *Davit* **C** *Float* **D** *Sweep deck* **E** *Main winch* **F** *Float*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Denmark
Type: Bluebird/adjutant (Coastal minesweeper)

Class: GRØNSUND

Aquired (MDAP): 8
Active: 1

Displacement:
standard: 350 t
full load: 376 t

Dimensions
Length: 45 m (147.6 ft)
Beam: 8.5 m (27.9 ft)
Draught: 2.6 m (8.5 ft)

Speed: 13 kts
Range: 3,000 n miles at 10 kts

Complement: 31 (4 officers)

SHIPS

GRONSUND (M 574)
Builder Stephen Bros Shipyard, California, USA
Commissioned (Denmark) 21 Sep 1956 (ex-MSC 256)

WEAPONS SYSTEMS

GUNS

1 Bofors 40 mm/60 (US Mk 3)

The US Mk 3 version of Bofors 40 mm/60 is an army mounting adapted for naval use. It is hand operated although many were fitted for electrically powered, oil hydraulic elevation and training. There is an RPLS Mk 3 which is fitted with remote power control from a Kerrison predictor and Mk 3 CN which has a shield and has been slightly navalised while the Mk 3* is a fully navalised mounting with Type 6 gyro sights for the layer and trainer. It is not clear which version is fitted to the 'Grønsund' class.

Specifications
Weight empty: 1.03 t
Traverse: Nominal 360° at 12°/s
Elevation: −6 to +90° at 25°/s
Crew: 5

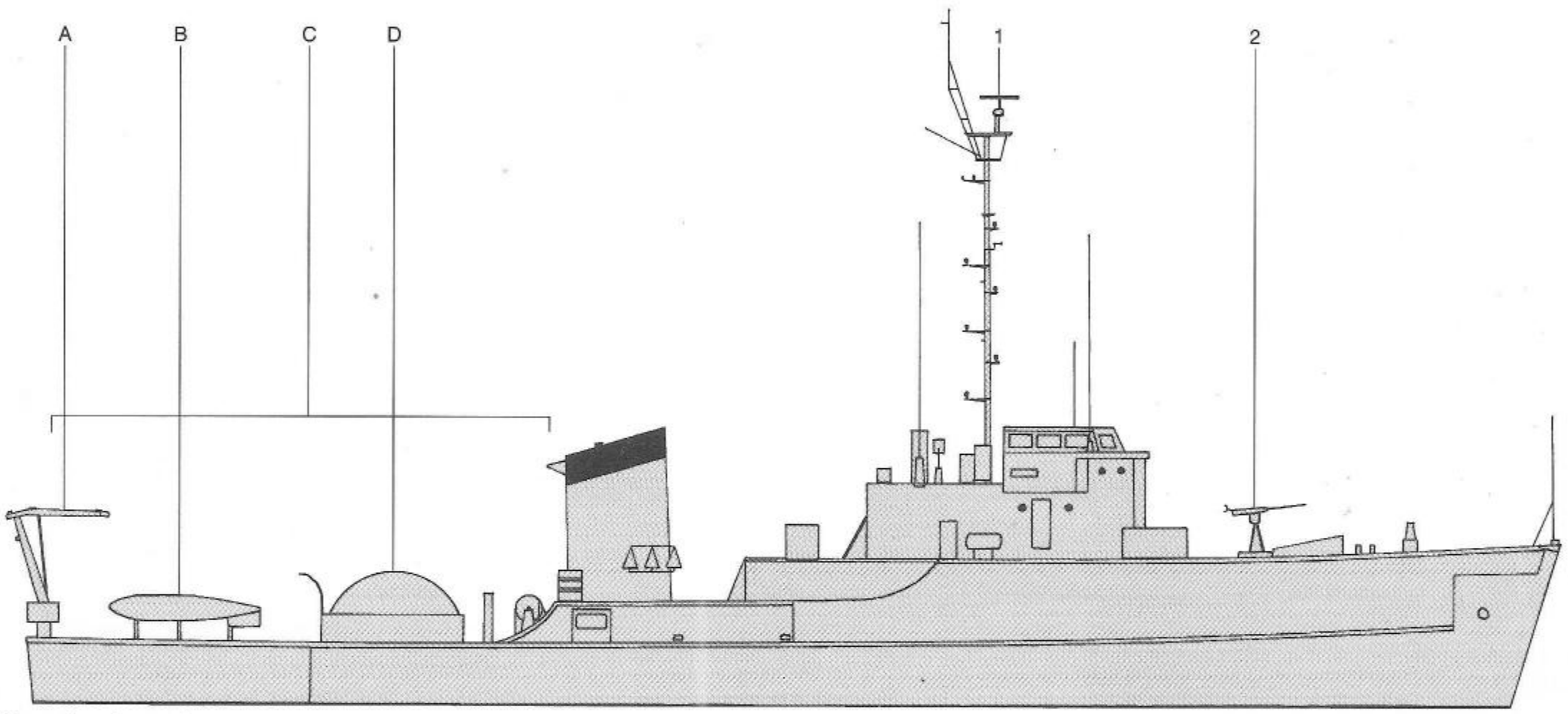
PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 8-268 diesels, 656 kW (880 hp)
Shafts: 2

FURTHER INFORMATION

This is the last survivor of eight 'Bluebird/Adjutant' class minesweepers supplied to Denmark in the 1950s. It is fitted with a charthouse between the bridge and the small stack and has been employed on surveying duties.

ALKYON (BLUEBIRD/ADJUTANT)



Alkyon (Ian Sturton)
MCM A *Crane* **B** *Float* **C** *Sweep deck* **D** *Main winch*

General 1 *Racal-Decca navigation radar* **2** *Oerlikon 20 mm cannon*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Greece

Type: Bluebird/Adjutant (Coastal minesweeper)

Class: ALKYON

Transferred: 15
Active: 15

	M 211-M 214, M 240-M 242, M 246-M 248	M 202, M 206, M 210, M 254 M 60, M 61
Displacement		
light	320 t	370 t
full load	370 t	402 t
Length	43 m (141.1 ft)	44.2 m (145.0 ft)
Beam	8 m (26.2 ft)	8.5 m (27.9 ft)
Draught	2.6 m (8.5 ft)	2.4 m (7.9 ft)

Speed: 13 kts
Range: 2,500 n miles at 10 kts

Complement: 39 (4 officers)

SHIPS

ALKYON (M 211)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Transferred (Greece)/ Commissioned 3 Dec 1968

KLIO (M 213)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Transferred (Greece)/ Commissioned 7 Aug 1968

AVRA (M 214)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Transferred (Greece)/ Commissioned 3 Oct 1968

AEDON (M 240)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Transferred (Greece)/ Commissioned 22 Jun 1967

KICHLI (M 241)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Transferred (Greece)/ Commissioned 14 Jul 1964

KISSA (M 242)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Transferred (Greece)/ Commissioned 1 Sep 1964

AIGLI (M 246)
Builder Tacoma, California, USA
Transferred (Greece)/ Commissioned 4 Jan 1965

DAFNI (M 247)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Transferred (Greece)/ Commissioned 23 Sep 1964

PLEIAS (M 248)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Transferred (Greece)/ Commissioned 13 Oct 1964

ATALANTI (M 202)
Builder Consolidated, Morris Heights, New York, USA
Transferred (Belgium) 1953 (*Sint Truiden* (M 919))
Returned to USA/ transferred (Greece) 1969

FAEDRA (M 206)
Builder Hodgson Brothers, East Booth Bay, Maine, USA
Transferred (Belgium) 1953 (*Malmedy* (M 922))
Returned to USA/ transferred (Greece) 1969

THALIA (M 210)
Builder Consolidated, Morris Heights, New York, USA
Transferred (Belgium) 1953 (*Blankenberge* (M 923))
Returned to USA/ transferred (Greece) 1969

NIOVI (M 254)
Builder Consolidated, Morris Heights, New York, USA
Transferred (Belgium) 1953 (*Laroche* M 924))
Returned to USA/ transferred (Greece) 1969

ERATO (M 60)
Builder Henry Grebe, New York, New York, USA
Commissioned 7 Aug 1955
Transferred (Italy) 1953 (*Castagno* (M 5504))
Converted to minehunter 1983
Purchased (Greece) 10 Oct 1995

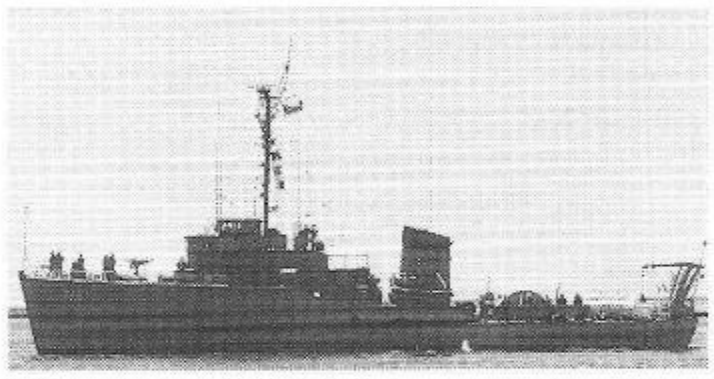
EVNIKI (M 61)
Builder Henry Grebe, New York, New York USA
Commissioned 8 Mar 1954
Transferred (Italy) 1953 (*Gelso* (M 5509))
Converted to minehunter 1984
Purchased (Greece) 10 Oct 1995

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING GEAR

These MSCs were originally outfitted with US minesweeping equipment, which included:

- **Mechanical sweeps.** Oropesa Wire Sweeps Size 4. These sweeps have 300 fathom (1,800 ft) sweep wires on each side of the MCMV, clearing a path 384 m (420 yd) wide at a speed of advance of 8 kts.
- **Acoustic sweeps.** Sweep A Mk 6. This consists of a 'fish' containing a diaphragm activated by pistons driven by an eccentric cam on an electric motor. It is towed by a wire some 1,100 m (1,200 yd) long.
- **Magnetic sweeps.** Sweep M Mk 5. This consists of two buoyant, conducting cables streamed astern of the minesweeper. One leg is 205 m (675 ft) long, the other 460 m (1,500 ft) long and a magnetic field is set up between the two which activates magnetic mines



Dafni *(M 247) is one of the 'MSC 294' class coastal minesweepers of the Hellenic Navy* (H & L van Ginderen Collection)

MINESWEEPING SONARS

AN/UQS-1
All ships were originally equipped with AN/UQS-1, hull-mounted minehunting sonar, which dates from the 1950s. A short pulse electronically scanned sonar, the UQS-1 is not a stabilised system and cannot therefore provide the mine-like image required for classification purposes. Some still retain this set.

Lockheed Martin AN/SQQ-14
Some of the original Greek and former Belgian ships have been refitted with AN/SQQ-14, an active, high-frequency variable depth minehunting sonar developed from the UQS-1 in the 1960s. AN/SQQ-14 is carried on a rigid retractable boom rather than a cable and has a maximum operating depth of about 45 m (148 ft). It comprises an 80 kHz search sonar and 350 kHz sonar for classification.

Lockheed Martin/FIAR AN/SQQ-14 (IT)
***Erato* (M 60) and *Evniki* (M 61) only.** These two ex-Italian ships were fitted, while in Italian service, with the AN/SQQ-14(IT) variable depth sonar. The AN/SQQ-14 system is essentially a variable depth, dual-frequency sonar for detecting and classifying bottom mines in shallow water. It utilises a towed body in the shape of an elongated sphere towed through a centre well on a mine countermeasures vessel.

The AN/SQQ-14 can operate down to 45 m (148 ft). It transmits at 80 kHz and 350 kHz respectively for search and classification, scanning over azimuths of 100° and 18°, and through an elevation of 10° in each case. Azimuth and range resolutions are 1.5° and 1 m (3.28 ft) for search, and 0.3° and 8 cm (3.1 in) for classification. Under the SQQ-14 IT programme FIAR produced new dry and wet end electronics for the SQQ-14 for the Belgian and Italian navies.

Manufacturers/Contractors
Lockheed Martin, USA.
FIAR, Italy.

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm (US Mk 24)
All ships can carry one or two Oerlikon 20 mm cannon.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range
anti-surface: 1.5 km
anti-air: 1,150 m (3,773 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca
All except M60, M 61. All have a Decca I-band navigation radar; model is not known.

SMA 3RM 20R
M 60, M 61. These two ex-Italian ships have the SMA 3RM 20R, I-band navigational radar.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM-268A diesels; 1.3 MW (1,760 hp)
Shafts: 2

FURTHER INFORMATION

Although all these ships are of US origin, Greece has obtained them in three different ways:

- One group of nine ships was built in the USA for direct export to Greece in the 1960s
- The second group of four ships was built in the USA for Belgium and transferred to Greece in 1969
- The third group of two minehunters was built in the USA for Italy and was sold by Italy to Greece in 1995.

MODERNISATION

A modernisation programme for the original Greek ships was begun in 1990 and completed in 1995. The work included replacing the main engines and navigation radar. A new sonar is under consideration. Having bought two ships from Italy in 1995, it appears that the Greek Navy intends to keep these ships in service for some years to come.

SHAHROKH (BLUEBIRD/ADJUTANT)

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Iran
Type: Bluebird/Adjutant (Coastal minesweeper)

Class: SHAHROKH

Transferred (MDAP): 4
Active: 3

Displacement:
full load: 376 t *(Shahrokh)*; 384 t (others)

Dimensions
Length: 44.5 m (145.8 ft)
Beam: 8.5 m (28 ft)
Draught: 2.5 m (8.3 ft)

Speed: 13 kts
Range: 2,400 n miles at 10 kts

Complement: 40 (6 officers)

SHIPS

SHAHROKH (301)
Builder Bellingham Shipyards, Bellingham, Washington, USA
Commissioned 1960

SIMORGH (302)
Builder Tacoma Boat, Tacoma, Washington, USA
Commissioned 1962

KARKAS (303)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Commissioned 1959

MINE COUNTERMEASURES SYSTEMS

These MSCs were originally outfitted with US minesweeping equipment, which included:

- **Mechanical sweeps.** Oropesa Wire Sweeps Size 4. These sweeps have 300 fathom (1,800 ft) sweep wires on each side of the MCMV, clearing a path 384 m (420 yd) wide at a speed of advance of 8 kts
- **Acoustic sweeps.** Sweep A Mk 6. This consists of a 'fish' containing a diaphragm activated by a piston driven by an eccentric cam on an electric motor. It is towed by a wire some 1,100 m (1,200 yd) long.
- **Magnetic sweeps.** Sweep M Mk 5. This consists of two buoyant, conducting cables streamed astern of the minesweeper. One leg is 205 m (675 ft) long, the other 460 m (1,500 ft) long and a magnetic field is set up between the two which activates magnetic mines.

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm
There is normally one twin mount per ship.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range
anti-surface: 1.5 km
anti-air: 1,150 m (3,773 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca
There is one Racal-Decca, I-band navigation radar, type unknown.

PROPULSION

Specifications
System: Diesel
Main machinery:
Shahrokh: 2 General Motors GM 8-268A diesels, 656 kW (880 hp)
Others: 4 General Motors GM 6-71 diesels; 519 kW (696 hp) sustained
Shafts: 2

FURTHER INFORMATION

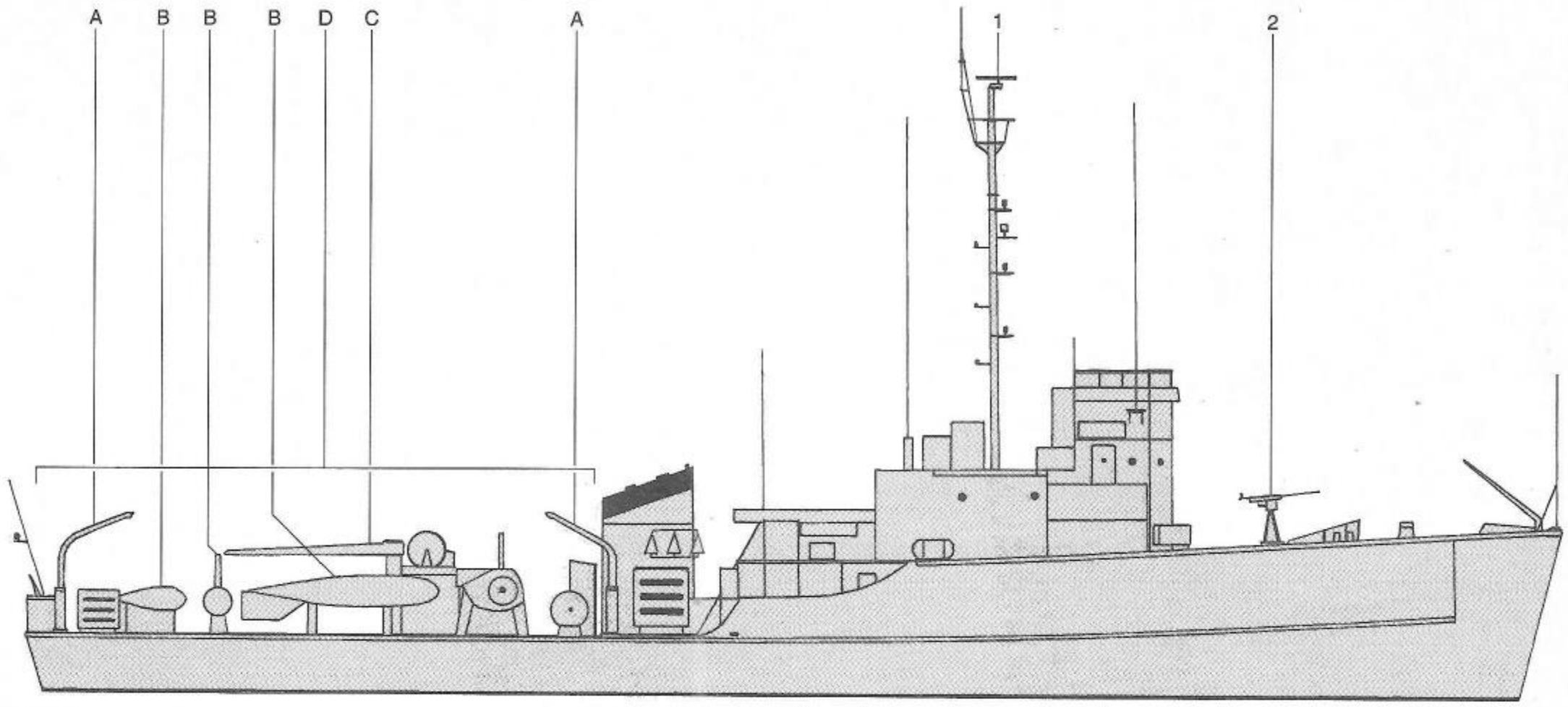
PROGRAMME

These four ships were built specifically for export to Iran and were transferred under the MDAP in 1959-62.

DEPLOYMENT

Shahrokh operates in the Caspian Sea as a training ship. *Simorgh* and *Karkas* are based at Boushehr, where *Karkas* is still active, although it is rarely seen at sea. *Simorgh* paid off some years ago but was reactivated in 1992.

KUM SAN (BLUEBIRD/ADJUTANT)



Kum San
MCM A *Davit* **B** *Floats* **C** *Crane* **D** *Sweep deck*

General 1 *Racal-Decca 45* **2** *Twin 20 mm Oerlikon*

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: South Korea
Type: Bluebird/Adjutant (Coastal minesweepers)

Class: KUM SAN

Transferred (MDAP): 8
Active: 8

	MSC 551-553	MSC 555-559
Displacement		
light	320 t	315 t
full load	370 t	380 t
Length	43 m (141.1 ft)	44.3 m (145.4 ft)
Beam	8 m (26.2 ft)	8.3 m (27.2 ft)
Draught	2.6 m (8.5 ft)	2.7 m (12 ft)

Speed: 14 kts
Range: 2,500 n miles at 14 kts

Complement: 40

SHIPS

KUM SAN (MSC 551)
Builder Harbor Boat Building, Terminal Island, California, USA
Commissioned (US Navy) Jun 1959 (MSC 284)
Transferred (South Korea) Jun 1959

KO HUNG (MSC 552)
Builder Harbour Boat Building, Terminal Island, California, USA
Commissioned (US Navy) Aug 1959 (MSC 285)
Transferred (South Korea) Sep 1959

KUM KOK (MSC 553)
Builder Harbour Boat Building, Terminal Island, California, USA
Commissioned (US Navy) Oct 1959 (MSC 286)
Transferred (South Korea) Nov 1959

NAM YANG MSC 555)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Commissioned (US Navy) Aug 1963 (MSC 295)
Transferred (South Korea) Sep 1963

HA DONG (MSC 556)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Commissioned (US Navy) Nov 1963 (MSC 296)
Transferred (South Korea) Nov 1963

SAM KOK (MSC 557)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Commissioned (US Navy) Jul 1968 (MSC 316)
Transferred (South Korea) Jul 1968

YONG DONG (MSC 558)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Commissioned (US Navy) Oct 1975 (MSC 320)
Transferred (South Korea) 2 Oct 1975

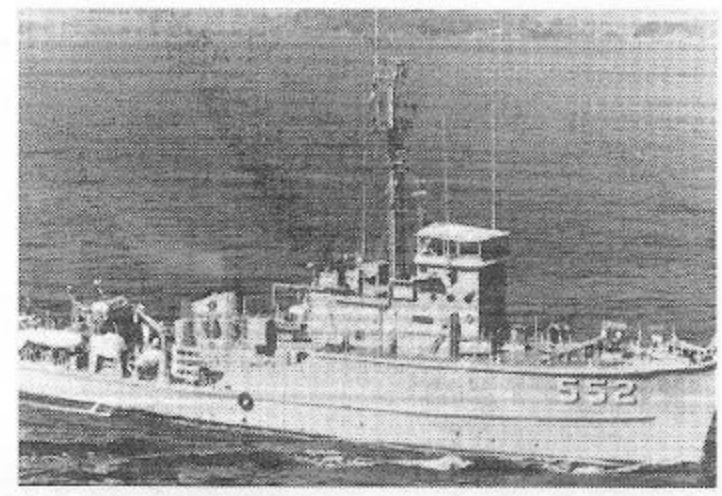
OK CHEON (MSC 559)
Builder Peterson Builders, Sturgeon Bay, Wisconsin, USA
Commissioned (US Navy) Oct 1975 (MSC 321)
Transferred (South Korea) 2 Oct 1975

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING GEAR

These MSCs were originally outfitted with US minesweeping equipment, which included:

- **Mechanical sweeps.** Oropesa Wire Sweeps Size 4. These sweeps have 300 fathom (1,800 ft) sweep wires on each side of the MCMV, clearing a path 384 m (420 yd) wide at a speed of advance of 8 kts.
- **Acoustic sweeps.** Sweep A Mk 6. This consists of a 'fish' containing a diaphragm activated by pistons driven by an eccentric cam on an electric motor. It is towed by a wire some 1,100 m (1,200 yd) long.
- **Magnetic sweeps.** Sweep M Mk 5. This consists of two buoyant, conducting cables streamed astern of the minesweeper. One leg is 205 m (675 ft) long, the other 460 m (1,500 ft) long and a magnetic field is set up between the two which activates magnetic mines.



Ko Hung *(MSC 552). Eight of these small coastal minesweepers remain in service with the RoK Navy. They were expected to pay off as the 'Swallow' class entered service but this has not yet happened* (G Jacobs)

SONAR

AN/UQS-1

AN/UQS-1 is a hull-mounted, minehunting sonar dating from the 1950s. A short pulse, electronically scanned sonar, the UQS-1 is not a stabilised system and cannot therefore provide the mine-like image required for classification purposes.

Unconfirmed reports suggest that at least some of these Korean ships may have had their AN/UQS-1 sonars replaced by a Thomson-CSF model, possibly the TSM 2022.

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm

MSC 551, MSC 552, MSC 553 only. One twin Oerlikon 20 mm mounting.

MSC 555, MSC 556, MSC 557, MSC 558, MSC 559 only. Two single Oerlikon 20 mm mountings.

Specifications

Gun

Calibre: 20 mm

Length of barrel: 70 calibres

Muzzle velocity: 835 m/s (2,740 ft/s)

Range

anti-surface: 1.5 km

anti-air: 1,150 m (3,773 ft)

Rate of fire: 450 rds/min

Round weight: 241 g

Projectile: 122 g

Browning 12.7 mm machine guns

Three per ship.

Specifications

Gun weight: 38.1 kg (84 lb)

Muzzle velocity: 893 m/s (2,930 ft/s)

Cyclic rate of fire: 550 rds/min

Practical rate of fire: 70 rds/min

Effective range: 0.98 n miles (1.83 km)

COMMAND AND CONTROL SYSTEMS

RADAR

Decca 45

An I-band navigation radar.

PROPULSION

Specifications

System: Diesel

Main machinery:

MSC 551, MSC 552, MSC 553 only: 2 GM 8-268A diesels; 656 kW (880 hp) sustained

MSC 555, MSC 556, MSC 557, MSC 558, MSC 559 only: 4 GM 6-71 diesels; 519 kW (696 hp) sustained

Shafts: 2

FURTHER INFORMATION

It is reported, but not confirmed, that the last four of these ships may have been retrofitted with Thomson Sintra mine detection sonars.

The RoK Navy announced that it planned to pay off these ships as the 'Swallow' class MCMVs are commissioned, but there is no indication as yet that this process has started.

MAHMOOD (BLUEBIRD/ADJUTANT)

GENERAL SPECIFICATIONS

Country of origin: USA

Operator: Pakistan

Type: Bluebird/Adjutant (Coastal minesweeper)

Class: MAHMOOD

Transferred: 8

Active: 2

Displacement

light: 330 t

full load: 390 t

Dimensions

Length: 43.9 m (144 ft)

Beam: 8.5 m (27.9 ft)

Draught: 2.6 m (8.5 ft)

Speed: 13.5 kts

Range: 3,000 n miles at 10.5 kts

Complement: 39

SHIPS

MAHMOOD (M 160)

Builder	Quincy Yacht, Quincy, Massachusetts, USA
Commissioned (US Navy)	Apr 1957 (MSC 267)
Transferred (MDAP)	May 1957

MUJAHID (M 164)

Builder	Hodgson Brothers, Boothbay, Maine, USA
Commissioned (US Navy)	Oct 1956 (MSC 261)
Transferred (MDAP)	Nov 1956
Paid off	1990
Recommissioned	1991

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING GEAR

These MSCs were originally outfitted with US minesweeping equipment, which included:

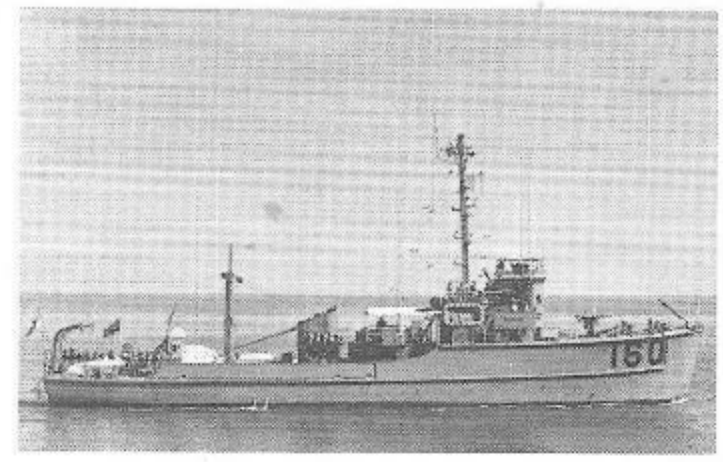
- **Mechanical sweeps.** Oropesa Wire Sweeps Size 4. These sweeps have 300 fathom (1,800 ft) sweep wires on each side of the MCMV, clearing a path 384 m (420 yd) wide at a speed of advance of 8 kts.
- **Acoustic sweeps.** Sweep A Mk 6. This consists of a 'fish' containing a diaphragm activated by pistons driven by an eccentric cam on an electric motor. It is towed by a wire some 1,100 m (1,200 yd) long.
- **Magnetic sweeps.** Sweep M Mk 5. This consists of two buoyant, conducting cables streamed astern of the minesweeper. One leg is 205 m (675 ft) long, the other 460 m (1,500 ft) long and a magnetic field is set up between the two which activates magnetic mines.

MINEHUNTING SONAR

AN/UQS-1

AN/UQS-1 is a hull-mounted, minehunting sonar dating from the 1950s. A short pulse, electronically scanned sonar, the UQS-1 is not a stabilised system and cannot therefore provide the mine-like image required for classification purposes.

Unconfirmed reports suggest that at least some of these Korean ships may have had their AN/UQS-1 sonars replaced by a Thomson-CSF model, posssibly the TSM 2022.



There are two of these US-built MSCs in the Pakistan Navy which are due to pay off in the near future (Pakistan Navy)

WEAPONS SYSTEMS

GUNS

Russian ZU-23-4 23 mm/80 in one quad mounting

These ships carry either a single Russian 23 mm/80 in ZU-23-4 mounting, or a single 20 mm Oerlikon. The Soviet Army ZU-23 was not produced for the Soviet Navy, which preferred 30 mm weapons, but the mounting has been adapted by a number of navies to produce a cheap, lightweight, short-range, point defence system on both large and small warships. The ZU-23-4 consists of four air-cooled 2A14 cannon fed from 50-round belts in boxes fitted to each side of the trunnions. A ZAP-23 optical sight is attached to the rear of the weapon which is on a manually operated firing platform. The whole mounting weighs 893 kg (1,969 lb) and it has a five-man crew, of whom two are on the mounting and three are ammunition carriers and loaders.

Specifications
Calibre: 23 mm
Length of barrel: 87 calibres
Traverse: 360°
Elevation: −10 to +90°
Rates of fire: 200 rds/min/barrel (practical)
Projectile: 0.19 kg (0.42 lb)
Range:
anti-surface: 1.1 n miles (2 km)
anti-air: 1,500 m (4,920 ft)

Oerlikon 20 mm

The Oerlikon 20 mm is sometimes mounted in place of the ZU-23-4.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,740 ft/s)
Range
anti-surface: 1.5 km
anti-air: 1,150 m (3,773 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca 45

The Racal-Decca 45 is an I-band navigation radar.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 8-268A diesels; 656 kW (880 hp) sustained
Shafts: 2

FURTHER INFORMATION

Both these ships are due to pay off as the 'Munsif Eridan' class comes into service.

ADDRIYAH (BLUEBIRD/ADJUTANT)

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Saudi Arabia
Type: Bluebird/Adjutant (Coastal minesweeper/hunter)

Class: ADDRIYAH

Purchased: 4
Active: 4

Displacement:
standard: 320 t
full load: 407 t

Dimensions
Length: 46.4 m (153 ft)
Beam: 8.2 m (26.9 ft)
Draught: 2.5 m (8.2 ft)

Speed: 13 kts

Complement: 39 (4 officers)

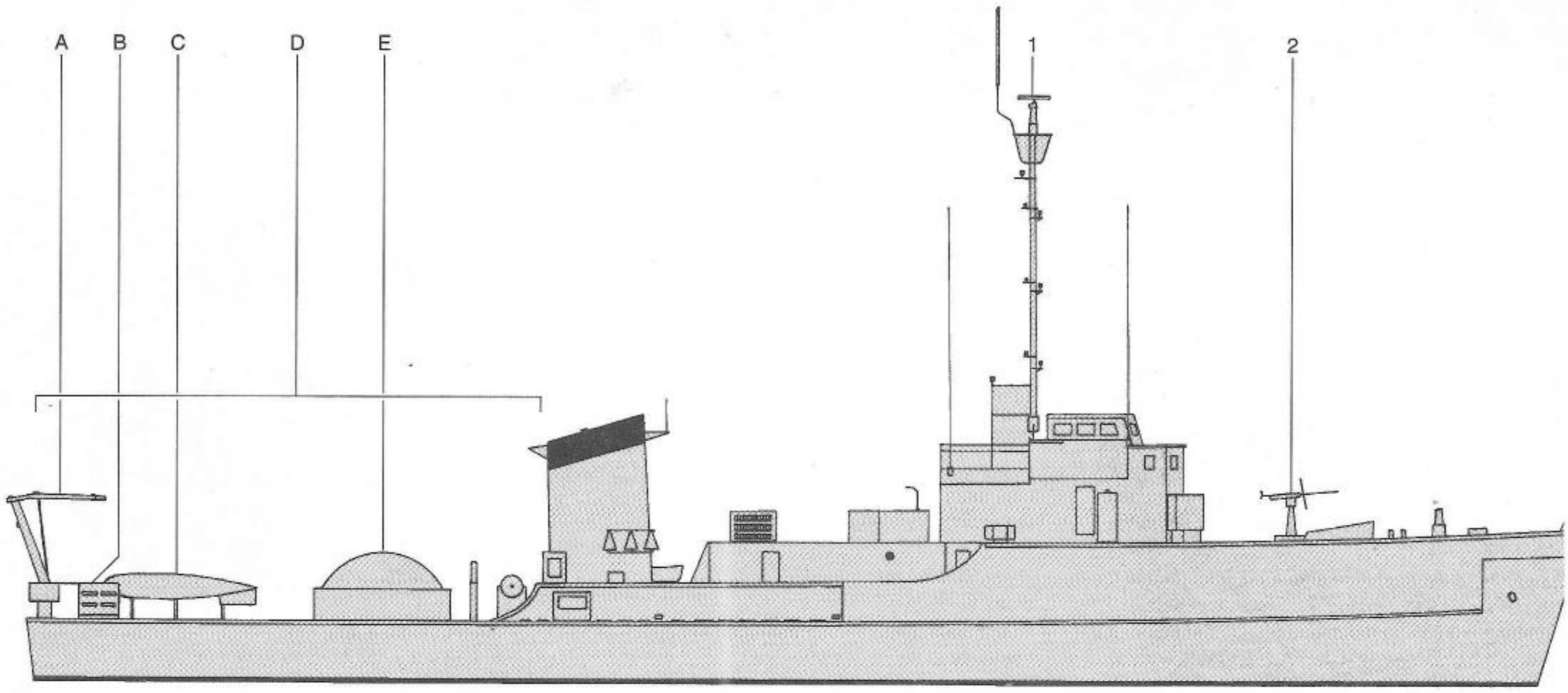
SHIPS

ADDRIYAH (MSC 412)
Builder Peterson Shipbuilders, Sturgeon Bay, Wisconsin, USA
Launched 20 Dec 1976
Commissioned 6 July 1978

AL QUYSUMAH (MSC 414)
Builder Peterson Shipbuilders, Sturgeon Bay, Wisconsin, USA
Launched 26 May 1977
Commissioned 15 Aug 1978

AL WADEEAH (MSC 416)
Builder Peterson Shipbuilders, Sturgeon Bay, Wisconsin, USA
Launched 6 Sep 1977
Commissioned 7 Sep 1979

SAFWA (MSC 418)
Builder Peterson Shipbuilders, Sturgeon Bay, Wisconsin, USA
Launched 7 Dec 1977
Commissioned 2 Oct 1979



MSC (Ian Sturton)
MCM A *Crane* **B** *Kite* **C** *Oropesa float* **D** *Sweep winch* **E** *Sweep deck*

General 1 *ISC Cardion AN/SPS-55 surface search radar* **2** *Oerlikon 20 mm cannon*

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING GEAR

These MSCs were supplied with US minesweeping equipment, which included:

- **Mechanical sweeps.** Oropesa Wire Sweeps Size 4. These sweeps have 300 fathom (1,800 ft) sweep wires on each side of the MCMV, clearing a path 384 m (420 yd) wide at a speed of advance of 8 kts.
- **Acoustic sweeps.** Sweep A Mk 6. This consists of a 'fish' containing a diaphragm activated by pistons driven by an eccentric cam on an electric motor. It is towed by a wire some 1,100 m (1,200 yd) long.
- **Magnetic sweeps.** Sweep M Mk 5. This consists of two buoyant, conducting cables streamed astern of the minesweeper. One leg is 205 m (675 ft) long, the other 460 m (1,500 ft) long and a magnetic field is set up between the two which activates magnetic mines.

Lockheed Martin AN/SQQ-14

Some of the original Greek and former Belgian ships have been refitted with AN/SQQ-14, an active, high-frequency variable depth minehunting sonar developed from the UQS-1 in the 1960s. AN/SQQ-14 is carried on a rigid retractable boom rather than a cable and has a maximum operating depth of about 45 m (148 ft). It comprises an 80 kHz search sonar and 350 kHz sonar for classification.

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm (US Mk 10)

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,738 ft/s)

Range
anti-surface: 0.81 n miles (1.5 km)
anti-air: 1,150 m (3,772 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

Safwa *(MSC 418), one of four built for Saudi Arabia, based on the Bluebird design but slightly longer* (H & L van Ginderen Collection)

COMMAND AND CONTROL SYSTEMS

RADAR

ISC Cardion AN/SPS-55

I/J-band surface search radar.

Specifications
AN/SPS-55)
Role: Surface search

Band: I/J (8-20 GHz)
Beam: 1.5 × 20°
Peak power: 130 kW
Gain: 31 dB
Pulsewidth: 1/12µs
PRF: 750/2,250 pps
Scan rate: 16 rpm

Manufacturer/Contractor
ISC Cardion

PROPULSION

Specifications
System: Diesel
Main machinery: 2 Waukesha L1616 diesels; 1,200 hp (895 kW)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These four ships were ordered on 30 September 1975 under the International Logistics Programme. They are different from other 'Bluebird/Adjutant' class ships in that they have roll dampers, and, in addition to wire and magnetic sweeps, they are also fitted for minehunting.

DESIGN

They are generally similar to other ships of the class, but are approximately 3 m (10 ft) longer.

DEPLOYMENT

Addriyah is based at Jiddah, the remainder at Al Jubail.

They appear to be used primarily as general-purpose patrol vessels rather than as minehunters

THE FUTURE

They will be replaced by the 'Sandown' class as these new vessels enter service.

YUNG CHOU (BLUEBIRD/ADJUTANT)

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Taiwan
Type: Bluebird/Adjutant (Coastal minesweeper)

Class: YUNG CHOU

Transferred: 14
Active: 5

Displacement:
full load: 375 t

Dimensions
Length: 43.9 m (144 ft)
Beam: 8.5 m (27.9 ft)
Draught: 2.4 m (8 ft)

Speed: 13 kts
Range: 2,500 n miles at 12 kts

Complement: 35

SHIPS

YUNG CHOU (423)
Builder Tacoma, California, USA
Commissioned Jul 1959

YUNG CHENG (441)
Builder Quincy Adams Yacht, Quincy, New York, USA
Commissioned (Belgium) Jul 1953 (Maaseick (M913) ex-MSC 78)
Returned to USA/ transferred to Taiwan Nov 1969

YUNG AN (449)
Builder Tacoma, California, USA
Commissioned Jun 1955

YUNG SUI (462
Builder Henry B Nevins, New York, USA
Commissioned (Belgium) Feb 1954 (*Diksmuide* (M 920)
Returned to USA/ transferred to Taiwan Nov 1969

YUNG JEN (485)
Builder Henry B Nevins, New York, USA
Commissioned (Belgium) Feb 1954 (*Sint Niklaas* (M 918))
Returned to USA/ transferred to Taiwan Nov 1969

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING GEAR

These MSCs were originally outfitted with US minesweeping equipment, which included:

- **Mechanical sweeps.** Oropesa Wire Sweeps Size 4. These sweeps have 300 fathom (1,800 ft) sweep wires on each side of the MCMV, clearing a path 384 m (420 yd) wide at a speed of advance of 8 kts.
- **Acoustic sweeps.** Sweep A Mk 6. This consists of a 'fish' containing a diaphragm activated by pistons driven by an eccentric cam on an electric motor. It is towed by a wire some 1,100 m (1,200 yd) long.
- **Magnetic sweeps.** Sweep M Mk 5. This consists of two buoyant, conducting cables streamed astern of the minesweeper. One leg is 205 m (675 ft) long, the other 460 m (1,500 ft) long and a magnetic field is set up between the two which activates magnetic mines.

MINEHUNTING SONAR

AN/UQS-1
All ships were originally equipped with AN/UQS-1, hull-mounted minehunting sonar, which dates from the 1950s. A short pulse electronically scanned sonar, the UQS-1 is not a stabilised system and cannot therefore provide the mine-like image required for classification purposes. Some still retain this set.

WEAPONS SYSTEMS

GUNS

Oerlikon 20mm (US Mk 24)
One twin mount per vessel. The Mk 24 mounting was designed primarily for air defence, and features two Mk 2 or Mk 4 guns which are 165 mm apart. The muzzle arc clearance is 138 cm and the working circle is 141-152 cm. The mounting is similar to the US Mk 10, but has a crew of three.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,738 ft/s)
Range
anti-surface: 0.81 n miles (1.5 km)
anti-air: 1,150 m (3,772 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca 45 or 707
These ships are fitted with Racal-Decca I-band navigation radars, either Model 45 or Model 707.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 8-268A diesels; 1,760 hp (1,312 kW)
Shafts: 2

FURTHER INFORMATION

All were refitted between 1984 and 1986. Only four of the class have operational sonars, and all are in very poor condition. Several have been deleted so far.

BANGKEO (BLUEBIRD/ADJUTANT)

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Thailand
Type: Bluebird/Adjutant (Coastal minesweeper)

Class: BANGKEO

Purchased: 4
Active: 2

Displacement:
standard: 317 t
full load: 384 t

Dimensions
Length: 44.3 m (145.3 ft)
Beam: 8.2 m (27 ft)
Draught: 2.6 m (8.5 ft)

Speed: 13 kts
Range: 2,750 n miles at 12 kts

Complement: 43 (7 officers)

SHIPS

BANGKEO (ex-MSC 303) (612 (ex-6))
Builder Dorchester SB Corporation, Camden, New Jersey, USA
Commissioned 9 July 1965

DONCHEDI (ex-MSC 313) (613 (ex-8))
Builder Peterson Builder Inc, Sturgeon Bay, Wisconsin, USA
Commissioned 17 Sep 1965

MINE COUNTERMEASURES SYSTEMS

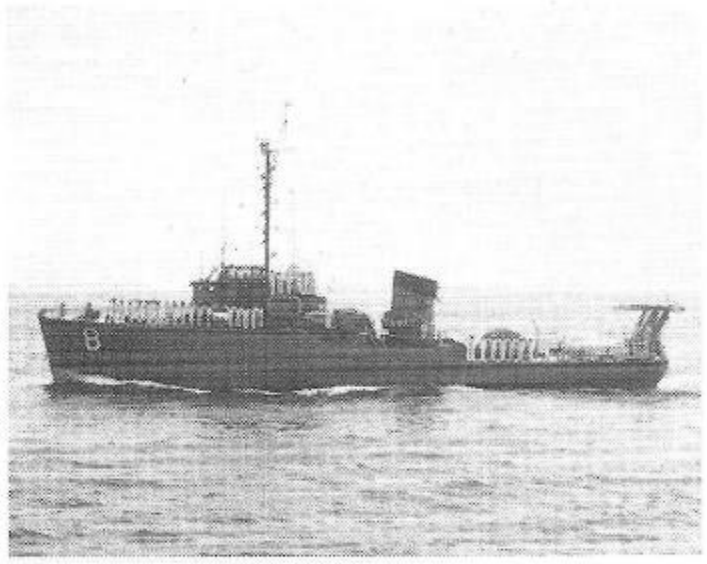
MINESWEEPING

These MSCs were supplied with US minesweeping equipment, which included:

- **Mechanical sweeps.** Oropesa Wire Sweeps Size 4. These sweeps have 300 fathom (1,800 ft) sweep wires on each side of the MCMV, clearing a path 384 m (420 yd) wide at a speed of advance of 8 kts.
- **Acoustic sweeps.** Sweep A Mk 6. This consists of a 'fish' containing a diaphragm activated by a pistons driven by an eccentric cam on an electric motor. It is towed by a wire some 1,100 m (1,200 yd) long.
- **Sweep A Mk 4 (V).** The Sweep A Mk 4 consists of a towed body with fins and a large diameter diaphragm in the nose. The diaphragm is struck by a hydraulically activated hammer causing it to emit signals at frequencies between 40 and 600 Hz. It was probably supplied to the Royal Thai Navy to enable it to counter mines in the shallow waters of the Gulf of Thailand.
- **Magnetic sweeps.** Sweep Q2. This is a post-Second World War magnetic sweep, consisting of two buoyant, conducting cables streamed astern of the minesweeper. A magnetic field is set up between the two which activates magnetic mines.

MINEHUNTING SONAR

AN/UQS-1
All ships were originally equipped with AN/UQS-1, hull-mounted minehunting sonar, which dates from the 1950s. A short pulse electronically scanned sonar, the UQS-1 is not a stabilized system and cannot therefore provide the mine-like image required for classification purposes. Some still retain this set.



Donchedi *(613)*

WEAPONS SYSTEMS

GUNS

Oerlikon 20 mm (US Mk 24)
One twin mount per vessel. The Mk 24 mounting was designed primarily for air defence, and features two Mk 2 or Mk 4 guns which are 165 mm apart. The muzzle arc clearance is 138 cm and the working circle is 141-152 cm. The mounting is similar to the US Mk 10, but has a crew of three.

Specifications
Gun
Calibre: 20 mm
Length of barrel: 70 calibres
Muzzle velocity: 835 m/s (2,739 ft/s)
Range
anti-surface: 0.81 n miles (1.5 km)
anti-air: 1,150 m (3,772 ft)
Rate of fire: 450 rds/min
Round weight: 241 g
Projectile: 122 g

COMMAND AND CONTROL SYSTEMS

RADARS

Racal-Decca TM 707
I-band navigation radar.

PROPULSION

Specifications
System: Diesel
Main machinery: 2 General Motors GM 8-268 diesels, 656 kW (880 hp)
Shafts: 2

FURTHER INFORMATION

PROGRAMME

These were constructed specifically for the Royal Thai Navy and are virtually identical to those built for NATO navies ten years earlier.

THE FUTURE

One paid off in 1992, followed by a second in 1995. The last two are now in limited operational service.

SELCUK (BLUEBIRD/ADJUTANT)

GENERAL SPECIFICATIONS

Country of origin: USA
Operator: Turkey
Type: Bluebird/Adjutant (Coastal minesweeper)

Class: SELCUK

Transferred: 12
Active: 11

Displacement:
standard: 320 t
full load: 370 t

Dimensions
Length: 43 m (141 ft)
Beam: 8 m (26 ft)
Draught: 2.6 m (8.3 ft)

Speed: 14 kts
Range: 2,500 n miles at 10 kts

Complement: 35 (2 officers)

SHIPS

SELCUK (M 508) (ex-MSC 124)

Builder	Stephen Brothers, California, USA
Commissioned (France)	Pavot (M 631)
Returned to USA/ transferred to Turkey	4 Sep 1970

SEYHAN (M 509) (ex-MSC 142)

Builder	South Coast Co, Newport Beach, California, USA
Commissioned (France)	Reconcule (M 634)
Returned to USA/ transferred to Turkey	4 Sep 1970

SAMSUN (M 510) (ex-MSC 268)

Builder	Bellingham Shipyard, Bellingham, Washington, USA
Transferred (Turkey)	3 Oct 1958

SINOP (M 511) (ex-MSC 270)

Builder	Bellingham Shipyard, Bellingham, Washington, USA
Transferred (Turkey)/ commissioned)	7 Feb 1959

SUMENE (M 512) (ex-MSC 271)

Builder	Bellingham Shipyard, Bellingham, Washington, USA
Transferred (Turkey)/ commissioned)	30 Mar 1959

SEDDÜLBAHIR (M 513) (ex-MSC 272)

Builder	Bellingham Shipyard, Bellingham, Washington, USA
Transferred (Turkey)/ commissioned)	1 May 1959

SILIFKE (M 514) (ex-MSC 304)

Builder	Dorchester Shipbuilders, Dorchester, New Jersey, USA
Transferred (Turkey)/ commissioned)	21 Mar 1966

SAROS (M 515) (ex-MSC 305)

Builder	Dorchester Shipbuilders, Dorchester, New Jersey, USA
Transferred (Turkey)/ commissioned)	25 Oct 1966

SIGACIK (M 516) (ex-MSC 311)

Builder	Peterson Shipbuilders, Sturgeon Bay, Wisconsin, USA
Transferred (Turkey)/ commissioned)	20 Dec 1965

SAPANCA (M 517) (ex-MSC 312)

Builder	Peterson Shipbuilders, Sturgeon Bay, Wisconsin, USA
Transferred (Turkey)/ commissioned)	20 Dec 1965

SARIYER (M 518) (ex-MSC 315)

Builder	Peterson Shipbuilders, Sturgeon Bay, Wisconsin, USA
Transferred (Turkey)/ commissioned)	7 Dec 1967

MINE COUNTERMEASURES SYSTEMS

MINESWEEPING

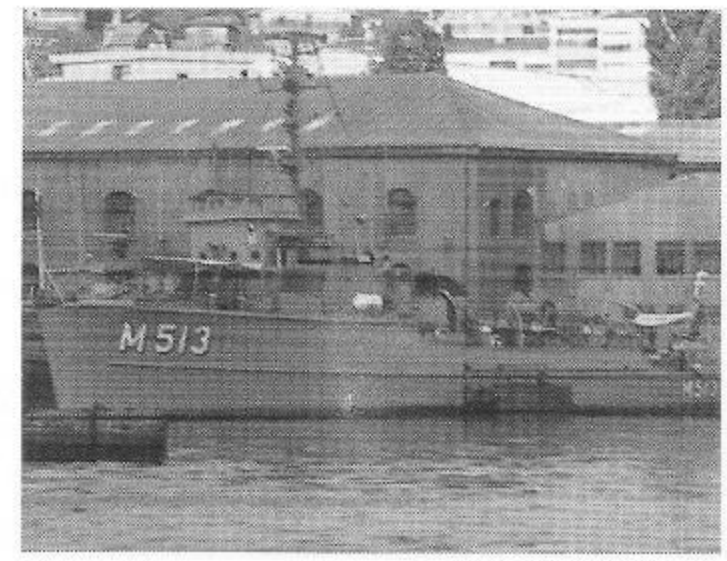
These MSCs were originally outfitted with US minesweeping equipment, which included:

- **Mechanical sweeps.** Oropesa Wire Sweeps Size 4. These sweeps have 300 fathom (1,800 ft) sweep wires on each side of the MCMV, clearing a path 384 m (420 yd) wide at a speed of advance of 8 kts.
- **Acoustic sweeps.** Sweep A Mk 6. This consists of a 'fish' containing a diaphragm activated by pistons driven by an eccentric cam on an electric motor. It is towed by a wire some 1,100 m (1,200 yd) long.
- **Magnetic sweeps.** Sweep M Mk 5. This consists of two buoyant, conducting cables streamed astern of the minesweeper. One leg is 205 m (675 ft) long, the other 460 m (1,500 ft) long and a magnetic field is set up between the two which activates magnetic mines.

MINEHUNTING SONAR

AN/UQS-1

All ships were originally equipped with AN/UQS-1, hull-mounted minehunting sonar, which dates from the 1950s. A short pulse electronically scanned sonar, the UQS-1 is not a stabilized system and cannot therefore provide the mine-like image required for classification purposes. Some still retain this set.



Seddülbahir *(M 513)* (C D Yaylali)

WEAPONS SYSTEMS

GUNS

Oerlikon 20mm (US Mk 24)

One twin mount per vessel. The Mk 24 mounting was designed primarily for air defence, and features two Mk 2 or Mk 4 guns which are 165 mm apart. The muzzle arc clearance is 138 cm and the working circle is 141-152 cm. The mounting is similar to the US Mk 10, but has a crew of three.

Specifications

Gun

Calibre: 20 mm

Length of barrel: 70 calibres

Muzzle velocity: 835 m/s (2,738 ft/s)

Range

anti-surface: 0.8 n miles (1.5 km)

anti-air: 1,150 m (3,772 ft)

Rate of fire: 450 rds/min

Round weight: 241 g

Projectile: 122 g

COMMAND AND CONTROL SYSTEMS

RADAR

Racal-Decca

These ships are fitted with a Racal-Decca I-band navigation radar.

PROPULSION

Specifications

System: Diesel

Main machinery:

MSC 268 class: 2 General Motors GM 6-71 diesels; 696 hp (519 kW) sustained

MSC 294 class: 2 Waukesha L 1616 diesels; 1,200 hp (895 kW)

Shafts: 2

FURTHER INFORMATION

Height of funnels and bridge arrangements vary.

INCHON

GENERAL SPECIFICATIONS

Operator: United States of America
Type: Converted Iwo Jima (Mine Countermeasures Command Control and Support Ship (MCS))

Class: INCHON

Converted: 1
Active: 1

Displacement:
standard: 11,250 t
full load: 18,798 t

Dimensions
Length: 183.7 m (602.3 ft)
Beam: 31.7 m (104 ft)
Draught: 9.7 m (31.7 ft)

Speed: 23 kts
Range: 10,000 n miles at 20 kts

Complement: 1,420 (113 officers)

SHIPS

INCHON (MCS 12)

Builder	Ingalls, Pascagoula, Mississippi, USA	**Launched**	3 Feb 1968
		Commissioned (LPH)	16 Nov 1968
Laid down	1 Mar 1966	**Converted (MCS)**	3 Mar 1995-May 1996

MCM SUPPORT FACILITIES

Mission

This unique ship provides three facilities:

- Command and control of an MCM force
- Support facilities for MCMVs
- Operation of Airborne Mine CounterMeasures (AMCM) helicopters.

MCM

- Can support to to eight Avenger or 'Osprey' class MCMVs, with alongside facilities for four at any one time.
- Mine Countermeasures Co-ordination Centre (MC^3)
- Helicopter Direction Centre

Airborne MCM (AMCM)

- Eight MH-53E Sea Dragon AMCM helicopters, whose equipment includes:
  - Mk 105 sleds (six carried)
  - Mk 103 mechanical sweep gear
  - Mk 104 acoustic device
  - SPU-1W Magnetic Orange Pipe (MOP)
  - Mk 2G rattle bars
  - AN/ALQ-41 acoustic device

  (See following entry for details)
- Three MH-53E employed in surveillance, reconnaissance and search-and-rescue (SAR), whose equipment includes:
  - AN/AQS-14 minehunting sonar

Explosive Ordnance Disposal (EOD)

- Inchon carries a maximum of four Explosive Ordnance Disposal (EOD) teams (approximately 70 personnel total)
- Two recompression chambers (one air-portable, one road transportable).

Inchon *(MCS 12) after conversion* (Ingalls Ship Building)

AVIATION

AVIATION FACILITIES

Specifications

Flight deck: 183.7 × 31.7 m (602.3 × 104 ft)
Hangar: 73 m (240 ft) long
Hangar: Accommodates 2 helicopters undergoing maintenance
EOD facilities and storage: 6 Mk 105 MCM sleds
Aircraft: 11 MH-53E Sea Stallions (8 MCM; 3 spotter/SAR)
Elevators: 2 deck-edge elevators: 1 port side opposite island; 1 starboard aft of island.

Capacity: 25 t each
Max activity level: Simultaneous take-off/landing of 4 MH-53E Sea Stallions
Aviation fuel: 152,930 litres (404,000 gal) JP-5 (sufficient for 7 to 10 days intensive MCM operations)

GENERAL FACILITIES

- Two cargo elevators operating between holds and flight deck; capacity: 7 t each.
- 517 m^2 (5,565 sq ft) MCM stores space (previously vehicle deck)
- Boats include:
  - Two LCVPs on davits retained from previous role as LPH.
  - Rigid Hull Inflatable Boats (RHIB) on sponsons.
- New, telescopic crane abaft island.
- Provision of mains electrical power for MCMVs alongside.
- Can replenish MCMVs at sea using over-the-stern method.

WEAPONS SYSTEMS

Hughes Mk 15 CIWS Phalanx

There are two Mk 15 CIWS: one is on a sponson on the starboard side forward, the other on another sponson on the port quarter. This CIWS was developed to provide fast reaction to submarine-launched anti-ship missiles and operates on a 'closed loop' system, tracking both the target and the stream of rounds, whilst seeking constantly to reduce the difference between the two. The gun is a six-barrelled 20 mm M61A1 Vulcan with extremely high firing rates.

Specifications

Gun
Calibre: 20 mm
Length of barrel: 53 calibres
Muzzle velocity: 1,030 m/s (3,379 ft/s)

Rate of fire (Block 0): 3,000 rds/min
Range (effective, horizontal): 0.75 n miles (1.47 km)

Mounting
Weight (Block 0): 5.42 t
Traverse: 310° at 126°/s
Elevation: −25 to +85° at 92°/s

25 mm Mk 38 Mod 0 automatic cannon (Sea Snake)

Four single Mk 88 mountings for Mk 38 Mod 0 25 mm cannon (Sea Snake). The Mk 88 mounting is replacing 20 mm mountings in many US Navy warships and is designed to engage surface and shore targets in low- and mid-intensity operational environments at ranges up to 1.33 n miles (2.47 km). The Mk 38/M-242 is a single barrel, externally powered weapon which incorporates a rotating bolt mechanism driven by a chain drive. The Mk 38 can fire single shots or 175 rds/min and features twin shoulder braces and an optical Aimpoint sight.

Specifications

Calibre: 25 mm
Length of barrel: 81 calibres
Muzzle velocity: 1,100 m/s (3,608 ft/s)
Traverse: 300°
Elevation: −20 to +55°
Crew: 1 (often supported by a spotter)
Range: 1.33 n miles (2.47 km)
Rate of fire: 175 rds/min (max)
Ammunition: 184 g HEI-T

M2HB 12.7 mm machine guns

Up to eight M2HB are carried. This is a selective short recoil automatic operation weapon with a 1,143 mm barrel.

Specifications

Gun weight: 38.1 kg (84 lb)
Muzzle velocity: 893 m/s (2,930 ft/s)
Cyclic rate of fire: 550 rds/min
Practical rate of fire: 70 rds/min
Effective range: 0.98 n miles (1.83 km)

ELECTRONIC WARFARE SYSTEMS

DECOYS

Mk 36 Mod 12 Loral Hycor SRBOC Mk 36 Chaff Launcher

There are four Mk 36 SRBOC Mod 12 launchers firing IR flares and chaff to 2.2 n miles (4 km). The Mk 36 SRBOC (Super Rapid Bloom Offboard Countermeasures) system consists of launcher, launcher control, power supplies, ready service lockers and munitions. The Mk 137 launcher has six 130 mm fixed tubes arranged in parallel rows at angles of 45 and 60°. The firing circuits use electromagnetic induction to initiate the propelling charges in the cartridges. The prime cartridge is the Mk 182 Torch with chaff payload.

Specifications

Launcher dimensions: 160 × 43 × 86 cm (63 × 17 × 34 in)
Launcher weight: 173 kg (381 lb)
Cartridge weight: 22.7 kg (50 lb)

AN/SLQ-25A Nixie noisemaker

AN/SLQ-25A Nixie is a solid-state, modular design electroacoustic countermeasures decoy system used to protect various classes of ships from acoustic homing torpedoes. It consists of a remote-control unit which can activate, deactivate and monitor (through an oscilloscope) the system, a countermeasures transmitter which generates and amplifies the signals, a power-operated double-drum winch for streaming and recovering the towed bodies (which are stored on racks attached to the winch), a coaxial switching unit which selects the appropriate cable or load, and towed bodies. The towed bodies convert the electrical signals to acoustic signals and project them while other elements of the system include three electronic dummies for testing the amplifier without streaming a towed body and either a deck edge tow chock or two CSL27 fleet angle compensators. Total weight of the system with the RL-272 winch is 2.75 tonnes.

ELECTRONIC SUPPORT/ELECTRONIC COUNTERMEASURES (ESM/ECM)

AN/SLQ-32(V)3 intercept and jammer

The AN/SLQ-32(V)3 is a combined ESM and ECM system, giving radar warning on B- to J-bands to give jamming and deception on H- to J-bands. The jammer has a maximum radiated power of 1 MW and is capable of forming 64 beams on either side of the ship, with jamming modes including Range Gate Pull Off (RGPO) and Azimuth Gate Pull Off (AGPO).

Manufacturer/Contractor

Raytheon, Electromagnetic System Division, Goleta, California, USA.

COMMAND AND CONTROL SYSTEMS

COMBAT DATA SYSTEMS

Command Systems

Command systems fitted or upgraded during the modification refit, include:

- Navy Tactical Command System — Afloat (NTCS-A)
- Joint Maritime Command Information System (JMCIS), including NAVMACS II processor.
- Link 11
- Navigation Sensor System Interface (NSSI)

COMMUNICATIONS AND DATALINKS

SRR-1 (satellite SHF)
WSC-3 (satellite UHF)
MF/HF transmit/receive
VHF ship-to-ship
UHF ship-to-ship

RADARS

	AN/SPS-40E	AN/SPS-67(V)1	AN/SPS-64(V)9
Manufacturer	Lockheed	Westinghouse	Raytheon
Role	Air/surface search	Surface search	Navigation
Frequency	UHF (400-450 MHz in 10 channels)	G (5.4-5.8 GHz)	I
Beam	10 × 19°	1.5 × 31°	1.9 × 22°
Peak power	125-225 kW	280 kW	20 kW
Gain	21 dB		28 dB
Pulsewidth	3 µs	0.1; 0.25; 1.0 µs	0.06/0.5/1.0 µs
PRF	300 pps		3,600/1,800/900 pps
Scan rate	7.5/15 rpm		33 rpm
Range	175 n miles (320 km)		

Carrier Controlled Approach (CCA) — AN/SPN-35A

AN/SPN-35A is a carrier approach radar set providing precise range, altitude and heading information to guide both fixed-wing aircraft and helicopters along the final approach to the carrier deck. Aircraft are accepted from the surveillance radar systems and then controlled by the SPN-35 to a final transition point from which the recovery is made. SPN-35 is mounted on a gyrostabilised platform that keeps the radar level and accurately aligned to the horizon at all times.

Carrier Controlled Approach (CCA) — AN/SPN-43B

AN/SPN-43B is used to marshal aircraft prior to their negotiating final landings and is mounted on top of a stabilised platform that automatically compensates for the pitch and roll of the ship. SPN-43 detects aircraft at distances up to 50 n miles (93 km) and provides tracking data allowing the radar operator to control and transition the aircraft into the final approach area for carrier recovery. Operational frequency is 3.5 to 3.7 GHz, with a peak power output of 850 kW.

Manufacturer/Contractor

ITT Gilfillan, Van Nuys, California, USA.

TACAN

URN 25

IFF

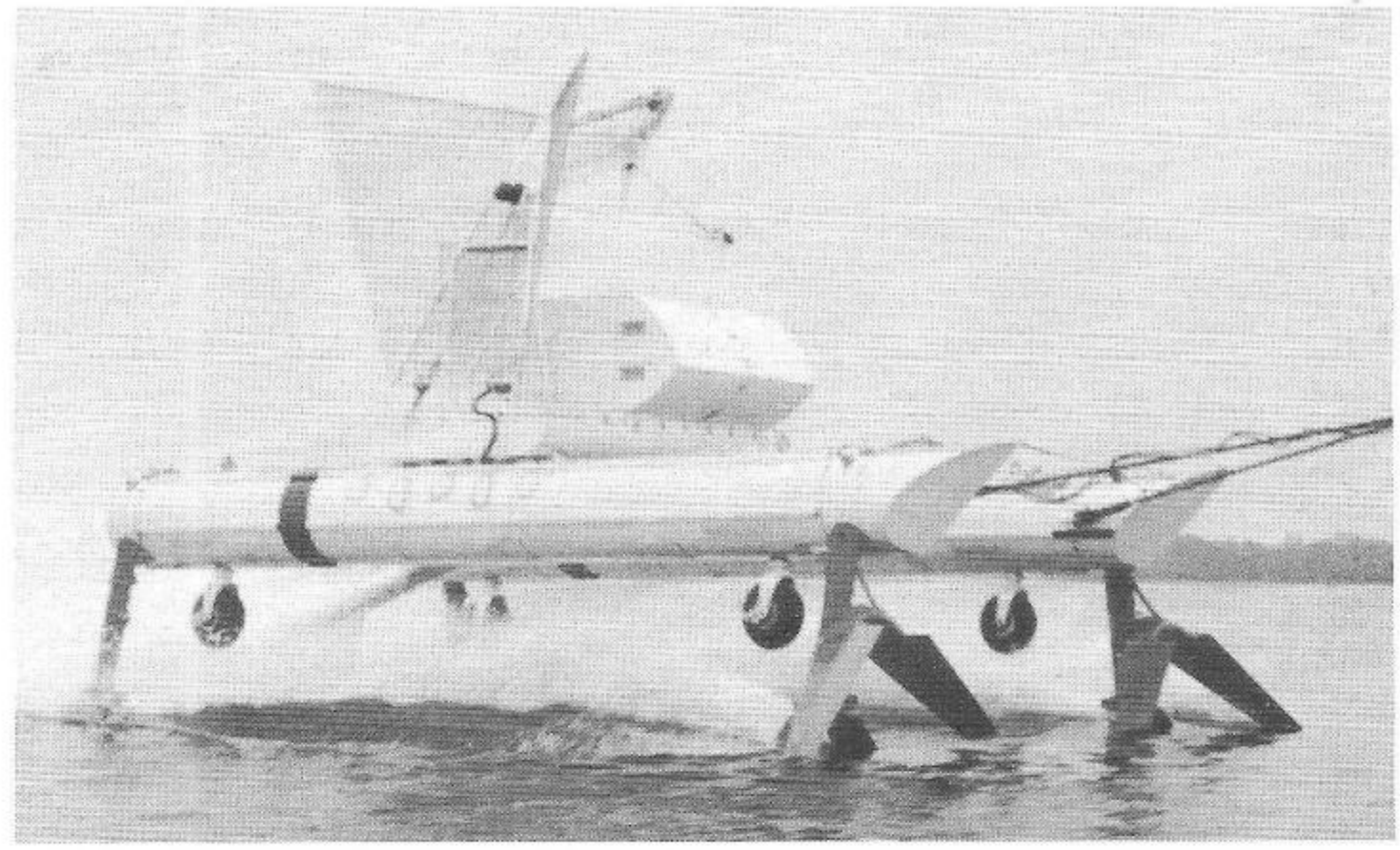
Mk XII AIMS
AN/UPX-29

PROPULSION

Specifications

System: Steam
Main machinery: 2 Babcock & Wilcox/Combustion Engineering boilers, 42.3 kg/cm² (600 psi); 482°C; De Laval/General Electric/Westinghouse turbine; 17.2 MW (23,000 hp)
Shafts: 1

SIKORSKY MH-53E SEA DRAGON



Mk 105 minesweeping sled foilborne

Background

The Sikorsky MH-53E Sea Dragon is a three-engined heavy-lift Airborne Mine CounterMeasures (AMCM) helicopter able to tow a variety of mechanical, acoustic and magnetic MCM devices. In essence, it combines the AMCM gear of the earlier twin-engined RH-53D, with the much greater power, improved airframe and increased fuel capacity of the CH-53E.

The CH-53 attracted early interest as an AMCM platform and 15 of the original service model, CH-53A, were transferred from the US Marine Corps to the US Navy as RH-53As, and given T64-GE-413 engines. Even so, these were found to have insufficient power and were later returned to the Marines Corps. The navy then developed the RH-53D, which had T64-GE-415 engines, and was used in the MCM role for many years including the clearance of Haiphong harbour and the Suez Canal, although, ironically, the type's most famous moment came in its use from USS *Nimitz* for the abortive Delta Force rescue raid on Tehran (Operation Eagle Claw).

An MCM version of the -E model, designated MH-53E Sea Dragon, entered service in 1986 and by 1996, 48 out of a planned 50 had entered service. The minehunting equipment is little changed from that of the RH-53D, but additional huge sponsons house fuel tanks which greatly extended the aircraft's operational capabilities. The MH-53E is also equipped with improved hydraulic and electrical systems, together with minefield, navigation and automatic flight control systems, towing is automatic, as is the approach and departure from hover modes.

In 1993-94 one MH-53E was fitted with T64-GE-419 engines, which resulted in yet further performance gains, especially in recovery and flyaway capability in the event of engine failure in the hover. It is planned to retrofit the entire MH-53E fleet, the first eight engine kits having been due for delivery in October 1996.

The Japanese Maritime Self-Defense Force (JMSDF) purchased eleven aircraft, which are designated S-80M-1 by Sikorsky. They are virtually identical to the US Navy's MH-53E, but do not have a refuelling probe. The first was delivered in November 1989 and the eleventh in May 1994.

Specifications

MH-53E
Main rotor diameter: 24.08 m (79.0 ft)
Tail rotor diameter: 6.10 m (20.0 ft)
Dimensions:
Length overall (rotors turning): 30.19 m (99.05 ft)
Fuselage: 22.35 m (73.33 ft)
Height (top of main rotor head): 5.32 m (17.45 ft)
Weights:
empty: 16,482 kg (36,336 lb)
useful load, influence sweep mission: 11,793 kg (26,000 lb)
max take-off internal payload: 31,640 kg (69,750 lb)
max take-off external payload: 33,340 kg (73,500 lb)
Performance:
max level speed (sea level): 170 kts (315 km/h)
cruising speed (sea level): 50 kts (278 km/h)
max rate of climb (sea level): 762 m (2,500 ft)/min
service ceiling (max continuous power): 5,640 m (18,500 ft)
hovering ceiling in ground effect: 3,520 m (11,550 ft)
hovering ceiling out of ground effect: 2,895 m (9,500 ft)
Power plant: 3 General Electric T64-GE-416 turboshafts; max continuous rating 2,756 kW (3,696 shp). (Retrofit planned with T64-GE-419s, rated at 3,542 kW (4,750 shp)
Fuel: Total internal capacity to 12,113 litres (3,200 US gallons), plus seven internal range extension tanks, total capacity 7,949 litres (2,100 US gallons)
Accommodation: 3 flight deck crew; 5 cabin crew

MCM CAPABILITIES

Specific AMCM features of the MH-53E include:

- 13,610 kg (30,000 lb) tension tow boom.
- Hydraulic winch with 137 m (450 ft) steel towing cable.
- A cabin crew of five persons to deploy and retrieve the MCM equipment and to monitor its function. They also operate the two 0.5 in machine guns which are used to explode buoyant mines brought to the surface by the mechanical sweeps.
- Large sponsons which increase the fuel capacity from 3,850 to 12,113 litres (1,017 to 3,200 US gallons).
- Two external rear-view mirrors to enable the pilot and copilot to observe the sweeps.

AMCM EQUIPMENT

AMCM equipment operated by the MH-53E includes:
Mk 105 sled
Mk 103 mechanical sweep gear
Mk 104 acoustic device
SPU-1W Magnetic Orange Pipe (MOP)
Mk 2G rattle bars
AN/AQS-14 minehunting sonar
AN/ALQ-141 acoustic device

Mk 105 Airborne Minesweeping System

The Mk 105 Airborne Minesweeping System consists of a towing helicopter, a hydrofoil sled, sweeping cable arrays and a gas-turbine generator set which provides onboard electrical power for magnetic sweeping. The sled consists of two lightweight tubular floats mounted on cavitating hydrofoils and connected by an aerofoil-shaped cross-beam. The surface-piercing, tandem hydrofoil configuration features two inverted V-shaped foils forward, with another two aft for balance. High-riding, pitch-control, subfoils of similar configuration are located ahead of the two bow foils. For landing and ground manoeuvres the foils are rotated upwards and parallel to the floats by a self-contained hydraulic system and four small, fixed, castored wheels then facilitate ground or deck handling. There is also a retrieval system mounted on the platform for helicopter recovery operations. The two floats also contain fuel for the turbine, and there are two tow cable attachment points on the forward inward faces of each float. Once launched, the sled is towed by the helicopter's 137 m (450 ft) tow cable, which also carries electronic control signals.

The gas-turbine-driven generator set is mounted on a cross-beam, together with a rectifier, a controller containing the waterborne electronics, and batteries to power the electronic system. The sweep cables are attached to the aft end of the sweep boom, which is located on the centreline of the sled, aft of and below the cross-beam assembly. The sweep boom comprises an upper electrode attached to the end of a trailing cable and a lower electrode fitted to the boom fin. Using the water as a conductor, the potential between the electrodes produces a magnetic field that simulates the magnetic signature of a ship.

The only person involved in the system is the sweep controller in the helicopter, who operates the 'control programmer', which houses the airborne electronics, controls and instrumentation necessary to operate the Mk 105. The control programmer console includes the fuel transfer control panel, turbine indicators, hydrofoil and boom actuators and the generator controls and indicators. The operator can start and stop the turbine, raise and lower the foils and control the magnetic influences generated through the sweep cables trailing behind the sled.

Specifications

Mk 105
Length overall: 8.38 m (27.5 ft)
Beam
catamaran structure only: 3.53 m (11.58 ft)
across foils: 6.4 m (21 ft)
Height (foils extended)
to top of retrieval rig: 5.26 m (17.25 ft)
to top of nacelle: 4.11 m (13.5 ft)
Height (foils retracted): 3.5 m (11.5 ft)
Weights
empty: 2,504 kg (5,520 lb)
gross: 2,917 kg (6,432 lb)

Manufacturer/Contractor

EDO Corporation, Government Systems Division, College Point, New York, USA.

AN/AQS-14 helicopter-towed sonar

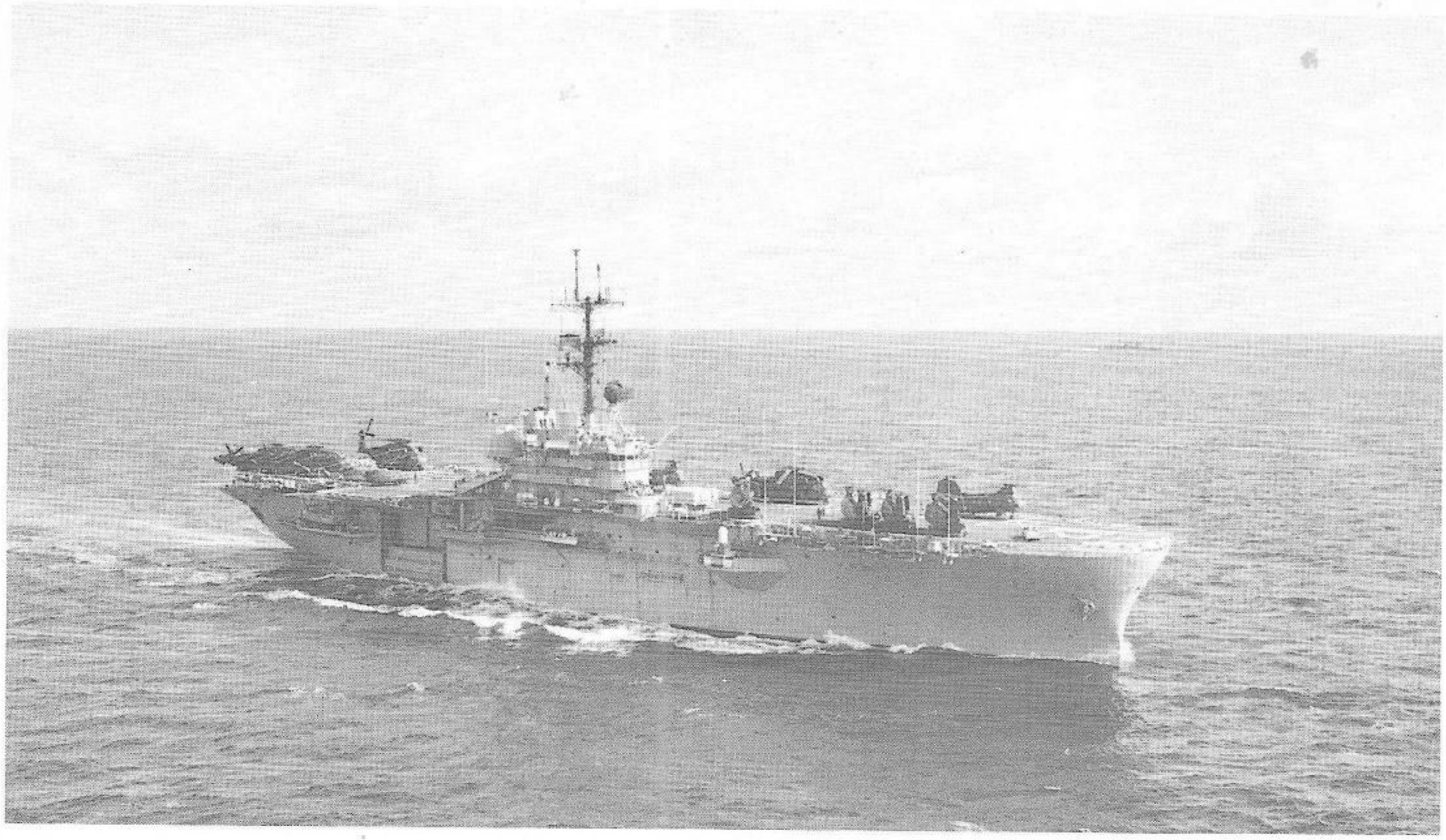
AN/AQS-14 is the helicopter-towed, sideways-looking, multibeam sonar used by the US Navy's MH-53E Sea Dragon helicopters. The 3 m (9.84 ft) long, underwater vehicle is towed on an armoured, non-magnetic cable, and has an active control system enabling the operator in the helicopter to select either fixed height above the seabed or a fixed depth beneath the water surface. Controls in the helicopter include a TV-type moving window sonar display, underwater vehicle controls and status displays, system status indicators and a magnetic tape recorder for sonar data recording. The system functions include all that is needed to locate, classify, mark, permanently record and review records of mines, mine-like objects and underwater features in the search area. Because the sonar employs electronic multiple beam-forming, all-range focusing and an adaptive processor, a rapid search speed is possible. At lower tow speeds the towed sonar automatically reduces the number of transmitted beams.

Manufacturer/Contractor

Westinghouse Electric Corporation, Annapolis, Maryland, USA.

SPU-1/W

SPU-1/W, also known as 'Magnetised Orange Pipe' (MOP), is a helicopter-towed device with two functions: the first is to explode sensitive magnetic mines in deeper waters and the second to operate against all types of magnetic mines in waters too shallow for the sled to be used. The MOP is a magnetised steel tube some 9.14 m (30 ft) long and 25.4 cm (10 in) in diameter, which is filled with styrofoam to make it buoyant. Up to three can be towed behind an MH-53E.



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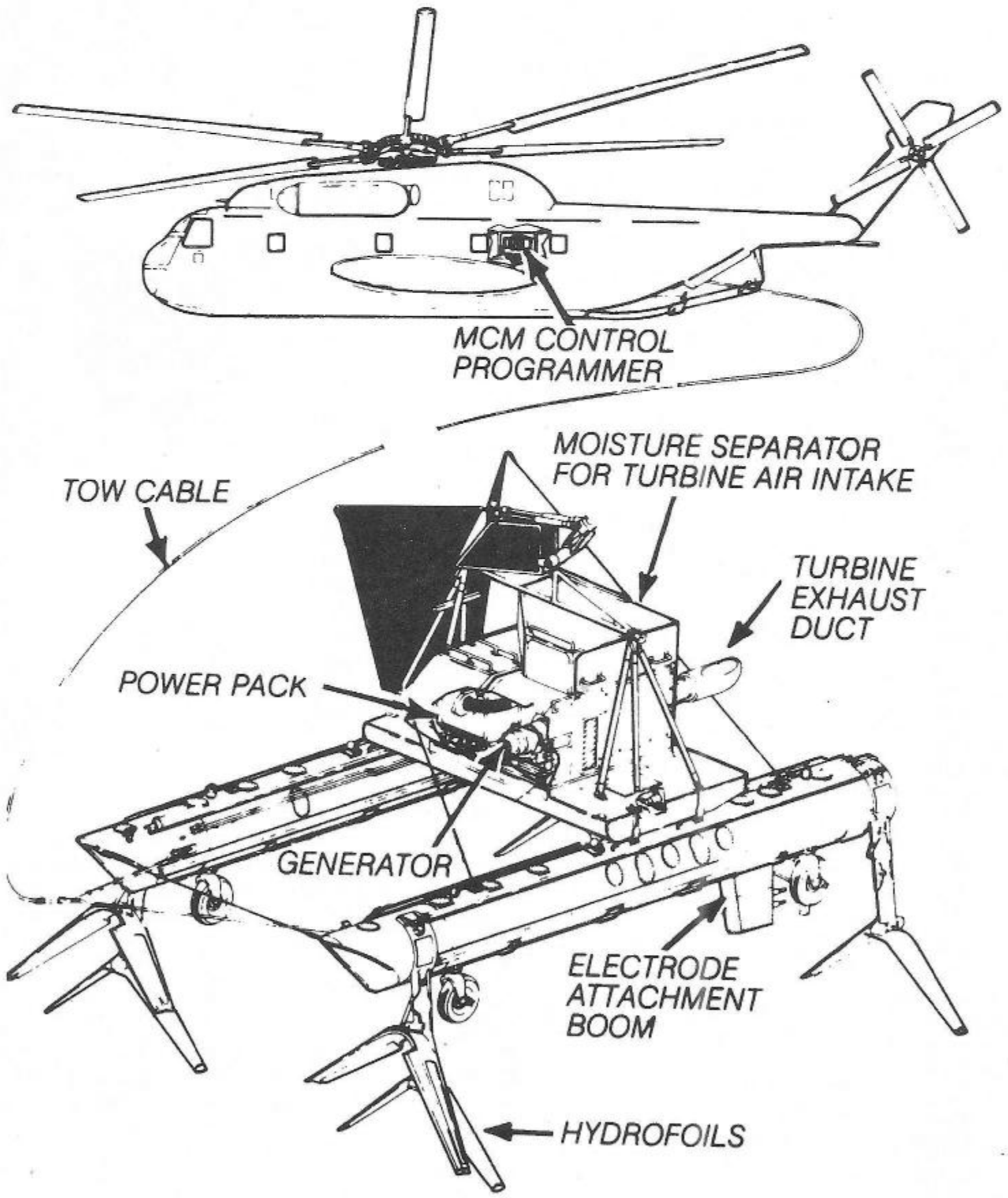

Schematic of Mk 105 system

AMCM System Mk 103 (mechanical sweep gear)

The Mk 103 system is similar to the mechanical gears used by MCM ships to sweep buoyant mines and consists of sweep wires with spaced explosive cutters, floats with pendants, a depressor and otters. Total weight is approximately 544 kg (1,200 lb). The usual method of deploying the Mk 103 is to position the helicopter at the extreme after end of the flight deck, stream the gear and then lift off, which must be one of the more challenging manoeuvres undertaken by helicopter pilots.

Manufacturer/Contractor
Boeing-Vertol.

AMCM System Mk 104 (acoustic sweep gear)

Mk 104 is an acoustic influence sweep, consisting of a towing cable and a venturi tube 124 cm (49 in) long, 66 cm (26 in) wide and 89 cm (35 in) deep, containing a rotating disc powered by a water-activated turbine, which reproduces a ship's acoustic signature. The sweep operates at a minimum depth of 9.1 m (30 ft) and is operated by the forward motion imparted by the helicopter.

Mk 2G rattle bars

This was developed from the Rotating Acoustic Pipe, which was produced very rapidly for use in the clearance of Haiphong harbour. This consisted of a similar 25 cm (10 in) pipe to that used for MOP, but only 1.2 m (4 ft) long, and containing several short lengths of iron bar. When towed by the helicopter, asymmetric vanes welded to the side of the pipe cause it to rotate haphazardly, causing the iron bars to rattle. This extremely low-tech device is claimed to be effective against both seismic and magnetically fuzed mines.

Rheinmetall Rh-202 20 mm cannon (NBFAP)

Contractors List

Where a discrepancy exists between data on the text pages and in this listing, the listing should be accepted as the most up to date and correct version as it is composed after the text has been completed, and there are often last-minute changes which cannot be included in the text.

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Country Abbreviations

Alb	Albania
Alg	Algeria
Ana	Anguilla
Ang	Angola
Ant	Antigua and Barbuda
Arg	Argentina
Aus	Austria
Aust	Australia
Az	Azerbaijan
Ban	Bangladesh
Bar	Barbados
Bdi	Burundi
Bel	Belgium
Ben	Benin
Bhm	Bahamas
Bhr	Bahrain
Blz	Belize
Bmd	Bermuda
Bol	Bolivia
Bru	Brunei
Brz	Brazil
Bul	Bulgaria
Bur	Burma
Cam	Cameroon
Can	Canada
Chi	Chile
CI	Cook Islands
Cmb	Cambodia
Col	Colombia
Com	Comoro Islands
Con	Congo
CpV	Cape Verde
CR	Costa Rica
Cro	Croatia
Cub	Cuba
Cypr	Cyprus (Republic)
Den	Denmark
Dji	Djibouti
Dom	Dominica
DPRK	Korea, Democratic People's Republic (North)
DR	Dominican Republic
Ecu	Ecuador
Egy	Egypt
ElS	El Salvador
EqG	Equatorial Guinea
Est	Estonia
Eth	Ethiopia and Eritrea
Fae	Faeroes
Fij	Fiji
FI	Falkland Islands
Fin	Finland
Fra	France
Gab	Gabon
Gam	The Gambia
GB	Guinea-Bissau
Ger	Germany
Geo	Georgia
Gha	Ghana
Gn	Guinea
Gra	Grenada
Gre	Greece
Gua	Guatemala
Guy	Guyana
Hai	Haiti
HK	Hong Kong
Hon	Honduras
Hun	Hungary
IC	Ivory Coast
Ice	Iceland
Ind	India
Indo	Indonesia
Iran	Iran
Iraq	Iraq
Ire	Irish Republic
Isr	Israel
Ita	Italy
Jam	Jamaica
Jor	Jordan
Jpn	Japan
Kaz	Kazakhstan
Ken	Kenya
Kir	Kiribati
Kwt	Kuwait
Lat	Latvia
Lbr	Liberia
Lby	Libya
Leb	Lebanon
Lit	Lithuania
Mad	Madagascar
Mex	Mexico
MI	Marshall Islands
Mic	Micronesia
Mld	Maldive Islands
Mlt	Malta
Mlw	Malawi
Mly	Malaysia
Mns	Montserrat
Mor	Morocco
Moz	Mozambique
Mrt	Mauritius
Mtn	Mauritania
Nam	Namibia
NATO	NATO
Nic	Nicaragua
Nig	Nigeria
Nld	Netherlands
Nor	Norway
NZ	New Zealand
Omn	Oman
Pak	Pakistan
Pan	Panama
Par	Paraguay
Per	Peru
Plp	Philippines
PNG	Papua New Guinea
Pal	Palau
Pol	Poland
Por	Portugal
PRC	People's Republic of China
Qat	Qatar
RoC	Taiwan
RoK	Korea, Republic (South)
Rom	Romania
Rus	Russia and Associated States
SA	South Africa
Sab	Sabah
SAr	Saudi Arabia
Sen	Senegal
Sey	Seychelles
Sin	Singapore
SL	Sierra Leone
Sol	Solomon Islands
Spn	Spain
Sri	Sri Lanka
StK	St Kitts
StL	St Lucia
StV	St Vincent and the Grenadines
Sud	Sudan
Sur	Surinam
Swe	Sweden
Swi	Switzerland
Syr	Syria
Tan	Tanzania
TC	Turks and Caicos
Tld	Thailand
Tog	Togo
Ton	Tonga
TT	Trinidad and Tobago
Tun	Tunisia
Tur	Turkey
Tuv	Tuvalu
UAE	United Arab Emirates
Uga	Uganda
UK	United Kingdom
Ukr	Ukraine
Uru	Uruguay
USA	United States of America
Van	Vanuatu
Ven	Venezuela
VI	Virgin Islands
Vtn	Vietnam
WS	Western Samoa
Yem	Yemen
Yug	Yugoslavia
Zai	Zaire

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FFG 47 *Nicholas* (USA) 1236
FFG 48 *Vandegrift* (USA) 1236
FFG 49 *Robert G Bradley* (USA) 1236
FFG 50 *Taylor* (USA) 1236
FFG 51 *Gary* (USA) 1236
FFG 52 *Carr* (USA) 1236
FFG 53 *Hawes* (USA) 1236
FFG 54 *Ford* (USA) 1236
FFG 55 *Elrod* (USA) 1237
FFG 56 *Simpson* (USA) 1237
FFG 57 *Reuben James* (USA) 1237
FFG 58 *Samuel B Roberts* (USA) 1237
FFG 59 *Kauffman* (USA) 1237
FFG 60 *Rodney M Davis* (USA) 1237
FFG 61 *Ingraham* (USA) 1237
FM 01 *Presidente Eloy Alfaro* (Ecu) 1124
FM 02 *Moran Valverde* (Ecu) 1124
FM 51 *Meliton Carvajal* (Per) 956
FM 52 *Manuel Villavicencio* (Per) 956
FM 53 *Montero* (Per) 956
FM 54 *Mariategui* (Per) 956
G 26 *Duque de Caxias* (Brz) 1652
G 28 *Mattoso Maia* (Brz) 1658
G 30 *Ceará* (Brz) 1664
G 31 *Rio de Janeiro* (Brz) 1664
HQ 501 *Qui Nonh* (Vtn) 1639
HQ 503 *Vung Tau* (Vtn) 1639
HQ 505 *Da Nang* (Vtn) 1639
K 11 *Stockholm* (Swe) 1349
K 12 *Malmö* (Swe) 1349
K 21 *Göteborg* (Swe) 1352
K 22 *Gälve* (Swe) 1352
K 23 *Kalmar* (Swe) 1352
K 24 *Sundsvall* (Swe) 1352
K 40 *Veer* (Ind) 1332
K 41 *Nibhik* (Ind) 1332
K 42 *Nipat* (Ind) 1332
K 43 *Nishank* (Ind) 1332
K 44 *Nirghat* (Ind) 1332
K 45 *Vibhuti* (Ind) 1332
K 46 *Vipul* (Ind) 1332
K 47 *Vinash* (Ind) 1332
K 48 *Vidyut* (Ind) 1332
K 83 *Nashak* (Ind) 1332
K 71 *Vijay Durg* (Ind) 1314
K 72 *Sindhu Durg* (Ind) 1314
K 73 *Hos Durg* (Ind) 1314
L 2 *Nasr al Bahr* (Omn) 1598
L 05 *President el Hadj Omar Bongo* (Gab) 1521
L 10 *Fearless* (UK) 1592
L 11 *Intrepid* (UK) 1592
L 12 *Ocean* (UK) 1600
L 14 *Ghorpad* (Ind) 1562
L 15 *Kesari* (Ind) 1562
L 16 *Shardul* (Ind) 1562
L 17 *Sharabh* (Ind) 1562
L 18 *Cheetah* (Ind) 1564
L 19 *Mahish* (Ind) 1564
L 20 *Magar* (Ind) 1528
L 21 *Guldar* (Ind) 1564
L 22 *Kumbhir* (Ind) 1564
L 23 *Gharial* (Ind) 1528
L 31 - (Ind) 1530
L 32 - (Ind) 1530
L 33 - (Ind) 1530
L 34 *Vasco da Gama* (Ind) 1530
L 35 - (Ind) 1530
L 36 - (Ind) 1530
L 37 - (Ind) 1530
L 38 *Midhur* (Ind) 1530
L 39 *Mangala* (Ind) 1530
L 40 - (Ind) 1530
L 41 *Hernan Cortes* (Spn) 1662
L 42 *Pizarro* (Spn) 1662
L 50 *Tobruk* (UK) 1615
L 51 *Rotterdam* (Nld) 1551
L 51 *Kanimbla* (Aust) 1656
L 52 *Manoora* (Aust) 1656
L 104 *Inouse* (Gre) 1646
L 116 *Kos* (Gre) 1646
L 126 *Balikpapan* (Aust) 1495
L 127 *Brunei* (Aust) 1495
L 128 *Labuan* (Aust) 1495
L 129 *Tarakan* (Aust) 1495
L 130 *Wewak* (Aust) 1495
L 133 *Betano* (Aust) 1495
L 144 *Siros* (Gre) 1622
L 154 *Ikaria* (Gre) 1622
L 157 *Rodos* (Gre) 1622
L 164 *Ipopliarhos Roussen* (Gre) 1641
L 165 *Ipopliarhos Krystalidis* (Gre) 1641
L 171 *Kriti* (Gre) 1622
L 173 *Chios* (Gre) 1526
L 174 *Samos* (Gre) 1526
L 175 *Ikaria* (Gre) 1526
L 176 *Lesbos* (Gre) 1526
L 177 *Rodos* (Gre) 1526
L 202 *Excellence* (Sin) 1632
L 203 *Intrepid* (Sin) 1632
L 206 *Perseverance* (Sin) 1609
L 401 *Ertugrul* (Tur) 1649
L 402 *Serdar* (Tur) 1649
L 800 *Juan de Austria* (Spn) 1551
L 3004 *Sir Bedivere* (UK) 1613
L 3005 *Sir Galahad* (UK) 1617
L 3027 *Sir Geraint* (UK) 1611
L 3036 *Sir Percival* (UK) 1611
L 3505 *Sir Tristram* (UK) 1611
L 4502 *Reinøysund* (Nor) 1554
L 4503 *Sørøysund* (Nor) 1554
L 4504 *Maursund* (Nor) 1554
L 4505 *Rotsund* (Nor) 1554
L 4506 *Tjeldsund* (Nor) 1554
L 9011 *Foudre* (Fra) 1504
L 9012 *Siroco* (Fra) 1504
L 9021 *Ouragan* (Fra) 1507
L 9022 *Orage* (Fra) 1507
L 9030 *Champlain* (Fra) 1521
L 9031 *Francis Garnier* (Fra) 1521
L 9032 *Dumont d'Urville* (Fra) 1521
L 9033 *Jacques Cartier* (Fra) 1521
L 9034 *La Grandière* (Fra) 1521
L 9052 - (Fra) 1514
L 9061 - (Fra) 1516
L 9062 - (Fra) 1516
L 9074 - (Fra) 1512
L 9077 *Bougainville* (Fra) 1509
L 9096 - (Fra) 1512
L 9892 *San Giorgio* (Ita) 1533
L 9893 *San Marco* (Ita) 1533
L 9894 *San Giusto* (Ita) 1533
LC 550 *Bacolod City* (Plp) 1699
LC 551 *Dagupan City* (Plp) 1699
LCC 1 *Kao Hsiung* (RoC) 1636
LCC 19 *Blue Ridge* (USA) 1692
LCC 20 *Mount Whitney* (USA) 1692
LDG 201 *Bombarda* (Port) 1512
LDG 202 *Alabarda* (Port) 1512
LDG 203 *Bacamarte* (Port) 1512
LHA 1 *Tarawa* (USA) 1679
LHA 2 *Saipan* (USA) 1679
LHA 3 *Belleau Wood* (USA) 1679
LHA 4 *Nassau* (USA) 1679
LHA 5 *Peleliu* (USA) 1679
LHD 1 *Wasp* (USA) 1683
LHD 2 *Essex* (USA) 1683
LHD 3 *Kearsarge* (USA) 1683
LHD 4 *Boxer* (USA) 1683
LHD 5 *Bataan* (USA) 1683
LHD 6 *Bonhomme Richard* (USA) 1683
LHD 7 - (USA) 1683
LM 21 *Quito* (Ecu) 1418
LM 22 *Guayaquil* (Ecu) 1418
LM 23 *Cuenca* (Ecu) 1418
LPD 4 *Austin* (USA) 1669
LPD 5 *Ogden* (USA) 1669
LPD 6 *Duluth* (USA) 1669
LPD 7 *Cleveland* (USA) 1669
LPD 8 *Dubuque* (USA) 1669
LPD 9 *Denver* (USA) 1669
LPD 10 *Juneau* (USA) 1669
LPD 12 *Shreveport* (USA) 1669
LPD 13 *Nashville* (USA) 1669
LPD 14 *Trenton* (USA) 1669
LPD 15 *Ponce* (USA) 1669
LPH 9 *Guam* (USA) 1676
LPH 11 *New Orleans* (USA) 1676
LSD 36 *Anchorage* (USA) 1666
LSD 37 *Portland* (USA) 1666
LSD 38 *Pensacola* (USA) 1666
LSD 39 *Mount Vernon* (USA) 1666
LSD 40 *Port Fisher* (USA) 1666
LSD 41 *Whidbey Island* (USA) 1672
LSD 42 *Germantown* (USA) 1672
LSD 43 *Fort McHenry* (USA) 1672
LSD 44 *Gunston Hall* (USA) 1672
LSD 45 *Comstock* (USA) 1672
LSD 46 *Tortuga* (USA) 1672
LSD 47 *Rushmore* (USA) 1672
LSD 48 *Ashland* (USA) 1672
LSD 49 *Harper's Ferry* (USA) 1672
LSD 50 *Carter Hall* (USA) 1672
LSD 51 *Oak Hill* (USA) 1673
LSD 52 *Pearl Harbor* (USA) 1673
LSM 655 *Ko Mun* (RoK) 1642
LSM 656 *Pi An* (RoK) 1642
LSM 657 *Wol Mi* (RoK) 1642
LSM 658 *Ki Rin* (RoK) 1642
LSM 659 *Nung Ra* (RoK) 1642
LSM 661 *Sin Mi* (RoK) 1642
LSM 662 *Ul Rung* (RoK) 1642
LST 671 *Un Bong* (RoK) 1626
LST 673 *Bi Bong* (RoK) 1626
LST 675 *Kae Bong* (RoK) 1626
LST 676 *Wee Bong* (RoK) 1626
LST 677 *Su Yong* (RoK) 1626
LST 678 *Buk Han* (RoK) 1626
LST 679 *Hwa San* (RoK) 1626
LST 1184 *Frederick* (USA) 1655
LST 1194 *La Moure County* (USA) 1655
LST 4101 *Atsumi* (Jpn) 1540
LST 4102 *Motobu* (Jpn) 1540
LST 4103 *Nemuro* (Jpn) 1540
LST 4151 *Miura* (Jpn) 1538
LST 4152 *Ojika* (Jpn) 1538
LST 4153 *Satsuma* (Jpn) 1538
LSU 4171 *Yura* (Jpn) 1542
LSU 4172 *Noto* (Jpn) 1542
LSV 1 *General Frank S Besson* (USA) 1699
LSV 2 *CW 3 Harold C Clinger* (USA) 1699
LSV 3 *General Brehon B Somervell* (USA) 1699
LSV 4 *Lieutenant General William B Bunker* (USA) 1699
LSV 5 *Major General Charles P Gross* (USA) 1699
LSV 6 *Specialist 4 James A Loux* (USA) 1699
LT 57 *Sierra Madre* (Plp) 1630
LT 86 *Zamboanga del Sur* (Plp) 1630
LT 87 *South Cotabato* (Plp) 1630
LT 501 *Laguna* (Plp) 1630
LT 504 *Lanao del Norte* (Plp) 1630
LT 507 *Benguet* (Plp) 1630
LT 516 *Kalinga Apayao* (Plp) 1630
M 1 *Neuquen* (Arg) 1841
M 2 *Rio Negro* (Arg) 1841
M 3 *Chubut* (Arg) 1841
M 4 *Tierra del Fuego* (Arg) 1841
M 5 *Chaco* (Arg) 1841
M 6 *Formosa* (Arg) 1841
M 01 *Viesturs* (Lat) 1750
M 03 *Visborg* (Swe) 1728
M 04 *Carlskrona* (Swe) 1729
M 15 *Áratu* (Brz) 1757
M 16 *Anhatomirim* (Brz) 1757
M 17 *Atalaia* (Brz) 1757
M 18 *Aracatuba* (Brz) 1757
M 19 *Abrolhos* (Brz) 1757
M 20 *Albardao* (Brz) 1757
M 29 *Brecon* (UK) 1846
M 30 *Ledbury* (UK) 1846
M 31 *Cattistock* (UK) 1846
M 32 *Cottesmore* (UK) 1846
M 33 *Brocklesby* (UK) 1846
M 34 *Middleton* (UK) 1846
M 35 *Dulverton* (UK) 1846
M 36 *Bicester* (UK) 1846
M 37 *Chiddingfold* (UK) 1846
M 38 *Atherstone* (UK) 1846
M 39 *Hurworth* (UK) 1846
M 40 *Berkeley* (UK) 1846
M 41 *Quorn* (UK) 1846
M 41 *Guadalete* (Spn) 1858
M 42 *Guadalmedina* (Spn) 1858
M 43 *Guadalquivir* (Spn) 1858
M 44 *Guadiana* (Spn) 1858
M 51 - (Spn) 1832
M 60 *Erato* (Gre) 1867
M 61 *Evniki* (Gre) 1867
M 61 *Pondicherry* (Ind) 1828
M 62 *Porbandar* (Ind) 1828
M 63 *Bedi* (Ind) 1828
M 64 *Bhavnagar* (Ind) 1828
M 65 *Alleppey* (Ind) 1828
M 66 *Ratnagiri* (Ind) 1828
M 67 *Karwar* (Ind) 1828
M 68 *Cannanore* (Ind) 1828
M 69 *Cuddalore* (Ind) 1828
M 70 *Kakinada* (Ind) 1828

M 71 *Kozhikoda* (Ind) 1828
M 71 *Landsort* (Swe) 1834
M 72 *Konkan* (Ind) 1828
M 72 *Arholma* (Swe) 1834
M 73 *Koster* (Swe) 1834
M 74 *Kullen* (Swe) 1834
M 75 *Vinga* (Swe) 1834
M 76 *Ven* (Swe) 1834
M 77 *Ulvon* (Swe) 1834
M 91 *Sagar* (Ban) 1812
M 101 *Sandown* (UK) 1850
M 102 *Inverness* (UK) 1850
M 103 *Cromer* (UK) 1850
M 104 *Walney* (UK) 1850
M 105 *Bridport* (UK) 1850
M 105 *Bedok* (Sin) 1838
M 106 *Penzance* (UK) 1850
M 106 *Kallang* (Sin) 1838
M 107 *Pembroke* (UK) 1850
M 107 *Katong* (Sin) 1838
M 108 *Grimsby* (UK) 1850
M 108 *Punggol* (Sin) 1838
M 109 *Bangor* (UK) 1850
M 110 *Ramsey* (UK) 1850
M 111 *Blythe* (UK) 1850
M 112 *Shoreham* (UK) 1850
M 152 *Podgora* (Yug) 1845
M 153 *Blitvenica* (Yug) 1845
M 160 *Mahmood* (Pak) 1870
M 164 *Mujahid* (Pak) 1870
M 166 *Munsif* (Pak) 1780
M 167 *Muhafiz* (Pak) 1780
M 168 *Mahmoud* (Pak) 1780
M 202 *Atalanti* (Gre) 1867
M 206 *Faedra* (Gre) 1867
M 210 *Thalia* (Gre) 1867
M 211 *Alkyon* (Gre) 1866
M 213 *Klio* (Gre) 1866
M 214 *Avra* (Gre) 1866
M 240 *Aedon* (Gre) 1866
M 241 *Kichli* (Gre) 1866
M 242 *Kissa* (Gre) 1866
M 246 *Aigli* (Gre) 1867
M 247 *Dafni* (Gre) 1867
M 248 *Pleias* (Gre) 1867
M 254 *Niovi* (Gre) 1867
M 340 *Oksøy* (Nor) 1801
M 341 *Karmøy* (Nor) 1801
M 342 *Maaløy* (Nor) 1801
M 343 *Hinnøy* (Nor) 1801
M 350 *Alta* (Nor) 1801
M 351 *Otra* (Nor) 1801
M 352 *Rauma* (Nor) 1801
M 353 *Orkla* (Nor) 1801
M 354 *Glomma* (Nor) 1801
M 371 *Ohue* (Nig) 1785
M 372 *Marabai* (Nig) 1785
M 508 *Selcuk* (Tur) 1875
M 509 *Seyhan* (Tur) 1875
M 510 *Samsun* (Tur) 1875
M 511 *Sinop* (Tur) 1875
M 512 *Sumene* (Tur) 1875
M 513 *Seddülbahir* (Tur) 1875
M 514 *Silifke* (Tur) 1875
M 515 *Saros* (Tur) 1875
M 516 *Sigacik* (Tur) 1875
M 517 *Sapanca* (Tur) 1875
M 518 *Sariyer* (Tur) 1875
M 520 *Karamürsel* (Tur) 1747
M 521 *Kerempe* (Tur) 1747
M 522 *Kirmle* (Tur) 1747
M 523 *Kozlu* (Tur) 1747
M 524 *Kusadasi* (Tur) 1747
M 525 *Kemer* (Tur) 1747
M 574 *Grønsund* (Den) 1865
M 641 *Eridan* (Fra) 1774
M 642 *Cassiopée* (Fra) 1774
M 643 *Andromède* (Fra) 1774
M 644 *Pegase* (Fra) 1774
M 645 *Orion* (Fra) 1774
M 646 *Croix du Sud* (Fra) 1774
M 647 *Aigle* (Fra) 1774
M 648 *Lyre* (Fra) 1774
M 649 *Persée* (Fra) 1774
M 650 *Sagittaire* (Fra) 1774
M 712 *Cybele* (Fra) 1745
M 713 *Calliope* (Fra) 1745
M 714 *Clio* (Fra) 1745
M 715 *Circe* (Fra) 1745
M 716 *Ceres* (Fra) 1745
M 823 *Naarden* (Nld) 1843
M 830 *Sittard* (Nld) 1843
M 850 *Alkmaar* (Nld) 1776
M 851 *Delfzyl* (Nld) 1776
M 852 *Dordrecht* (Nld) 1776
M 853 *Haarlem* (Nld) 1776
M 854 *Harlingen* (Nld) 1776
M 855 *Scheveningen* (Nld) 1776
M 856 *Maassluis* (Nld) 1776
M 857 *Makkum* (Nld) 1776
M 858 *Middelburg* (Nld) 1776
M 859 *Hellevoetsluis* (Nld) 1776
M 860 *Schiedam* (Nld) 1776
M 861 *Urk* (Nld) 1776
M 862 *Zieriksee* (Nld) 1776
M 863 *Vlaardingen* (Nld) 1776
M 864 *Willemstad* (Nld) 1776
M 903 *A F Dufour* (Bel) 1856
M 908 *Georges Truffaut* (Bel) 1856
M 915 *Aster* (Bel) 1772
M 916 *Bellis* (Bel) 1772
M 917 *Crocus* (Bel) 1772
M 921 *Lobelia* (Bel) 1772
M 922 *Myosotis* (Bel) 1772
M 923 *Narcis* (Bel) 1772
M 924 *Primula* (Bel) 1772
M 1058 *Fulda* (Ger) 1765
M 1059 *Weilheim* (Ger) 1765
M 1060 *Weiden* (Ger) 1765
M 1061 *Rottweil* (Ger) 1765
M 1062 *Sulzbach-Rosenberg* (Ger) 1765
M 1063 *Bad Bevensen* (Ger) 1765
M 1064 *Gromitz* (Ger) 1765
M 1065 *Dillingen* (Ger) 1765
M 1066 *Frankenthal* (Ger) 1765
M 1067 *Bad Rappenau* (Ger) 1765
M 1068 *Datteln* (Ger) 1765
M 1069 *Homburg* (Ger) 1765
M 1070 *Göttingen* (Ger) 1754
M 1071 *Koblenz* (Ger) 1754
M 1072 *Lindau* (Ger) 1754
M 1073 *Schleswig* (Ger) 1755
M 1074 *Tübingen* (Ger) 1754
M 1076 *Paderborn* (Ger) 1755
M 1078 *Cuxhaven* (Ger) 1754
M 1079 *Düren* (Ger) 1755
M 1080 *Marburg* (Ger) 1754
M 1081 *Konsstanz* (Ger) 1755
M 1082 *Wolfsburg* (Ger) 1755
M 1083 *Ulm* (Ger) 1755
M 1085 *Minden* (Ger) 1755
M 1087 *Volkingen* (Ger) 1755
M 1090 *Pegnitz* (Ger) 1768
M 1091 *Kulmbach* (Ger) 1768
M 1092 *Hameln* (Ger) 1768
M 1093 *Auerbach* (Ger) 1768
M 1094 *Ensdorf* (Ger) 1768
M 1095 *Überherrn* (Ger) 1768
M 1096 *Passau* (Ger) 1768
M 1097 *Laboe* (Ger) 1768
M 1098 *Siegburg* (Ger) 1768
M 1099 *Herten* (Ger) 1768
M 1142 *Umzimkulu* (SA) 1759
M 1210 *Kimberley* (SA) 1842
M 1212 *Umhloti* (SA) 1759
M 1213 *Umgeni* (SA) 1759
M 1214 *Walvisbaai* (SA) 1842
M 1215 *East London* (SA) 1842
M 1498 *Windhoek* (SA) 1842
M 1499 *Umkomaas* (SA) 1759
M 2658 *Frauenlob* (Ger) 1753
M 2660 *Gefion* (Ger) 1753
M 2661 *Medusa* (Ger) 1753
M 2662 *Undine* (Ger) 1753
M 2665 *Loreley* (Ger) 1753
M 5550 *Lerici* (Ita) 1783
M 5551 *Sapri* (Ita) 1783
M 5552 *Milazzo* (Ita) 1783
M 5553 *Vieste* (Ita) 1783
M 5554 *Gaeta* (Ita) 1787
M 5555 *Termoli* (Ita) 1787
M 5556 *Alghero* (Ita) 1787
M 5557 *Numana* (Ita) 1787
M 5558 *Crotone* (Ita) 1787
M 5559 *Viareggio* (Ita) 1787
M 5560 *Chioggia* (Ita) 1787
M 5561 *Rimini* (Ita) 1787
MCM 1 *Avenger* (USA) 1862
MCM 2 *Defender* (USA) 1862
MCM 3 *Sentry* (USA) 1862
MCM 4 *Champion* (USA) 1862
MCM 5 *Guardian* (USA) 1862
MCM 6 *Devastator* (USA) 1862
MCM 7 *Patriot* (USA) 1862
MCM 8 *Scout* (USA) 1862
MCM 9 *Pioneer* (USA) 1862
MCM 10 *Warrior* (USA) 1862
MCM 11 *Gladiator* (USA) 1862
MCM 12 *Ardent* (USA) 1862
MCM 13 *Dextrous* (USA) 1862
MCM 14 *Chief* (USA) 1862
MCS 12 *Inchon* (USA) 1877
MHC 51 *Osprey* (USA) 1791
MHC 52 *Heron* (USA) 1791
MHC 53 *Pelican* (USA) 1791
MHC 54 *Robin* (USA) 1791
MHC 55 *Oriole* (USA) 1791
MHC 56 *Kingfisher* (USA) 1791
MHC 57 *Cormorant* (USA) 1791
MHC 58 *Blackhawk* (USA) 1791
MHC 59 *Falcon* (USA) 1791
MHC 60 *Cardinal* (USA) 1791
MHC 61 *Raven* (USA) 1791
MHC 62 *Shrike* (USA) 1791
MMC 951 *Souya* (Jpn) 1720
MSA 110 *Anticosti* (Can) 1735
MSA 112 *Moresby* (Can) 1735
MSC 412 *Addriyah* (SAr) 1871
MSC 414 *Al Quysumah* (SAr) 1871
MSC 416 *Al Wadeeah* (SAr) 1871
MSC 418 *Safwa* (SAr) 1871
MSC 551 *Kum San* (RoK) 1869
MSC 552 *Ko Hung* (RoK) 1869
MSC 553 *Kum Kok* (RoK) 1869
MSC 555 *Nam Yang* (RoK) 1869
MSC 556 *Ha Dong* (RoK) 1869
MSC 557 *Sam Kok* (RoK) 1869
MSC 558 *Yong Dong* (RoK) 1869
MSC 559 *Ok Cheon* (RoK) 1869
MSC 652 *Enoshima* (Jpn) 1793
MSC 653 *Ukishima* (Jpn) 1793
MSC 654 *Ooshima* (Jpn) 1793
MSC 655 *Niijima* (Jpn) 1793
MSC 656 *Yakushima* (Jpn) 1793
MSC 657 *Narushima* (Jpn) 1793
MSC 658 *Chichijima* (Jpn) 1793
MSC 659 *Torishima* (Jpn) 1793
MSC 660 *Hahajima* (Jpn) 1793
MSC 661 *Takashima* (Jpn) 1793
MSC 662 *Nuwajima* (Jpn) 1793
MSC 663 *Etajima* (Jpn) 1793
MSC 664 *Kamishima* (Jpn) 1793
MSC 665 *Himeshima* (Jpn) 1793
MSC 666 *Ogishima* (Jpn) 1793
MSC 667 *Moroshima* (Jpn) 1793
MSC 668 *Yurishima* (Jpn) 1793
MSC 669 *Hikoshima* (Jpn) 1793
MSC 670 *Awashima* (Jpn) 1793
MSC 671 *Sakushima* (Jpn) 1793
MSC 672 *Uwajima* (Jpn) 1793
MSC 673 *Ieshima* (Jpn) 1793
MSC 674 *Tsukishima* (Jpn) 1793
MSC 675 *Maejima* (Jpn) 1793
MSC 676 *Kumejima* (Jpn) 1793
MSC 677 *Makishima* (Jpn) 1793
MSC 678 *Tobishima* (Jpn) 1794
MSC 679 - (Jpn) 1794
MSC 680 - (Jpn) 1794
MSC 681 - (Jpn) 1797
MSC 682 - (Jpn) 1797
MSO 301 *Yaeyama* (Jpn) 1795
MSO 302 *Tsushima* (Jpn) 1795
MSO 303 *Hachijou* (Jpn) 1795
MST 462 *Hayase* (Jpn) 1718
N 04 *Aktion* (Gre) 1731
N 05 *Amvrakia* (Gre) 1731
N 52 *Vidar* (Nor) 1722
N 53 *Vale* (Nor) 1722
N 80 *Falster* (Den) 1707
N 81 *Fyen* (Den) 1707
N 82 *Møen* (Den) 1707
N 83 *Sjaelland* (Den) 1707
N 104 *Mersin* (Tur) 1731
N 110 *Nusret* (Den) 1708
NL 120 *Bayraktar* (Tur) 1638
NL 121 *Sancaktar* (Tur) 1638
NL 122 *Çakabey* (Tur) 1585
NL 123 *Sarucabey* (Tur) 1583
NL 124 *Karamürselbey* (Tur) 1583
NL 125 *Osman Gazi* (Tur) 1581
P 02 *Waspada* (Bru) 1454
P 03 *Pejuang* (Bru) 1454
P 04 *Seteria* (Bru) 1454
P 10 *General Nazaire Boulingui* (Gab) 1397
P 14 *Antipliarhos Anninos* (Gre) 1400
P 15 *Ipopliarhos Arliotis* (Gre) 1400
P 16 *Ipopliarhos Konidis* (Gre) 1400
P 17 *Ipopliarhos Batsis* (Gre) 1400
P 20 *Antipliarhos* (Gre) 1405
P 21 *Plotarhis Blessas* (Gre) 1405
P 22 *Ipopliarhos Mikonios* (Gre) 1405
P 23 *Ipopliarhos Troupakis* (Gre) 1405
P 24 *Simeoforos Kavaloudis* (Gre) 1405
P 25 *Antipliarhos Kostakos* (Gre) 1405
P 26 *Ipopliarhos Degiannis* (Gre) 1405
P 27 *Simeoforos Xenos* (Gre) 1405
P 28 *Simeoforos Simitzopoulis* (Gre) 1405
P 29 *Simeoforos Starakis* (Gre) 1405
P 33 *Abhay* (Ind) 1326
P 34 *Ajay* (Ind) 1326
P 35 *Akshay* (Ind) 1326
P 36 *Agray* (Ind) 1326
P 44 *Kirpan* (Ind) 1290
P 46 *Kuthar* (Ind) 1290
P 47 *Khanjar* (Ind) 1290
P 49 *Khukri* (Ind) 1290
P 50 *Hesperos* (Gre) 1415
P 51 *Isla Coronado* (Mex) 1483
P 52 *Isla Lobos* (Mex) 1483
P 53 *Isla Guadalupe* (Mex) 1483

P 53 *Kykklon* (Gre) 1415
P 54 *Isla Cozumel* (Mex) 1483
P 54 *Lelaps* (Gre) 1415
P 56 *Tyfon* (Gre) 1415
P 62 *Niki* (Gre) 1262
P 63 *Doxa* (Gre) 1262
P 64 *Eleftheria* (Gre) 1262
P 65 *Carteria* (Gre) 1262
P 66 *Agon* (Gre) 1262
P 68 *Arnala* (Ind) 1049
P 69 *Androth* (Ind) 1049
P 72 *Ipopliarhos Votsis* (Gre) 1400
P 73 *Antipliarhos Pezopoulos* (Gre) 1400
P 73 *Anjadip* (Ind) 1049
P 74 *Plotarhis Vlahavas* (Gre) 1400
P 75 *Plotarhis Maridakis* (Gre) 1400
P 75 *Amini* (Ind) 1049
P 76 *Sea Wolf* (Sin) 1418
P 77 *Sea Lion* (Sin) 1418
P 78 *Sea Dragon* (Sin) 1418
P 79 *Sea Tiger* (Sin) 1418
P 80 *Sea Hawk* (Sin) 1418
P 81 *Sea Scorpion* (Sin) 1418
P 88 *Victory* (Sin) 1276
P 89 *Valour* (Sin) 1276
P 90 *Vigilance* (Sin) 1276
P 91 *Valiant* (Sin) 1276
P 92 *Vigour* (Sin) 1276
P 93 *Vengeance* (Sin) 1276
P 104 *Bakassi* (Cam) 1411
P 151 *Hugin* (Swe) 1443
P 152 *Munin* (Swe) 1443
P 154 *Mode* (Swe) 1443
P 156 *Vidar* (Swe) 1443
P 159 *Kaparen* (Swe) 1443
P 160 *Vaktaren* (Swe) 1443
P 161 *Snapphanen* (Swe) 1443
P 162 *Spejaren* (Swe) 1443
P 163 *Strybjörn* (Swe) 1443
P 164 *Starkodder* (Swe) 1443
P 165 *Tordön* (Swe) 1443
P 166 *Tirfing* (Swe) 1443
P 182 *Ayam* (Nig) 1405
P 183 *Ekun* (Nig) 1405
P 221 *Kaman* (Iran) 1401
P 222 *Zoubin* (Iran) 1401
P 223 *Khadang* (Iran) 1401
P 226 *Falakhon* (Iran) 1401
P 227 *Shamshir* (Iran) 1401
P 228 *Gorz* (Iran) 1401
P 229 *Gardouneh* (Iran) 1401
P 229 *Tolmi* (Gre) 1481
P 230 *Khanjar* (Iran) 1401
P 230 *Ormi* (Gre) 1481
P 231 *Neyzeh* (Iran) 1401
P 232 *Tabarzin* (Iran) 1401
P 286 *Diopos Antoniou* (Gre) 1398
P 287 *Kelefstis Stamou* (Gre) 1398
P 301 *Bizerte* (Tun) 1411
P 302 *Horria* (Tun) 1411
P 304 *Monastir* (Tun) 1411
P 321 *Denizkusu* (Tur) 1415
P 322 *Atmaca* (Tur) 1415
P 323 *Sahin* (Tur) 1415
P 324 *Kartal* (Tur) 1415
P 326 *Pelikan* (Tur) 1415
P 327 *Albatros* (Tur) 1415
P 328 *Simsek* (Tur) 1415
P 329 *Kasirga* (Tur) 1415
P 339 *Bora* (Tur) 1481
P 340 *Doğan* (Tur) 1423
P 341 *Marte* (Tur) 1423
P 342 *Tayfun* (Tur) 1423
P 343 *Volkan* (Tur) 1423
P 344 *Rüzgar* (Tur) 1423
P 345 *Poyraz* (Tur) 1423
P 346 *Gurbet* (Tur) 1423
P 347 *Firtina* (Tur) 1423
P 348 *Yildiz* (Tur) 1423
P 349 *Karayel* (Tur) 1423
P 350 - (Tur) 1423
P 351 - (Tur) 1423
P 352 - (Tur) 1423
P 421 *Nibbio* (Ita) 1438
P 422 *Falcone* (Ita) 1438
P 423 *Astore* (Ita) 1438
P 424 *Grifone* (Ita) 1438
P 425 *Gheppio* (Ita) 1439
P 426 *Condor* (Ita) 1439
P 540 *Bille* (Den) 1388
P 541 *Bredal* (Den) 1388
P 542 *Hammer* (Den) 1388
P 543 *Huitfeld* (Den) 1388
P 544 *Krieger* (Den) 1388
P 545 *Norby* (Den) 1388
P 546 *Rodsteen* (Den) 1388
P 547 *Sehested* (Den) 1388
P 548 *Suenson* (Den) 1388
P 549 *Willemoes* (Den) 1388
P 550 *Flyvefisken* (Den) 1255, 1741
P 551 *Hajen* (Den) 1255, 1741
P 552 *Havkatten* (Den) 1255, 1741
P 553 *Laxen* (Den) 1255, 1741
P 554 *Makrelen* (Den) 1255, 1741
P 555 *Storen* (Den) 1255, 1741
P 556 *Svaerdfisken* (Den) 1255, 1741
P 557 *Glenten* (Den) 1255, 1741
P 558 *Gribben* (Den) 1255, 1741
P 559 *Lommen* (Den) 1255, 1741
P 560 *Ravnen* (Den) 1255, 1741
P 561 *Skaden* (Den) 1255, 1741
P 562 *Viben* (Den) 1255, 1741
P 563 *Soloven* (Den) 1255, 1741
P 961 *Blink* (Nor) 1446
P 965 *Kjekk* (Nor) 1446
P 966 *Djerv* (Nor) 1446
P 967 *Skudd* (Nor) 1446
P 969 *Steil* (Nor) 1446
P 972 *Hvass* (Nor) 1446
P 977 *Brask* (Nor) 1446
P 979 *Gnist* (Nor) 1446
P 986 *Hauk* (Nor) 1443
P 987 *Orn* (Nor) 1443
P 988 *Terne* (Nor) 1443
P 989 *Tjeld* (Nor) 1443
P 990 *Skarv* (Nor) 1443
P 991 *Teist* (Nor) 1443
P 992 *Jo* (Nor) 1443
P 993 *Lom* (Nor) 1443
P 994 *Stegg* (Nor) 1443
P 995 *Falk* (Nor) 1443
P 996 *Ravn* (Nor) 1443
P 997 *Gribb* (Nor) 1443
P 998 *Geir* (Nor) 1443
P 999 *Erle* (Nor) 1443
P 1021 *Haibat* (Pak) 1378
P 1022 *Jalalat* (Pak) 1378
P 1023 *Jurat* (Pak) 1378
P 1024 *Shujaat* (Pak) 1378
P 1561 *Jan Smuts* (SA) 1431
P 1562 *P W Botha* (SA) 1431
P 1563 *Frederic Cresswell* (SA) 1431
P 1564 *Jim Fouche* (SA) 1431
P 1565 *Frans Erasmus* (SA) 1431
P 1566 *Oswald Pirow* (SA) 1431
P 1567 *Hendrik Mentz* (SA) 1431
P 1568 *Kobie Coetsee* (SA) 1431
P 1569 *Magnus Malan* (SA) 1431
P 3100 *Mamba* (Ken) 1466
P 3121 *Madaraka* (Ken) 1464
P 3122 *Jamhuri* (Ken) 1464
P 3123 *Harambee* (Ken) 1464
P 3126 *Nyayo* (Ken) 1467
P 3127 *Umoja* (Ken) 1467
P 4401 *Mubarraz* (UAE) 1413
P 4402 *Makasib* (UAE) 1413
P 4501 *Ban Yas* (UAE) 1419
P 4502 *Marban* (UAE) 1419
P 4503 *Rodom* (UAE) 1419
P 4504 *Shaheen* (UAE) 1419
P 4505 *Sagar* (UAE) 1419
P 4505 *Al Sanbouk* (Kwt) 1418
P 4506 *Tarif* (UAE) 1419
P 5702 *Istiqlal* (Kwt) 1423
P 6111 *Albatros* (Ger) 1427
P 6112 *Falke* (Ger) 1427
P 6113 *Geier* (Ger) 1427
P 6114 *Bussard* (Ger) 1427
P 6115 *Sperber* (Ger) 1428
P 6116 *Greif* (Ger) 1428
P 6117 *Kondor* (Ger) 1428
P 6118 *Seeadler* (Ger) 1428
P 6119 *Habricht* (Ger) 1428
P 6120 *Kormoran* (Ger) 1428
P 6121 *Gepard* (Ger) 1427
P 6122 *Puma* (Ger) 1427
P 6123 *Hermelin* (Ger) 1427
P 6124 *Nerz* (Ger) 1427
P 6125 *Zobel* (Ger) 1427
P 6126 *Frettchen* (Ger) 1427
P 6127 *Dachs* (Ger) 1427
P 6128 *Ozelot* (Ger) 1427
P 6129 *Wiesel* (Ger) 1427
P 6130 *Hyäne* (Ger) 1427
P 6141 *Tiger* (Ger) 1400
P 6143 *Luchs* (Ger) 1400
P 6145 *Leopard* (Ger) 1400
P 6146 *Fuchs* (Ger) 1400
P 6147 *Jaguar* (Ger) 1400
P 6148 *Löwe* (Ger) 1400
P 6149 *Wolf* (Ger) 1400
P 6150 *Panther* (Ger) 1400
P 6153 *Pelikan* (Ger) 1400
P 6154 *Elster* (Ger) 1400
P 6155 *Alk* (Ger) 1400
P 6156 *Dommel* (Ger) 1400
P 6157 *Weihe* (Ger) 1400
P 6158 *Pinguin* (Ger) 1400
P 6159 *Reiher* (Ger) 1400
P 6160 *Kranich* (Ger) 1400
P 8111 *Durbar* (Ban) 1378
P 8112 *Duranta* (Ban) 1378
P 8113 *Durvedya* (Ban) 1378
P 8114 *Durdam* (Ban) 1378
P 8141 *Uttal* (Ban) 1378
PC 1 *Cyclone* (USA) 1489
PC 2 *Tempest* (USA) 1489
PC 3 *Hurricane* (USA) 1489
PC 4 *Monsoon* (USA) 1489
PC 5 *Typhoon* (USA) 1489
PC 6 *Sirocco* (USA) 1489
PC 7 *Squall* (USA) 1489
PC 8 *Zephyr* (USA) 1489
PC 9 *Chinook* (USA) 1489
PC 10 *Firebolt* (USA) 1489
PC 11 *Whirlwind* (USA) 1489
PC 11 *Constitución* (Ven) 1473
PC 12 *Thunderbolt* (USA) 1489
PC 12 *Federación* (Ven) 1473
PC 13 *Shamar* (USA) 1489
PC 13 *Independencia* (Ven) 1473
PC 14 *Libertad* (Ven) 1473
PC 15 *Patria* (Ven) 1473
PC 16 *Victoria* (Ven) 1473
PGM 581 *Pae Ku 51* (RoK) 1481
PGM 582 *Pae Ku 52* (RoK) 1486
PGM 583 *Pae Ku 53* (RoK) 1486
PGM 585 *Pae Ku 55* (RoK) 1486
PGM 586 *Pae Ku 56* (RoK) 1486
PGM 587 *Pae Ku 57* (RoK) 1486
PGM 588 *Pae Ku 58* (RoK) 1486
PGM 589 *Pae Ku 59* (RoK) 1486
PGM 591 *Pae Ku 61* (RoK) 1486
PM 111 *Albuquerque* (Col) 1481
PM 112 *Quita Sueno* (Col) 1481
PKM 271 *Kilurki 71* (RoK) 1441
PKM 272 *Kilurki 72* (RoK) 1441
P Q 01 *Damsah* (Qat) 1406
P Q 02 *Al Ghariyah* (Qat) 1406
P Q 03 *Rbigah* (Qat) 1406
Q 04 *Barzan* (Qat) 1470
Q 05 *Hwar* (Qat) 1470
Q 06 *Al Udeid* (Qat) 1470
Q 07 *Adeebel* (Qat) 1470
Q 31 *Qahir al Amwaj* (Omn) 1359
Q 32 *Al Mua'zzer* (Omn) 1359
Q 42 *Cabo San Antonio* (Arg) 1651
R 131 *Norrköpping* (Swe) 1456
R 132 *Nynäshamn* (Swe) 1456
R 133 *Norrtälje* (Swe) 1456
R 134 *Varberg* (Swe) 1456
R 135 *Västerås* (Swe) 1456
R 136 *Västervik* (Swe) 1456
R 137 *Umeå* (Swe) 1456
R 138 *Piteå* (Swe) 1456
R 139 *Luleå* (Swe) 1456
R 140 *Halmstad* (Swe) 1456
R 141 *Strömstad* (Swe) 1456
R 142 *Ystad* (Swe) 1456
T 61 *Capana* (Ven) 1546
T 62 *Esequibo* (Ven) 1546
T 63 *Goajira* (Ven) 1546
T 64 *Los Llanos* (Ven) 1546
TR 61 *Hualcopo* (UK) 1621
U 400 *Ilya Azarov* (Ukr) 1577
V 30 *Inhauma* (Brz) 789
V 31 *Jaceguay* (Brz) 789
V 32 *Julio de Noronha* (Brz) 789
V 33 *Frontin* (Brz) 789
V 34 *Barroso* (Brz) 789
VPB 31 *Beograd* (Yug) 1081
VPB 32 *Kopar* (Yug) 1081
VPB 33 *Kotor* (Yug) 1081
VPB 34 *Novi Sad* (Yug) 1081

Ships' Names and Classes

Note: Ships' classes are in **bold** and ships' names in *italics*

1-114 (Syr) 1560
2-114 (Syr) 1560
3-114 (Syr) 1560
6 October (Egy) 1390
44 (Syr) 1448
45 (Syr) 1448
46 (Syr) 1448
139 (Yem) 1568
201 (Yem) 1831
301 (Egy) 1557
303 (Egy) 1557
305 (Egy) 1557
350 (Cub) 1076
350 (Cub) 1076
356 (Cub) 1076
383 (Cub) 1076
471 (Alg) 1560
501 (Alb) 1811
532 (Syr) 1808
609 (Egy) 1378
611 (Egy) 1378
613 (Egy) 1378
615 (Egy) 1378
617 (Egy) 1378
619 (Egy) 1378
690 (Cub) 1560
781 (Egy) 1390
783 (Egy) 1390
785 (Egy) 1390
787 (Egy) 1390
789 (Egy) 1390
791 (Egy) 1390
971 (Yem) 1344
971 (Yem) 1344
976 (Yem) 1344

A

A 06 (Spn) 1512
A 07 (Spn) 1512
A 08 (Spn) 1512
Abdul Aziz (SAr) 1478
Abdul Halim Perdanakusuma (Indo) 1132
Abdul Rahman al Fadel (Bhr) 1418
Abha (SAr) 854
Abhay (Ind) 1326
Abhay (Ind) 1326
Abou Abdallah el Ayachi (Mor) 1521
Abraham van der Hulst (Nld) 1026
Abrolhos (Brz) 1757
Abu Obadiah (SAr) 1478
Abu Qir (Egy) 1089
Abu Qir (Egy) 1089
Abukuma (Jpn) 984
Abukuma (Jpn) 984
Adatepe (Tur) 1213
Addriyah (SAr) 1871
Addriyah (SAr) 1871
Adeebel (Qat) 1471
Adelaide (Aust) 1218
Adelaide (Aust) 1218
Admiral Petre Barbuneanu (Rom) 1042
Adrias (Gre) 1018
Aedon (Gre) 1866
Aegeon (Gre) 1018
Agon (Grc) 1262
Agray (Ind) 1326
Ahmad el Fateh (Bhr) 1418
Ahmad el Fateh (Bhr) 1418
Ahmad Yani (Indo) 1132
Ahmed es Sakali (Mor) 1521
Aigle (Fra) 1774
Aigli (Gre) 1867
Aina Vao Vao (Mad) 1512
Ajay (Ind) 1326
Ajsberg (Rus) 1318
Akdeniz (Tur) 1213
Akshay (Ind) 1326
Aktion (Gre) 1731
Al Bahan (SAr) 1853
Al Bat'nah (Omn) 1467
Al Farouk (SAr) 1478
Al Ghariyah (Qat) 1406
Al Hani (Lby) 1078
Al Hani (Lby) 1078
Al Hirasa (Syr) 1051
Al Hirasa (Syr) 1051
Al Isar (Lby) 1830
Al Jawf (SAr) 1853
Al Jawf (SAr) 1853
Al Jibiri (Bhr) 1418
Al Kharj (SAr) 1853
Al Manama (Bhr) 1273
Al Manama (Bhr) 1273
Al Mua'zzer (Omn) 1359
Al Muharraq (Bhr) 1273
Al Qirdabiyah (Lby) 1078
Al Quysumah (SAr) 1871
Al Raas (SAr) 1853
Al Sanbouk (Kwt) 1418
Al Sharqiyah (Omn) 1467
Al Siddiq (SAr) 1478
Al Siddiq (SAr) 1478
Al Taweelah (Bhr) 1418
Al Tiyar (Lby) 1830
Al Udeid (Qat) 1470
Al Wadeeah (SAr) 1871
Al Yarmook (SAr) 1364
Alabarda (Port) 1512
Albardao (Brz) 1757
Albatros (Ger) 1427
Albatros (Ger) 1427
Albatros (Tur) 1415
Albion (UK) 1603
Albion (UK) 1603
Alborz (Iran) 1100
Albuquerque (Col) 1481
Aleksandr Nikolaev (Rus) 1573
Aleksandr Shabalin (Rus) 1568
Aleksandr Tortsev (Rus) 1577
Alesha (Rus) 1727
Alfonso Cerqueira (Port) 1038
Alghero (Ita) 1787
Aliseo (Ita) 968
Aliya (Isr) 1433
Aliya (Isr) 1433
Alk (Ger) 1400
Alkmaar (Nld) 1776
Alkmaar (Nld) 1776
Alkyon (Gre) 1866
Alkyon (Gre) 1866
Alleppey (Ind) 1828
Alligator (Rus) 1577
Almirante Brion (Ven) 960
Almirante Brown (Arg) 883
Almirante Brown (Arg) 883
Almirante Garcia (Ven) 960
Almirante Lynch (Chi) 1119
Almirante Padilla (Col) 1265
Almirante Padilla (Col) 1265
Alta (Nor) 1801
Alta (Nor) 1801
Alvand (Iran) 1100
Alvand (Iran) 1100
Alvares Cabral (Port) 918
Älvsborg (Swe) 1728
Amini (Ind) 1049
Amir (Iran) 1532
Amvrakia (Gre) 1731
Amyot d'Inville (Fra) 846
Amyr (SAr) 1478
An Dong (RoK) 1308
An Yang (RoK) 1306
Anadyr (Rus) 1063
Anchorage (USA) 1666
Anchorage (USA) 1666
Andalucia (Spn) 1200
Andromède (Fra) 1774
Androth (Ind) 1049
Anhatomirim (Brz) 1757
Anjadip (Ind) 1049
Annapolis (Can) 797
Annapolis (Can) 797
Anninos (Gre) 1400
Anqing (PRC) 826
Anshun (PRC) 809
Antares (Bul) 1557
Ante Banina (Yug) 1459
Anticosti (Can) 1735
Antioquia (Col) 1265
Antipliarhos Anninos (Gre) 1400
Antipliarhos Kostakos (Gre) 1405
Antipliarhos Laskos (Gre) 1405
Antipliarhos Pezopoulos (Gre) 1400
Antonio Enes (Port) 1040
ANZAC (Aust/NZ) 881
ANZAC (Aust/NZ) 881
Aracatuba (Brz) 1757
Aradu (Nig) 881
Aratu (Brz) 1757
Aratu (Brz) 1757
Ardent (USA) 1862
Argyll (UK) 1167
Arholma (Swe) 1834
Arnala (Ind) 1049
Arnala (Ind) 1049
Artigliere (Ita) 964
Artigliere (Ita) 964
Arunta (Aust/NZ) 889
Asheville (USA) 1481
Ashland (USA) 1672
Assiout (Egy) 1814
Aster (Bel) 1772
Aster (Bel) 1772
Astore (Ita) 1438
Asturias (Spn) 1200
Aswan (Egy) 1818
Atalaia (Brz) 1757
Atalanti (Gre) 1867
Atherstone (UK) 1846
Atmaca (Tur) 1415
Atsmout (Isr) 1431
Atsumi (Jpn) 1540
Atsumi (Jpn) 1540
Aubrey Fitch (USA) 1236
Audaz (Uru) 1752
Auerbach (Ger) 1768
Augsburg (Ger) 1013
Augusto de Castilho (Port) 1040
Aungthong (Tld) 1637
Austin (USA) 1669
Austin (USA) 1669
Avenger (USA) 1862
Avenger (USA) 1862
Aviere (Ita) 964
Avra (Gre) 1866
Awashima (Jpn) 1793
Ayam (Nig) 1405
Ayam (Nig) 1405
Ayase (Jpn) 978

B

Babur (Pak) 1144
Bacamarte (Port) 1512
Bacolod City (Plp) 1699
Bad Bevensen (Ger) 1765
Bad Rappenau (Ger) 1765
Badik (Indo) 1486
Badr (Egy) 1475
Badr (Pak) 1144
Badr (SAr) 1364
Badr (SAr) 1364
Bahariya (Egy) 1814
Bakassi (Cam) 1411
Bakassi (Cam) 1411
Baleares (Spn) 1200
Baleares (Spn) 1200
Balikpapan (Aust) 1495
Ballarat (Aust/NZ) 889
Ban Yas (UAE) 1419
Ban Yas (UAE) 1419
Bangkeo (Tld) 1874
Bangkeo (Tld) 1874
Bangor (UK) 1850
Bangpakong (Tld) 823
Bangrachan (Tld) 1763
Bangrachan (Tld) 1763
Baptiste de Andrade (Port) 1038
Baptiste de Andrade (Port) 1038
Barbaros (Tur) 912
Barbaros (Tur) 912
Bark (Lby) 1401
Barroso (Brz) 789
Barzan (Qat) 1470
Barzan (Qat) 1470
Bataan (USA) 1683
Bayandor (Iran) 1177
Bayandor (Iran) 1177
Bayern (Ger) 895
Bayraktar (Tur) 1638
Bditelni (Bul) 1311
Beas (Ind) 928
Beaver (UK) 1154
Bedi (Ind) 1828
Bedok (Sin) 1838
Bedok (Sin) 1838
Beleijan (PRC) 1706
Belleau Wood (USA) 1679
Bellis (Bel) 1772
Benguet (Plp) 1630

Beograd/Kotor (Yug) 1081
Beograd (Yug) 1081
Bergen (Nor) 1031
Berk (Tur) 1096
Berk (Tur) 1096
Berkeley (UK) 1846
Bersagliere (Ita) 964
Bessmenny (Rus) 1063
Betano (Aust) 1495
Betwa (Ind) 928
Bezstrashni (Bul) 1311
Bezukorizenny (Rus) 1063
Bhavnagar (Ind) 1828
Bi Bong (RoK) 1626
Bicester (UK) 1846
Bille (Den) 1388
Bizerte (Tun) 1411
Bizerte (Tun) 1411
Black Hawk (USA) 1791
Blink (Nor) 1446
Blitvenica (Yug) 1845
Bloys van Treslong (Nld) 1008
Blue Ridge (USA) 1692
Blythe (UK) 1850
Bobruisk (Rus) 1568
Bodri (Bul) 1322
Bodry (Rus) 1063
Bombarda (Port) 1512
Bonhomme (USA) 1683
Boone (USA) 1236
Bora (Rus) 1346
Bora (Tur) 1481
Bosisio (Brz) 1150
Bougainville (Fra) 1509
Boxer (UK) 1154
Boxer (UK) 1154
Boxer (USA) 1683
Brahmaputra (Ind) 928
Brandenburg (Ger) 895
Brandenburg (Ger) 895
Brandon (Can) 1737
Brask (Nor) 1446
Brave (UK) 1154
Brecon (UK) 1846
Bredal (Den) 1388
Bremen (Ger) 1013
Bremen (Ger) 1013
Bridport (UK) 1850
Briz (Bul) 1807
Briz (Bul) 1807
Brocklesby (UK) 1846
Brunei (Aust) 1495
Bu Chon (RoK) 1308
Buk Han (RoK) 1626
Bulwark (UK) 1603
Busan (RoK) 992
Bussard (Ger) 1427

C

C 108 (Tur) 1512
C 110 (Tur) 1512
C 113 (Tur) 1512
C 114 (Tur) 1512
C 117 (Tur) 1512
C 118 (Tur) 1512
C 119 (Tur) 1587
C 120 (Tur) 1512
C 121 (Tur) 1587
C 122 (Tur) 1587
C 123 (Tur) 1587
C 124 (Tur) 1587
C 125 (Tur) 1587
C 126 (Tur) 1587
C 127 (Tur) 1587
C 128 (Tur) 1587
C 129 (Tur) 1587
C 132 (Tur) 1587
C 133 (Tur) 1587
C 134 (Tur) 1587
C 135 (Tur) 1587
C 137 (Tur) 1587
C 138 (Tur) 1587
C 139 (Tur) 1587
C 140 (Tur) 1587
C 141 (Tur) 1587
C 142 (Tur) 1587
C 143 (Tur) 1587
C 144 (Tur) 1587
C 145 (Tur) 1587
C 146 (Tur) 1587
C 147 (Tur) 1587
C 148 (Tur) 1587
C 149 (Tur) 1587
C 150 (Tur) 1587
Cabo San Antonio (Arg) 1651
Çakabey (Tur) 1583
Caldas (Col) 1265
Calgary (Can) 800
Callao (Per) 1648
Calliope (Fra) 1745
Campbeltown (UK) 1160
Canarias (Spn) 1223
Canberra (Aust) 1218
Cannanore (Ind) 1828
Canterbury (NZ) 1139
Capana (Ven) 1546
Capana (Ven) 1546
Cardinal (USA) 1791
Carlskrona (Swe) 1729
Carr (USA) 1236
Carter Hall (USA) 1672
Carteria (Gre) 1262
Carthage (Tun) 1406
Casma (Chi) 1430
Casma (Chi) 1430
Cassiopée (Fra) 1774
Cataluna (Spn) 1200
Cattistock (UK) 1846
Cazadora (Spn) 1084
CDIC (Fra) 1516
Ceará (Brz) 1664
Ceres (Fra) 1745
Cetina (Cro) 1702
Chacabuco (Chi) 1521
Chaco (Arg) 1840
Champion (USA) 1862
Champlain (Fra) 1521
Champlain (Fra) 1521
Chang (Tld) 1637
Chang Chien (RoC) 1228
Chang De (PRC) 809
Changzhi (PRC) 809
Chao Phraya (Tld) 823
Chao Phraya (Tld) 823
Charlottetown (Can) 801
Chatham (UK) 1160
Che Ju (RoK) 992
Cheetah (Ind) 1564
Cheng Ho (RoC) 1228
Cheng Kung (RoC) 1228
Cheng Kung (RoC) 1228
Chi Kuang (RoC) 1228
Chi Yang (RoC) 1205
Chi Yang (RoC) 1205
Chichijima (Jpn) 1793
Chiddingfold (UK) 1846
Chief (USA) 1862
Chikugo (Jpn) 978
Chikugo (Jpn) 978
Chikuma (Jpn) 984
Chimera (Ita) 1293
Chinook (USA) 1489
Chioggia (Ita) 1787
Chios (Gre) 1526
Chipana (Chi) 1430
Chitose (Jpn) 978
Chon An (RoK) 1308
Chon Nam (RoK) 992
Chubut (Arg) 1840
Chung Chien (RoC) 1633
Chung Chih (RoC) 1634
Chung Chuan (RoC) 1633
Chung Fu (RoC) 1634
Chung Hai (RoC) 1633
Chung Hai (RoC) 1633
Chung Hsing (RoC) 1633
Chung Ju (RoK) 992
Chung Ju (RoK) 1308
Chung Kuang (RoC) 1633
Chung Ming (RoC) 1634
Chung Nam (RoK) 991
Chung Pang (RoC) 1634
Chung Shun (RoC) 1634
Chung Suo (RoC) 1633
Chung Yeh (RoC) 1634
Chung Yung (RoC) 1634
Cinnabdabt Azzougarh (Mor) 1423
Circe (Fra) 1745
Circe (Fra) 1745
Clark (USA) 1235
Cleveland (USA) 1669
Clio (Fra) 1745
CME (Spn) 1832
Comandante Hermenegildo Capelo (Port) 840
Comandante Joao Belo (Port) 840
Comandante Joao Belo (Port) 840
Comandante Sacadura Cabral (Port) 840
Commandant Birot (Fra) 847
Commandant Blaison (Fra) 847
Commandant Bouan (Fra) 847
Commandant Boutouba (Mor) 1423
Commandant Ducuing (Fra) 847
Commandant el Harty (Mor) 1423
Commandant l'Herminier (Fra) 846
Commandant de Pimodan (Fra) 846
Comstock (USA) 1672
Condell (Chi) 1119
Condell (Chi) 1119
Condor (Ita) 1439
Constituicao (Brz) 1103
Constitución (Ven) 1473
Contre Admiral Eustatiu Sebastian (Rom) 1044
Copeland (USA) 1235
Cormorant (USA) 1791
Cornwall (UK) 1160
Cornwall (UK) 1160
Corte Real (Port) 918
Cottesmore (UK) 1846
Courbet (Fra) 859
Covadonga (Chi) 1418
Coventry (UK) 1154
Crocus (Bel) 1772
Croix du Sud (Fra) 1774
Cromer (UK) 1850
Crommelin (USA) 1236
Crotone (Ita) 1787
Cuddalore (Ind) 1828
Cuenca (Ecu) 1418
Cumberland (UK) 1160
Curts (USA) 1236
Cut Nyak Dien (Indo) 1284
Cuxhaven (Ger) 1754
CW 3 Harold C Clinger (USA) 1699
Cybele (Fra) 1745
Cyclone (USA) 1489
Cyclone (USA) 1489

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Da Nang (Vtn) 1639
Dachs (Ger) 1427
Dae Chon (RoK) 1308
Dafni (Gre) 1867
Dagger (Indo) 1485
Dagupan City (Plp) 1699
Damour (Leb) 1514
Damsah (Qat) 1405
Damyat (Egy) 1192
Damyat (Egy) 1192
Danaide (Ita) 1293
Dandong (PRC) 809
Daoud ben Aicha (Mor) 1521
Daqahliya (Egy) 1814
Darwin (Aust) 1218
Das (UAE) 1279
Datteln (Ger) 1765
De Los Heros (Per) 1409
De Ruyter (Nld) 1004
Defender (USA) 1862
Defensora (Brz) 1103
Delfzyl (Nld) 1776
Denver (USA) 1669
Dergach (Rus) 1344
Descubierta (Spn) 1084
Descubierta (Spn) 1084
d'Estienne d'Orves (Fra) 846
d'Estienne d'Orves (Fra) 846
Detroyat (Fra) 846
Devastator (USA) 1862
De Wert (USA) 1236
Dextrous (USA) 1862
Dhofar (Omn) 1467
Di Hua (RoC) 869
Diamantina (Aust) 1789
Diana (Spn) 1082
Dillingen (Ger) 1765
Diopos Antiniou (Gre) 1398
Diopos Antiniou (Gre) 1398
Djebel Chinoise (Alg) 1249
Djebel Chinoise (Alg) 1249
Djerv (Nor) 1446
Dobrotich (Bul) 1824
Dodsworth (Brz) 1150
Doğan (Tur) 1423
Doğan (Tur) 1423
Dokkum (Nld) 1843
Dommel (Ger) 1400
Donchedi (Tld) 1874
Donetsky Shakhter (Rus) 1577
Dong Hae (RoK) 1306
Dong Hae (RoK) 1306
Dongguan (PRC) 809
Dordrecht (Nld) 1776
Doxa (Gre) 1262
Doyle (USA) 1236
Driade (Ita) 1293
Drogou (Fra) 846
Drummond (Arg) 851
Drummond (Arg) 851
Druzhny (Rus) 1063
Dubuque (USA) 1669
Dufour (Bel) 1856
Dufour (Bel) 1856
Duke (UK) 1167
Duluth (USA) 1669
Dulverton (UK) 1846
Dumont d'Urville (Fra) 1521

Dunagiri (Ind) 1127
Duque de Caxias (Brz) 1652
Duranta (Ban) 1378
Durbar (Ban) 1378
Durbar (Ban) 1378
Durdam (Ban) 1378
Durdarsha (Yem) 1384
Düren (Ger) 1755
Durvedya (Ban) 1378
Dzerzhinsky (Rus) 1063

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Ean Al Gazala (Lby) 1316
Ean Zara (Lby) 1316
East London (SA) 1842
EDIC (Fra) 1512
EDIC 700 (Fra) 1514
Edmonton (Can) 1737
Ege (Tur) 1213
Eilat (Isr) 1370
Eilat (Isr) 1370
Ekun (Nig) 1405
El Chihab (Alg) 1249
El Kadessaya (Egy) 1475
El Khattabi (Mor) 1423
El Kobayat (Lby) 1587
El Nasser (Egy) 820
El Oro (Ecu) 1297
El Suez (Egy) 1089
El Yarmouk (Egy) 1475
Eleftheria (Gre) 1262
Elli (Gre) 1018
Elli (Gre) 1018
Eloy Alfaro (Ecu) 1124
Elrod (USA) 1237
Elster (Ger) 1400
Emden (Ger) 1013
Enoshima (Jpn) 1793
Ensdorf (Ger) 1768
Enseigne de Vaisseau Jacoubet (Fra) 847
Epirus (Gre) 1196
Epirus (Gre) 1196
Erato (Gre) 1867
Eridan (Fra) 1774
Eridan (Fra) 1774
Erle (Nor) 1443
Errhamani (Mor) 1093
Ertugrul (Tur) 1649
Esequibo (Ven) 1546
Esmeraldas (Ecu) 1297
Esmeraldas (Ecu) 1297
Espero (Ita) 968
Espora (Arg) 923
Espora (Arg) 923
Essex (USA) 1683
Estocin (USA) 1235
Etajima (Jpn) 1793
Eten (Per) 1648
Evstati Vinarov (Bul) 1824
Euro (Ita) 968
Evniki (Gre) 1867
Excellence (Sin) 1630
Extremadura (Spn) 1200

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F 100 (Spn) 948
Faedra (Gre) 1867
Fahrion (USA) 1235
Faisal (SAr) 1478
Falakhon (Iran) 1401
Falcon (USA) 1791
Falcone (Ita) 1438
Falk (Nor) 1443
Falke (Ger) 1427
Falster (Den) 1707
Falster (Den) 1707
Farsi (Iran) 1550
Fatahillah (Indo) 1000
Fatahillah (Indo) 1000
Fatih (Tur) 907
Fearless (UK) 1592
Federación (Ven) 1473
Feng Yang (RoC) 1205
Fenice (Ita) 1293
Firebolt (USA) 1489
Firtina (Tur) 1423
Floréal (Fra) 874
Floréal (Fra) 874
Flyvefisken (Den) 1255, 1741
Flyvefisken (Den) 1255, 1741
Fong Yang (RoC) 1205
Ford (USA) 1236
Formosa (Arg) 1840
Fort Fisher (USA) 1666
Fort McHenry (USA) 1672
Fortuna (Uru) 1752
Foudre (Fra) 1504
Foudre (Fra) 1504
Francis Garnier (Fra) 1521
Frankenthal (Ger) 1765
Frankenthal (Ger) 1765
Frans Erasmus (SA) 1431
Frauenlob (Ger) 1753
Frederic Cresswell (SA) 1431
Frederick (USA) 1655
Fredericton (Can) 800
Frettchen (Ger) 1427
Frontin (Brz) 789
Fuchs (Ger) 1400
Fulda (Ger) 1765
Fyen (Den) 1707

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Gaeta (Ita) 1787
Gaeta (Ita) 1787
Galeana (Mex) 1182
Gälve (Swe) 1352
Ganas (Mly) 1401
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Ganyang (Mly) 1401
Gardouneh (Iran) 1401
Gary (USA) 1236
Gascoyne (Aust) 1789
Gatineau (Can) 793
Gefion (Ger) 1753
Geier (Ger) 1427
Geir (Nor) 1443
Gempita (Mly) 1459
General Artigas (Uru) 843
General Baquedano (Chi) 1119
General Brehon B Somervell (USA) 1699
General Frank S Besson Jr (USA) 1699
General Nazaire Boulingui (Gab) 1397
General Nazaire Boulingui (Gab) 1397
General Pereira d'Eca (Port) 1040
General Salom (Ven) 960
General Soublette (Ven) 960
General Urdaneta (Ven) 960
George Philip (USA) 1235
Georges Truffaut (Bel) 1856
Geoula (Isr) 1433
Gepard (Ger) 1427
Gepard (Ger) 1427
Germantown (USA) 1672
Germinal (Fra) 874
Gharbiya (Egy) 1814
Gharial (Ind) 1528
Gheppio (Ita) 1439
Ghorpad (Ind) 1562
Giza (Egy) 1818
Glace Bay (Can) 1737
Gladiator (USA) 1862
Glenten (Den) 1255, 1741
Glomma (Nor) 1801
Gniezno (Pol) 1571
Gnist (Nor) 1446
Goajira (Ven) 1546
Godavari (Ind) 928
Godavari (Ind) 928
Gomati (Ind) 928
Gomez Roca (Arg) 883
Goose Bay (Can) 1737
Gornik (Pol) 1334
Gornik (Pol) 1334
Gorz (Iran) 1401
Göteborg (Swe) 1352
Göteborg (Swe) 1352
Göttingen (Ger) 1754
Grafton (UK) 1168
Granatiere (Ita) 964
Granville (Arg) 851
Grecale (Ita) 968
Greenhalgh (Brz) 1150
Greenhalgh (Brz) 1150
Greif (Ger) 1428
Gribb (Nor) 1443
Gribben (Den) 1255, 1741
Grifone (Ita) 1438
Grimsby (UK) 1850
Grisha I (Rus) 1057
Grisha II (Rus) 1057
Grisha III (Rus) 1057
Grisha IV (Rus) 1057
Grisha V (Rus) 1057
Grom (Pol) 1282
Grom (Rus) 1318
Gromitz (Ger) 1765
Grønsund (Den) 1865
Grozyashchy (Rus) 1063
Grunwald (Pol) 1566
Guadalete (Spn) 1857
Guadalete (Spn) 1858
Guadalmedina (Spn) 1858
Guadalquivir (Spn) 1858
Guadiana (Spn) 1858
Guam (USA) 1676
Guardian (USA) 1862
Guayaquil (Ecu) 1418
Guepratte (Fra) 859
Guerrico (Arg) 851
Guldar (Ind) 1564
Gumanenko (Rus) 1821
Gunstone Hall (USA) 1672
Gurbet (Tur) 1423

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Ha Dong (RoK) 1869
Haarlem (Nld) 1776
Habicht (Ger) 1428
Hachijou (Jpn) 1795
Hae Yang (RoC) 1205
Hahajima (Jpn) 1793
Hai Ou (RoC) 1461
Haibat (Pak) 1378
Hajen (Den) 1255, 1741
Halifax (Can) 800
Halifax (Can) 800
Halmstad (Swe) 1456
Halyburton (USA) 1236
Hämeenmaa (Fin) 1712
Hämeenmaa (Fin) 1712
Hameln (Ger) 1768
Hameln (Ger) 1768
Hammer (Den) 1388
Handalan (Mly) 1459
Handalan (Mly) 1459
Hanhak Sattru (Tld) 1418
Hanit (Isr) 1370
Harambee (Ken) 1464
Harlingen (Nld) 1776
Harper's Ferry (USA) 1672
Hasan Basri (Indo) 1285
Hasan Zahirović Laca (Yug) 1459
Hauk (Nor) 1443
Hauk (Nor) 1443
Havkatten (Den) 1255, 1741
Hawes (USA) 1236
Hawkesbury (Aust) 1789
Hayase (Jpn) 1718
Hegu (PRC/Egy/Pak) 1378
Hejaz (Iran) 1532
Hellevoetsluis (Nld) 1776
Helsinki (Fin) 1392
Helsinki (Fin) 1392
Hendrik Mentz (SA) 1431
Hengam (Iran) 1589
Hengam (Iran) 1589
Hermeli (Ger) 1427
Hermenegildo Galeana (Mex) 1182
Hernan Cortes (Spn) 1662
Heron (USA) 1791
Heroina (Arg) 883
Herrera (Per) 1409
Herten (Ger) 1768
Hesperos (Gre) 1415
Hetman Dorosenko (Ukr) 1063
Hetman Sagaidachny (Ukr) 1063
Hettein (Egy) 1475
Hetz (Isr) 1433
Hetz (Isr) 1433
Hikoshima (Jpn) 1793
Himeshima (Jpn) 1793
Himgiri (Ind) 1127
Hinnøy (Nor) 1801
Hitteen (SAr) 1364
Hofouf (SAr) 854
Hola (PRC) 1384
Homburg (Ger) 1765
Honorio Barreto (Port) 1040
Horizon (Fra/Ita/UK) 933
Hormuz 21 (Iran) 1532
Hormuz 24 (Iran) 1550
Horria (Tun) 1411
Hos Durg (Ind) 1314
Houjian (PRC) 1380
Houxin (PRC) 1382
HQ 01 (Vtn) 1053
HQ 09 (Vtn) 1053
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Huaibei (PRC) 826
Huainan (PRC) 826
Hualcopo (Ecu) 1621
Huangfen (Ban/PRC/DPRK/Pak) 1384
Huangshi (PRC) 815
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Huchuan (Alb/Ban/PRC/Rom/Tan) 1386
Hudong (Iran) 1384
Hugin (Swe) 1443
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Huitfeld (Den) 1388
Hunt (UK) 1846
Huon (Aust) 1789
Huon (Aust) 1789
Hurricane (USA) 1489
Hurworth (UK) 1846
Hutnik (Pol) 1335
Hvass (Nor) 1446
Hvidbjornen (Den) 837
Hwa San (RoK) 1626
Hwai Yang (RoC) 1205
Hwar (Qat) 1470
Hyäne (Ger) 1427
Hydra (Gre) 902
Hydra (Gre) 902

I

Ibn al Farat (Lby) 1564
Ibn al Hadrami (Lby) 1564
Ibn al Idrisi (Lby) 1587
Ibn Harissa (Lby) 1518
Ibn Marwan (Lby) 1587
Ibn Ouf (Lby) 1518
Ibn Ouf (Lby) 1518
Ibn Umayaa (Lby) 1564
Ieshima (Jpn) 1793
Ikaria (Gre) 1526
Ikaria (Gre) 1622
Ilya Azarov (Ukr) 1577
Imam Bonjol (Indo) 1285
Imanta (Lat) 1750
Inchon (USA) 1877
Independencia (Brz) 1104
Independencia (Ven) 1473
Independiente (Col) 1265
Inez (Rus) 1318
Infanta Cristina (Spn) 1084
Infanta Elena (Spn) 1084
Ingraham (USA) 1237
Inhauma (Brz) 789
Inhauma (Brz) 789
Inouse (Gre) 1646
Intrepid (UK) 1592
Intrepid (Sin) 1630
Inverness (UK) 1850
Ipopliarhos Arliotis (Gre) 1400
Ipopliarhos Batsis (Gre) 1400
Ipopliarhos Degiannis (Gre) 1405
Ipopliarhos Konidis (Gre) 1400
Ipopliarhos Krystalidis (Gre) 1641
Ipopliarhos Mikonios (Gre) 1405
Ipopliarhos Roussen (Gre) 1641
Ipopliarhos Troupakis (Gre) 1405
Ipopliarhos Votsis (Gre) 1400
Iquique (Chi) 1418
Iquique (Chi) 1418
Iran Ajr (Iran) 1716
Iran Asir (Iran) 1716
Iran Ghaydr (Iran) 1716
Iron Duke (UK) 1168
Ishikari (Jpn) 975
Ishikari (Jpn) 975
Iskar (Bul) 1824
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Isla Coronado (Mex) 1483
Isla Coronado (Mex) 1483
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Istiqlal (Kwt) 1423
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Ivan Rogov (Rus) 1573
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Jaceguay (Brz) 789
Jacinto Candido (Port) 1040
Jacob van Heemskerck (Nld) 1022
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Jacques Cartier (Fra) 1521
Jaguar (Ger) 1400
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Jalalat (Pak) 1378
Jamhuri (Ken) 1464
Jan Smuts (SA) 1431
Jan van Brakel (Nld) 1008
Jarrett (USA) 1236
Jason (Gre) 1526
Jaureguiberry (Fra) 859
Je Chon (RoK) 1308
Jean Moulin (Fra) 846
Jebat (Mly) 1108
Jian (PRC) 809
Jianghu I (PRC) 808
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Jim Fouche (SA) 1431
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Jinhua (PRC) 809
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Jo (Nor) 1443
João Coutinho (Port) 1040
João Coutinho (Port) 1040
João Roby (Port) 1038
John A Moore (USA) 1235
John H Sides (USA) 1235
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Julio de Noronha (Brz) 789
Juan de Austria (Spn) 1551
Juneau (USA) 1669
Junga (Rus) 1287
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Kae Bong (RoK) 1626
Kahlid (SAr) 1478
Kakinada (Ind) 1828
Kala'at beni Hammad (Alg) 1595
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Kalinga Apayao (Plp) 1630
Kallang (Sin) 1838
Kalmar (Swe) 1352
Kaman (Iran) 1401
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Kamishima (Jpn) 1793
Kang Ding (RoC) 869
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Kang Jin (RoK) 1799
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Kang Reung (RoK) 1307
Kangding (PRC) 809
Kanimbla (Aust) 1656
Kao Hsiung (RoC) 1636
Kaparen (Swe) 1443
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Kapitan Patimura (Indo) 1284
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Karabala (Iran) 1532
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Karadeniz (Tur) 1213
Karamürsel (Tur) 1747
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Karayel (Tur) 1423
Karel Doorman (Nld) 1026
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Karjala (Fin) 1259
Karkas (Iran) 1868
Karlsruhe (Ger) 1013
Karmøy (Nor) 1801
Kartal (Tur) 1415
Kartal (Tur) 1415
Karwar (Ind) 1828
Kasirga (Tur) 1415
Kasturi (Mly) 1268
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Kaszub (Pol) 1035
Katong (Sin) 1838
Kauffman (USA) 1237
Kearsarge (USA) 1683
Kedrov (Rus) 1063
Kelefstis Stamou (Gre) 1398
Kemalreis (Tur) 912
Kemer (Tur) 1747
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Keris (Indo) 1486
Kesari (Ind) 1562
Keshet (Isr) 1433
Khadang (Iran) 1401
Khaibar (Pak) 1144
Khamronsin (Tld) 1356
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Khanjar (Ind) 1290
Khanjar (Iran) 1401
Khirirat (Tld) 1179
Khrabri (Bul) 1311
Khukri (Ind) 1290
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Khyber (Egy) 1475
Ki Hajar Dewantara (Indo) 1243
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Kichli (Gre) 1866
Kidon (Isr) 1433
Kilmle (Tur) 1747
Kilurki (RoK) 1441
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Kim Chon (RoK) 1308
Kim Po (RoK) 1799
Kimberley (SA) 1842
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Kinabalu (Mly) 1784
Kingfisher (USA) 1791
Kingston (Can) 1737
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Kirch (Ind) 1290
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Kissa (Gre) 1866
Kjekk (Nor) 1446
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Ko Chang (RoK) 1799
Ko Hung (RoK) 1869
Ko Mun (RoK) 1642
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Ko Ryeong (RoK) 1799
Kobie Coetsee (SA) 1431
Koblenz (Ger) 1754
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Komar (DPRK/Syr) 1448
Komemiut (Isr) 1431
Koncar (Cro/Yug) 1459
Kondor (Ger) 1428
Kondor II (Indo) 1749
Koni (Rus) 1070
Konkan (Ind) 1828
Konstantin Olshanskiy (Rus) 1568
Konstanz (Ger) 1755
Kopar (Yug) 1081
Kora (Ind) 1290
Kormoran (Ger) 1428
Kortenaer (Nld) 1008
Kos (Gre) 1646
Koster (Swe) 1834
Kotka (Fin) 1392
Kotor (Yug) 1081
Kozhikoda (Ind) 1828
Kozlu (Tur) 1747
Kraburi (Tld) 823
Krakow (Pol) 1571
Kralj (Cro) 1251
Kralj Petar Kresimir (Cro) 1251
Kram (Tld) 1645
Kranich (Ger) 1400
Krieger (Den) 1388
Kriti (Gre) 1622
Krivak I (Rus) 1062
Krivak II (Rus) 1062
Krivak III (Rus) 1062
Krivak III (Ukr) 1062
Krka (Cro) 1702
Kullen (Swe) 1834
Kulmbach (Ger) 1768
Kum Kok (RoK) 1869
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Kum San (RoK) 1869
Kum Wha (RoK) 1799
Kumano (Jpn) 978
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